# Integrated Transportation Scenario Planning

FHWA-HEP-10-034

by


## Keith Bartholomew & Reid Ewing

with Gail Meakins


July 2010


## Metropolitan Research Center

University of Utah

College of Architecture + Planning



*This report was funded through a contract from the Federal Highway Administration, U.S. Department of Transportation's Surface Transportation Environment and Planning Cooperative Research Program. The views and opinions of the authors expressed herein do not state or reflect those of the U.S. Department of Transportation. Additional research assistance provided by John Stevens and Kimber Gabryszak.*

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## Abstract

Regional land use-transportation scenario planning emerged as a planning technique in U.S. metropolitan areas in the 1990s. Building on prior work by this research team, this study continues to track the development and expansion of regional scenario planning, using 28 projects completed between 2003 and 2010. These projects demonstrate the continued popularity of scenario planning techniques when used to articulate and evaluate compact alternatives for future growth. The research team used hierarchical multivariate modeling to evaluate 107 scenarios, demonstrating important associations between land use and transportation variables and vehicle travel demand. Coefficients from this analysis suggest that a shift to compact development—increasing average regional density by 50 percent by 2050, emphasizing infill, mixing land uses, and increasing the price of automobile use--could result in 25% fewer VMT compared to amounts projected under trend conditions. The projects also demonstrate important methods for effectively integrating scenario techniques into traditional long-range regional transportation planning processes.

These important advances in regional scenario practice are hampered, to some degree, by continued limitations in the ability of travel demand models to evaluate the impacts of land use-based strategies. Another limitation is the failure by project sponsors to incorporate important changes in global economic and environmental conditions, such as climate change and peak oil, both as input variables and as evaluation metrics.

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## Introduction

During the 1990s a style of simulation-based regional land use-transportation planning emerged in U.S. metropolitan areas that employed scenario analysis methods originally developed by business and military strategic planners (Smith, 2007). The borrowed techniques were effectively merged with the alternative analysis practices developed under the National Environmental Policy Act and the "3C" (comprehensive, continuous, coordinated) systems planning requirements of the Federal-Aid Highway Act of 1962 (Bartholomew, 2007b). The resulting hybrid, known as land use-transportation scenario planning, became common enough by 2007 for some to refer to it as part of the state of planning practice (Ewing, 2007).

Prior research funded by the Federal Highway Administration and completed in 2005 (DTFH61-03-H-00134) identified 80 land use-transportation scenario planning projects completed in the U.S. between 1989 and 2003 (Bartholomew, 2007a), and it appears that the technique's popularity has remained strong. In 2005, the California Department of Transportation (CalTrans) developed a planning assistance program that provides funding to regions undertaking land use-transportation scenario planning analyses (CalTrans, 2006). The program, now in its fifth year, has supported scenario projects in metropolitan areas across the state; in 2009, the grants from this program totaled $5 million. According to CalTrans (2006, p. 1), the value of land use-transportation scenario analysis is that it "enables public officials and other participants to more realistically evaluate future land use patterns and their potential impacts on the region's transportation system, housing supply, jobs-housing proximity and balance, environment and natural resources." In northeastern Illinois, the Chicago Metropolitan Agency for Planning (CMAP, 2007) has been using land use-transportation scenario planning to develop the metro area's first regional comprehensive plan. Planners in central Florida recently completed a scenario-based regional planning process called "How Shall We Grow?" that has successfully forged a shared vision for the region. That vision is now providing a template for policy and investment decisions for both public and private sectors at multiple levels (myregion.org, 2007).

The popularity of regional scenario analysis accrued at about the time that researchers and policy makers began looking at the roles that land use development patterns play in contributing to the nation's overall emissions of greenhouse gases (GHGs). Residential development and the auto travel associated with it comprise almost 40% of U.S. CO2 emissions (EIA, 2008). Not all development-transportation patterns emit the same amounts of carbon. Some are carbon sippers while others are carbon hogs. Studying these patterns and the variables that are associated with different carbon outputs has led to a growing recognition that future land use-transportation patterns, if directed in certain ways, could significantly contribute to achieving the greenhouse gas reduction targets that scientists have identified as necessary for climate stability (Ewing et al., 2008). This recognition of land use's role in GHG emissions is evidenced by recent state-level policy initiatives, including California's Senate Bill 375 (2008) and Oregon's House Bill 2001 (2009) and Senate Bill 1059 (2010), which require

metropolitan planning organizations to incorporate GHG emission reduction strategies into their federally-required long-range transportation plans. It is also demonstrated by a number of proposed bills introduced during the 111th Congress, including the Clean, Low-Emission, Affordable, New Transportation Efficiency Act (H.R. 1329 & S. 575), the Federal Surface Transportation Policy and Planning Act (S. 1036), the National Transportation Objectives Act (H.R. 2724), and the Livable Communities Act (S. 1619).

Data generated by the 2005 scenario study facilitated a meta-analysis of 62 scenarios derived from 23 different projects around the country. The analysis suggested some level of association between travel demand, as measured by vehicle miles traveled (VMT), and various land use variables, including density, land use mixing, and infill development (Bartholomew & Ewing, 2009). While this research addressed important issues, several important questions could not be answered from the data:

1. **What effects do absolute changes in land use measures (density, heterogeneity, centeredness) and transportation supply and costs have on scenario planning outcomes?** The 2005 study collected data sufficient to measure density only in relative terms (i.e., percentage difference compared to a baseline) and produced results that did not achieve standard measures of statistical significance. Other factors, including heterogeneity, centeredness, and transportation supply and costs were assessed only categorically (i.e., through the use of "dummy" variables). Although some of these variables proved to be statistically significant, the categorical nature of the variables precluded assessment of elasticities.

2. **What analytical tools are being used by regional planning agencies to quantify the impacts of land use-transportation scenarios and how do variations in those techniques impact project results?** The 2005 study provided only summary, descriptive information on modeling techniques.

3. **How are regional scenario planning/visioning processes being connected to long-range transportation plans and project-level analyses?** Most of the scenario projects studied in the 2005 study were conducted as visioning exercises outside of normal long-range transportation planning structures. As a consequence, many of the metropolitan planning organizations (MPOs) in the regions where the studies occurred were unable or unwilling to employ the output from the scenario studies in standard transportation planning documents (long-range transportation plans, transportation improvement programs, and project-level analyses).

4. **What is the state of the practice on the use of regional land use-transportation scenario planning for assessing greenhouse gas (GHG) emissions and climate change?** The 2005 study indicated that only 10 out of the 80 projects studied made any attempt at measuring GHGs (Bartholomew & Ewing, 2008). However, since 2003, the last year included in the 2005 study, interest in assessing GHGs has grown substantially, suggesting a possible increase in attention to GHGs in more recent scenario projects.

5. **To what degree are national or global economic and environmental variables being incorporated into regional land use-transportation scenario planning processes?** Originally, scenario planning processes—especially those developed for business and military applications—focused on large-scale (frequently, global) environmental and economic variables. The 2005 study showed that these variables were not being included in land use-transportation scenario planning processes, possibly limiting the technique's planning and analytical power (Avin, 2007; Bartholomew & Ewing, 2009). Increased attention to global climate change and peak oil issues in recent years, combined with recent volatility in world oil prices, suggests possible increased attention to global economic and environmental issues in more recent scenario projects.

## Data Collection

Addressing these questions required accumulating a large sample of recent regional scenario planning projects. To accomplish this, the research team employed a combination of methods, graphically represented in Figure 1, that included informal surveys, keyword web searches, and cross referenced investigations.

The first step was the distribution of an open-ended survey questionnaire to members of the Association of Metropolitan Planning Organizations (AMPO). Because the objective was to focus on region-level scenario analyses, especially those associated with MPOs, the AMPO membership seemed to best represent the intended study group. To help increase survey response rates, an AMPO staff member helped craft the survey instrument and undertook distribution of the survey to the 385 AMPO member agencies via the AMPO email account.

The open ended survey was sent to the planning director of each MPO, requesting "any information you have about land use-transportation scenario planning projects that have occurred since 2000" (Appendix A). Responses were returned directly to the research team using a linked email account. Forty-three responses were generated through this mailing for an 11% response rate. AMPO staff indicated that this was a strong response given the increased rate of survey requests to MPOs in recent years, which has led to "survey fatigue" among AMPO members.

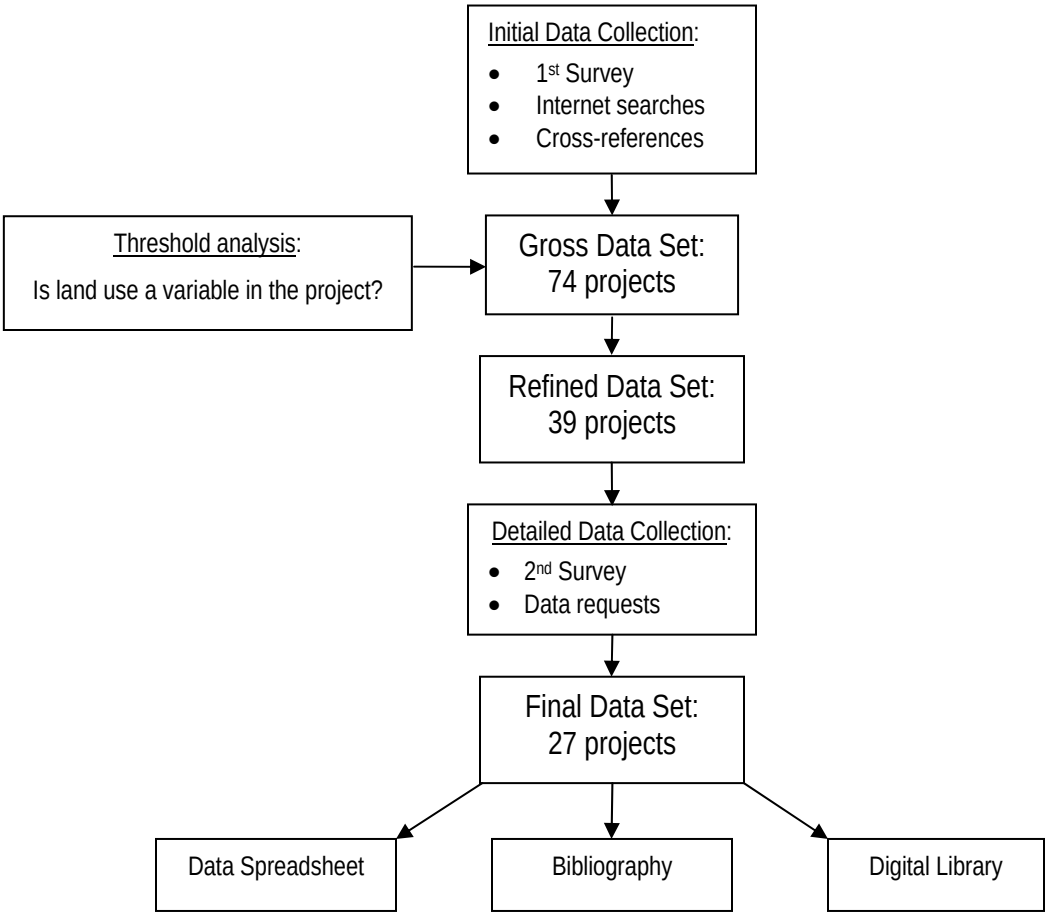


Figure 1. Data Collection Process.

To increase the potential data pool, the research team independently reviewed the websites of all AMPO member agencies. Researchers also employed internet keyword search methods, using "transportation planning", "scenario planning", and "long range transportation plans" as key search terms. Additional cross-referenced studies were also identified through internet searches. In total, researchers identified 74 projects—25 through the email survey, plus an additional 49 through the various internet methods.

The research team next collected basic information on the 74 projects, using project sponsor websites and solicitation of sponsor staff via email or telephone. The objective was to collect enough information to determine whether the projects met the study's primary discriminating criterion: whether future land use inputs—i.e., the spatial allocation, density, diversity, or design of growth—varied across scenarios. To remain in the study, a project had to have at least two scenarios exhibiting this type of variation. Thirty-nine of the original 74 projects were identified as meeting this criterion.

For these projects, the research team crafted and distributed a second survey and information request (Appendix B) that sought detailed qualitative and quantitative information about the project's scenarios and modeling processes. Researchers also used this second survey instrument to attempt collection of additional data about projects that had been included in the 2005 scenario study. The research team discovered that the requested information was often not available because staff members associated with the project were no longer at the agency, current staff members had no knowledge of project details and processes, and many organizations were in the process of updating second or even third generation studies and lacked the time or personnel to provide assistance. This was the case for all of the projects from the 2005 study and for 11 of the 39 more recent projects, leaving a total of 28 projects in the final data set.

For these 28 projects, the research team collated data onto a master spreadsheet according to policy categories described by Bartholomew (2009):

- Transportation infrastructure
    - Lane miles of roadways
    - Annual revenue hours of transit service
- Demand management/pricing
- Social marketing/education
- Land use patterns
    - Density
    - Diversity (heterogeneity)
    - Destination accessibility (compactness)
    - Distance to transit
    - Design

For most projects, researchers were required to make repeated requests to project staff to obtain data for as many of the policy categories as possible. Even after months of correspondence, it was not possible to obtain all of the requested information. What the team could collect is presented in summary form in Appendix C.

Researchers also created a detailed bibliographic summary of each project. These summaries are contained in Appendix D. In addition, source materials for each project were placed in a publicly-accessible digital library, created and maintained by the J. Willard Marriott Library at the University of Utah (http://content.lib.utah.edu/cdm4/az_details.php?id=20).

## Scenario Planning 101

A scenario is "an internally consistent view of what the future might turn out to be—not a forecast, but one possible future outcome" (Porter, 1985, p. 446). An analysis using multiple scenarios—a scenario planning process—defines a range of possible future conditions. The scenarios in such a process should reflect the influences that are both most important and most uncertain to the focus topic (Schwartz, 1991). Focusing on such influences gives scenario analysis its greatest strength, which is to narrow the range of uncertainty about possible future conditions to a more manageable set of possibilities.

The roots of scenario analysis lie within the broader topic of adaptive response technique, the military applications of which can be traced back centuries, at least as far as Sun Tzu's famous 6th century BCE treatise, the *Art of War* (Giles, 1910). As with a number of our current planning approaches, the more modern applications of scenario analysis come from the RAND Corporation, where during the 1950s scenario analysis was used to anticipate, and prepare for, possible Soviet nuclear attack strategies (Ringland, 1998). The apocryphal business application of scenario analysis was Royal Dutch/Shell's use of the technique to effectively anticipate the OPEC Oil Embargo of 1973 (Schwartz, 1991). Since then, scenario analysis has become fairly common in business circles and the business-based literature is fairly well-developed.

Scenario analysis, at least in a modified form, came to transportation planning comparatively late. The antecedent technique to scenario planning—alternatives analysis—became relatively common at the metropolitan level after the passage of the Federal Aid Highway Act of 1962 with its mandate for "3C" planning (continuing, comprehensive, cooperative); it became obligatory at the project level for major projects with the adoption of the National Environmental Policy Act of 1969 (NEPA) (Weiner, 1999). This style of alternatives analysis, however, was highly constrained, varying only the transportation system components, while keeping all other potential variables (e.g., land use development, transportation costs, and economic conditions) constant across alternatives.

Frustration with the narrowness—and artificiality—of this approach led to the development of two projects in the late 1980s/early 1990s that used land use development patterns as a variable across alternatives, in addition to transportation system elements. The two projects—Montgomery County's Comprehensive Growth Policy Study (1989) and 1000 Friend of Oregon's LUTRAQ project (Bartholomew, 1995)—were not the first explorations into using land use as a variable in a transportation analysis. Most of the earlier examples, however, were academic in origin (e.g., Edwards & Schofer, 1976; Mazziotti, et al., 1977; Peskin & Schofer, 1977). What set the Montgomery County and 1000 Friends studies apart and arguably made them vanguard projects is that they were done in decision making contexts that resulted in the adoption and implementation of land use planning and infrastructure investment policies.

## A New Practice is Born

These two projects helped kick off a decade of similar studies in more than 50 metropolitan areas across the U.S. (Bartholomew, 2007a), effectively creating a new planning practice that merged elements of the military/business style of scenario planning and the NEPA/3C style of transportation planning. Through the 1990s and early 2000s, this hybrid process—now known as "land use-transportation scenario planning" or "blueprint planning"—followed a fairly consistent work program. The modal project began with the assessment of a trend scenario where urban development and transportation investment patterns of the recent past were assumed to continue to the planning horizon (typically 20 to 50 years in the future) and the impacts of this scenario on the land, environment, and transportation system of the study were assessed. Almost uniformly, these results indicated land consumption rates, transportation performance measures, and air quality projections that were dismal, often shocking. This created a political and professional impetus to craft alternative scenarios. Stone (2002, p. 138) refers to this rhetorical trope as the "story of decline": "'In the beginning, things were pretty good. But they got worse. In fact, right now, they are nearly intolerable. Something must be done.'" In a way reminiscent of Ebenezer Scrooge's response to the visages portrayed by the Ghost of Christmas Future, political stakeholders viewed the estimated impacts of the trend scenario and begged for some other future. Two studies from Salt Lake City, Utah illustrate this process arc.

### Envision Utah

The Envision Utah project was motivated by concern over impacts on the quality of life in the Salt Lake region from high population and employment growth rates in the 1980s and 90s and a projection of a near tripling of the region's population by 2050. The project was inspired and supported by a series of high-profile meetings and conferences on growth in the mid-90s, some of which were hosted by the state's governor. The project began with a baseline projection of how the region would grow if current municipal plans were followed through 2020, plus an extrapolation of those development trends through 2050. Consistent with the archetypal narrative outlined above, the land, air quality, water, and transportation impacts of this projection alarmed many of the region's citizens, fueling an interest in alternative future scenarios.

In addition to this baseline scenario (Scenario B in Table 1), planners articulated a market trend scenario (Scenario A) showing how the region might grow if development trends from the previous three to five years continued into the future. This scenario was even less dense than Scenario B. Citizens and political leaders, working in a series of intensive charrette-style public meetings, then crafted two alternate futures. Scenario C accommodated new growth by designating a significant percentage in existing urbanized areas as walkable infill/redevelopment. Scenario D accelerated and intensified these development strategies,

significantly increasing regional densities by assuming large amounts of infill/redevelopment concentrated in rail transit corridors.

Not surprisingly, the analysis showed that Scenario A had the biggest increases in travel (as measured by vehicle miles traveled (VMT)) and water consumption, while Scenario D had the smallest (see Table 1). Interestingly, while Scenario A was projected to be the costliest for infrastructure, Scenario D was not the least expensive—the scenario's extensive transit improvements placed it $1 billion ahead of Scenario C.

Table 1. Evaluation results for the Envision Utah project. Sources: QGET, 1998, 2000.

| | Scenarios | | | | |
|---|---|---|---|---|---|
| | **A** | **B** | **C** | **D** | **Quality Growth** |
| Persons per residential acre | 5.0 | 5.6 | 7.6 | 8.2 | 7.6 |
| Daily VMT (millions) | 85.3 | 79.2 | 76.6 | 76.0 | 76.8 |
| Percent of work trips on transit | 2.9 | 3.2 | 4.2 | 4.8 | 5 |
| Percent of population ½ mile of rail transit | 1.5 | 1.7 | 25 | 32 | 22.6 |
| Water Consumption (000s acre feet) | 1,025.9 | 954.2 | 808.6 | 770.5 | 915.6 |
| Infrastructure Capital Costs ($ billions) | 37.6 | 29.8 | 22.1 | 23.1 | 21.9 |

The project's sponsors distributed these findings widely using a variety of media, including a full-color insert in the Sunday edition of the region's most widely circulated newspaper. After reading about the differences between the four scenarios and their varying impacts on livability indices, citizens were urged to vote for their preferred scenario. Though the vote tally was not controlled to ensure statistical reliability, the results indicated a decided rejection of "business as usual" (scenarios A & B) and a preference for a more compact future (scenarios C & D) (see Figure 2).

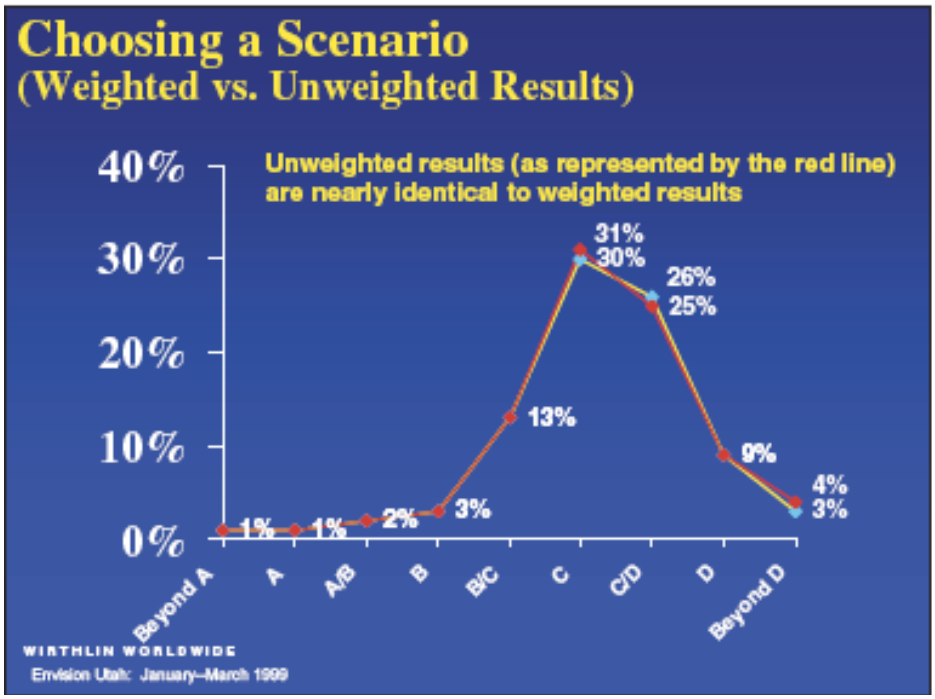


Figure 2. Citizen preferences for Envision Utah scenarios.
Source: Coalition for Utah's Future, n.d.

Given the closeness of the votes for scenarios C and D, the project sponsors elected to blend components from each scenario to craft a compromise scenario, dubbed the Quality Growth Scenario. On some measures, the hybrid scenario performed even better than its parent scenarios. For example, the Quality Growth Scenario achieved the highest percentage of work trip transit ridership of all the scenarios, while posting the lowest price tag for infrastructure costs (see Table 1).

The sponsors of Envision Utah intended to use the Quality Growth Scenario as a lobbying tool to encourage local, regional, and state agencies to adopt policy reforms designed to achieve the scenario's basic goals. Rather than promote the scenario's specific spatial growth allocation, however, the project sponsors elected to redact a series of more generalized principles from the scenario and use those as the basis for implementation activities. The Quality Growth *Strategy* that resulted from this process essentially traded the very specific land use and growth allocations of the Quality Growth *Scenario* for generally worded—some would argue, vague—admonitions (see Table 2).

Table 2. Excerpt from Goal II: Promote Mobility & Transportation Choices of the Envision Utah Quality Growth Strategy. Source: Coalition for Utah's Future, 2000.

| Strategy | Why | Who | How |
|---|---|---|---|
| Promote creation of a network of bikeways and trails, especially commuter trails linking daytime destinations. | • Improves air quality<br>• Provides more transportation choices<br>• Lowers cost of infrastructure and services<br>•Lowers personal transportation costs | local governments, employers, WFRC, MAG, SLC Mayor's Bicycle Advisory Committee, UDOT, other bicycle groups, Quality Growth Commission, Legislature (offer incentives and funding to local governments) | • Envision Utah, bicycle groups work with local governments, UDOT to establish bike routes on streets, and where possible, to acquire independent rights-of-way.<br>• Bring groups of commuters together to work on plan logistics and incentives.<br>• Envision Utah work with bicycle groups, transportation officials to identify primary corridors for bicycle commuting.<br>• Bicycle groups work with railroads, utility companies, and canal companies to identify possible dedicated bicycle paths. |

The advantage of this strategic choice was that it avoided potentially offending local government officials, who in the Salt Lake region—as in most U.S. metro areas—jealously guard their authority over land use planning and zoning. The calculation, which seems plausible, was that the geographic specificity of the Quality Growth Scenario could easily be understood as an assertion by the project's primary sponsor—a non-governmental organization—that certain plan and zoning amendments needed to be made for particular pieces of real estate. In addition to potentially offending local government officials, such an assertion could have engendered a negative response from property owners. Such controversies could have side-tracked discussion of the important issues underlying the Quality Growth Scenario.

The strengths of this approach, however, proved to be a weakness when it came to transportation planning processes. Transportation planning, as it is traditionally practiced in the U.S., requires a set of assumptions about the spatial allocation of future growth as a primary input (Beimborn, Kennedy & Schaefer, n.d.). Without a firm political commitment to the growth allocation assumptions of the Quality Growth Scenario, government transportation planners in the Salt Lake region were left with little choice than to use trend-based allocations of future growth—essentially, Scenario A—the same scenario so roundly rejected by Envision Utah participants.

## Wasatch Choices 2040

This lack of connection between the visioning functions of the Envision Utah process and the traditional planning functions of regional and state transportation planning agencies led to a new scenario planning project, jointly sponsored by Envision Utah and the Salt Lake region's two metropolitan planning organizations. The new project—Wasatch Choices 2040—was designed specifically to be integrated with a scheduled update to the region's long-range transportation plans (Burbidge, Knowlton & Matheson, 2007).

While using the now familiar four-scenario format, the sponsors of the Wasatch Choices project elected to craft scenarios that were more theme-based then the earlier Envision Utah project. Scenario A remained the trend scenario, referred to as "business as usual." Scenario B emphasized nodal urban development in transit station villages. Scenario C focused on mixed-used development in linear boulevards. Scenario D postulated greater suburban business development centered on the regional highway system. Hence, the scenarios varied, not just in intensity, but also in urban form.

Consistent with the earlier project, assessment of the scenarios showed the most land consumptive scenario (Scenario D) had the highest VMT, highest infrastructure costs, and the lowest transit ridership, while the opposite was true of the most compact scenario (Scenario B) (see Table 3). Also similar to the earlier project, the Wasatch Choices team subsequently crafted a synthesis scenario—the 2040 Vision—as the preferred option. According to the team, the vision scenario represents a "plausible outcome" if communities adhere to a set of nine growth principles also developed through the study process. These growth principles effectively mirror the content of the earlier Quality Growth Strategy, but in simplified form (see Burbidge, Knowlton & Matheson, 2007, pp. 151-152).

Table 3. Evaluation Results from the Wasatch Choices 2040 Project.
Source: Burbidge, Knowlton & Matheson, 2007.

| | Scenarios | | | |
|---|---|---|---|---|
| | **A** | **B** | **C** | **D** |
| Land Consumed (sq. miles) | 338 | 282 | 329 | 389 |
| Average Daily VMT (millions) | 81.2 | 79 | 80.9 | 85.4 |
| Percent of Peak Hour Trips on Transit | 2.5% | 2.8% | 2.5% | 2.4% |
| Infrastructure Capital Costs ($ billions) | 31.49 | 23.19 | 18.6 | 37.38 |

The similarities between the original Envision Utah and Wasatch Choices projects are striking, if not unexpected. The treatment of the projects' respective outcomes by government transportation planning agencies, however, was significantly different. Where the earlier study was effectively ignored by transportation planners, those same planners used the latter project to inform their assumptions about the location of future growth. While the 2040 Vision was not incorporated into transportation planning assumptions wholesale, local governments were provided an opportunity to substitute the 2040 Vision allocation in place of the more customary trend assumptions (Wasatch Front Regional Council, 2007). The results varied from jurisdiction to jurisdiction, resulting in a pastiche of outcomes that reflect a fairly wide range of attitudes across the Salt Lake region toward growth management issues. Still, the Wasatch Choices study importantly demonstrates how a regionally based scenario-driven visioning process can be incorporated into standard transportation practice in the context of a local government-dominated land use regulatory environment. Additional information about the Wasatch Choices project is provided at in Appendix D at page D-136.

## National Data

The two Utah projects are representative of the growing practice in metropolitan land use-transportation scenario planning, noted above. The extent of practice is represented in Figure 3, which depicts the geographic location of scenario projects tracked both by the 2005 study (1989-2003) and by this study (2003-2010).

Figure 3. U.S. scenario planning projects, 1989-2010.

As can be seen, the location of projects loosely matches the distribution of the country's population. Given the association of scenario planning with concerns about growth issues, noted in the 2005 study (Bartholomew, 2007a), it is not surprising to see the technique more widely practiced in places with either high rates of growth, large populations, or both. It is interesting to observe the places where projects in the second period (2003-2010) occurred in the same location as projects from the first period (1989-2003). In some cases, as with the Utah-based projects discussed above, the earlier project functioned as a "warm up" that prepared the region for a more rigorous later project. In other cases, the newer project represents the latest iteration of an established regional practice of conducting scenario analyses at regular intervals, frequently as part of the process to update the MPO's long-range transportation plan. Examples of this practice can be seen in the Puget Sound (p. D-147);[1] San Francisco Bay (D-6); Lansing (D-75); Wilmington, Delaware (D-25); and Albany, New York (D-89) regions. In these regions, scenario planning is something that occurs regularly at a regional scale, with the apparent understanding that growth related issues morph and change over time, requiring updated observations and interventions.

By contrast, the later period did not see many scenario projects from Oregon jurisdictions, although many are represented in the earlier time frame. Especially conspicuous by its absence is Portland, long known for its advanced growth management systems (Ozawa, 2004). The impression one gets in reading planning materials from Metro, the Portland area regional government, is that the Portland region did its big scenario project (Region 2040) in the mid-1990s, which touched-off a series of policies and programs that the region is still implementing. With the Portland region's unique hierarchical power structure over growth-related issues, the region could more easily view its vision as "set" for a longer period of time than perhaps other regions could. The question in such a place is how best to implement that vision.

## Transportation Outcomes

The scenario projects reported transportation outcomes in a variety of ways, including vehicle hours of travel, vehicle hours of delay, miles and hours of congested conditions, and mode split. The one metric shared by all projects was vehicle miles of travel (VMT). Given its easy availability and its ability to represent overall travel demand, the research team elected to use VMT as the primary output variable for the study. Figure 4 shows daily VMT per person for all 150 scenarios included in the study. As can be seen, the range is quite broad, running from 12.06 to 62.72. Figure 5 displays the percentage difference in VMT between alternative (non-trend) scenarios and their respective trend scenarios. It is remarkable that the greatest percentage of VMT reduction (-30.27%) is almost the same as the percentage reported in the 2005 scenario study (-31.68%) (Bartholomew & Ewing, 2009). The other end of the range, however, is quite different: the 2005 data indicate only eight scenarios with more

[1] Page references are to annotated bibliographies of the projects in Appendix D.

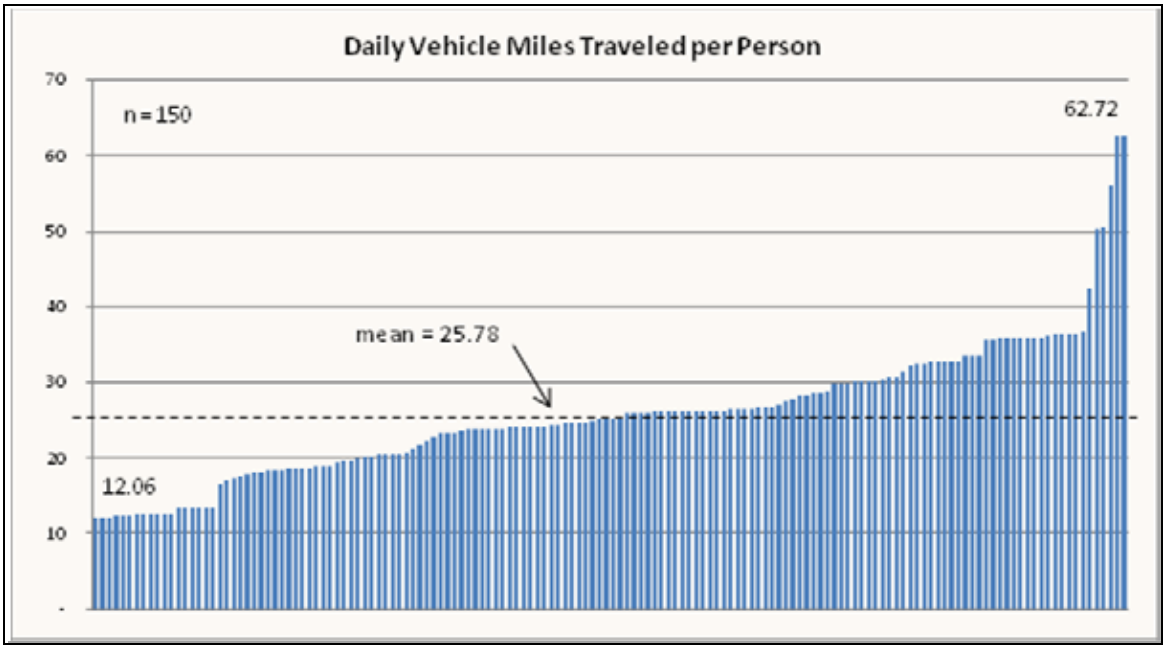


Figure 4. Daily VMT per person.

VMT than the trend with a maximum percentage of +5.17%, while this dataset includes 32 scenarios with greater VMT and a maximum of +23.64%. The reason for this difference is not clear. One possible factor is the number of scenarios in the current database, which is nearly twice the number in the 2005 study (119 vs. 62).

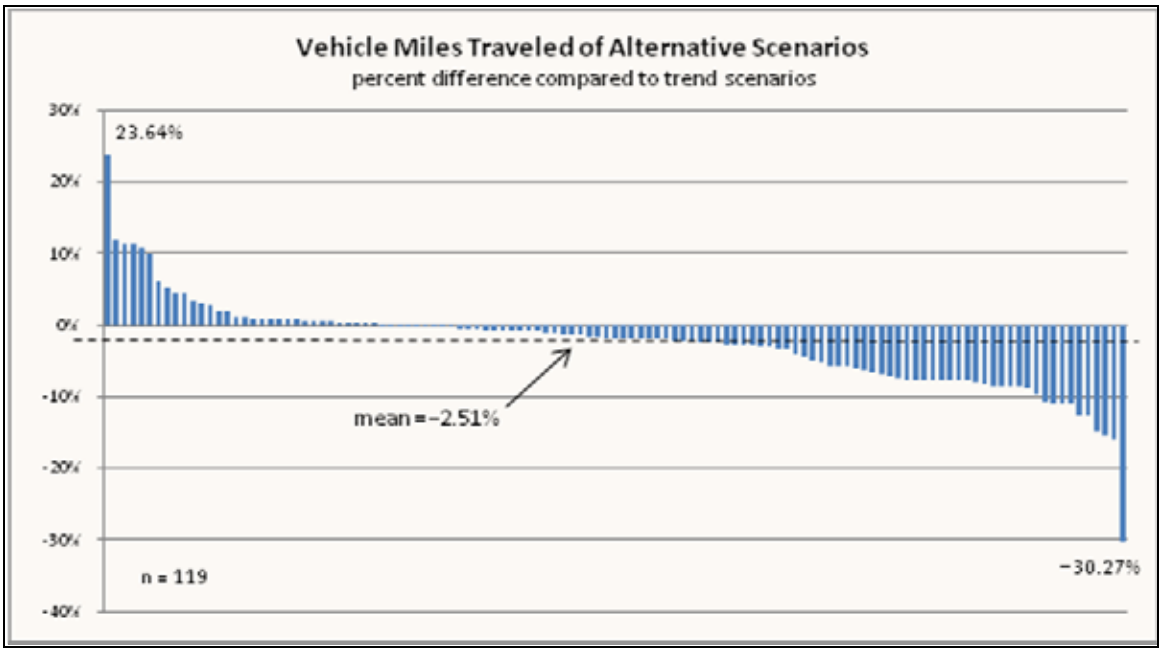


Figure 5. Percent difference in VMT: alternative vs. trend scenarios.

## Policy Factors

The 2005 scenario study identified concerns about urban form, sprawl, and automobile dependence as primary reasons given by scenario planning project sponsors for engaging in scenario analysis (Bartholomew, 2007a). Given this focus, the research team elected to use a framework suggested by Bartholomew (2009) for obtaining, classifying, and analyzing data for this study. That framework groups the policy, economic, and physical environment influences on metropolitan-scale transportation patterns into four basic categories: transportation infrastructure, the pricing of transportation use, social marketing and education about transportation and land use choices, and physical land use patterns and urban form. For the latter category, the framework sub-classifies land use influences into 5 "D" variables (per Ewing et al., 2008): density, diversity (heterogeneity), destination accessibility, distance to transit, and design.

*Transportation Infrastructure*

The research team set out to collect data on transportation infrastructure in a way that would provide summary information on the extent and nature of the region-wide transportation systems so as to facilitate region-to-region comparisons. The team chose to focus on roadway lane miles and transit revenue hours of service as the metrics that would best satisfy this objective.

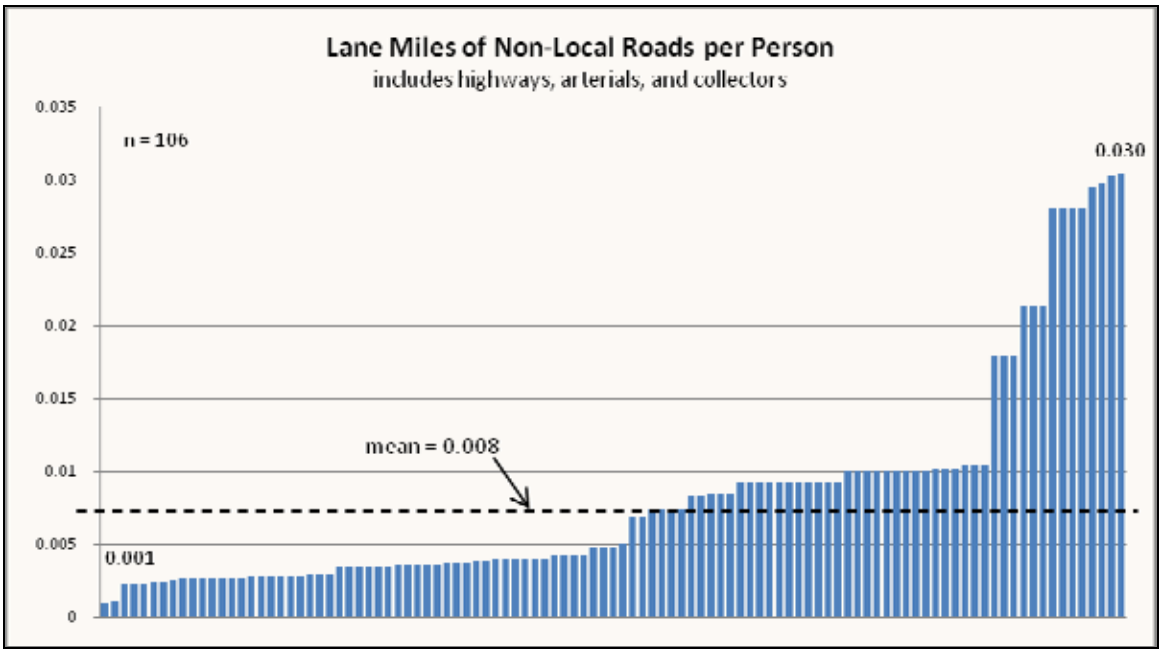


Figure 6. Lane miles of highways, arterials, and collectors per person.

For road lane miles, the focus was on freeways, highways, arterials, and collectors—roads that have something other than local property access as a primary function. The research team was able to collect lane mile data for 18 projects, containing 106 scenarios. The number of lane miles per person (Figure 6) in those scenarios ranges widely from 0.001 to 0.030, with a mean value of 0.008.

A bivariate scatterplot of lane miles per capita vs. VMT per capita is presented in Figure 7. The direction of change is consistent with other research on road supply and travel demand (e.g., Cervero, 2002).

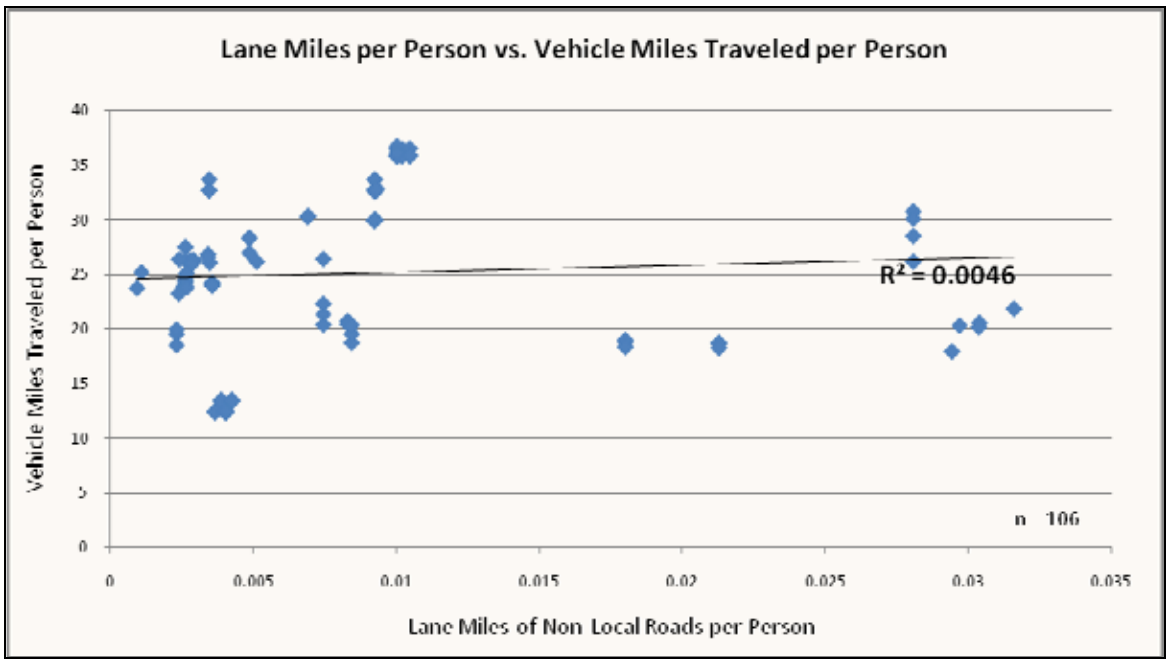


Figure 7. Scatterplot of lane miles per person and vehicle miles traveled per person.

Data on levels of transit service was more difficult to locate. The research team was able to collect transit data—in the form of annual revenue hours of service—for only 10 of the projects, containing 35 scenarios. As with lane miles, the range of service hours per person is broad, from less than 0.001 to 1.804 (Figure 8).

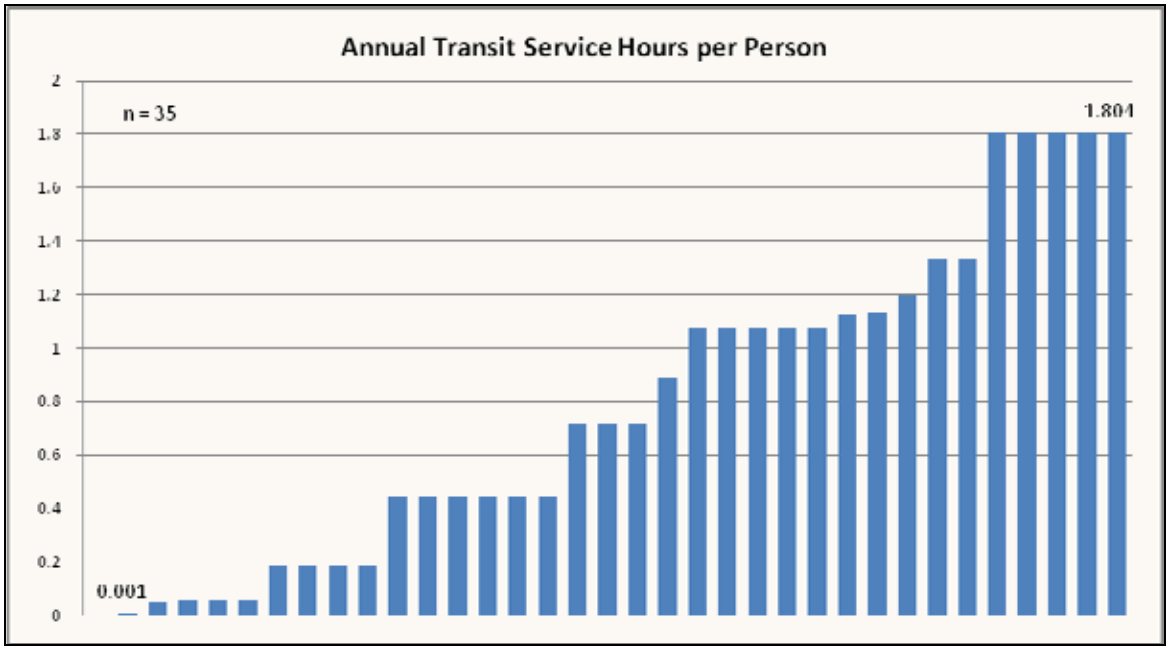


Figure 8. Annual transit revenue hours of service per person.

A scatterplot of transit revenue hours per person vs. VMT per person shows the expected negative relationship (Figure 9).

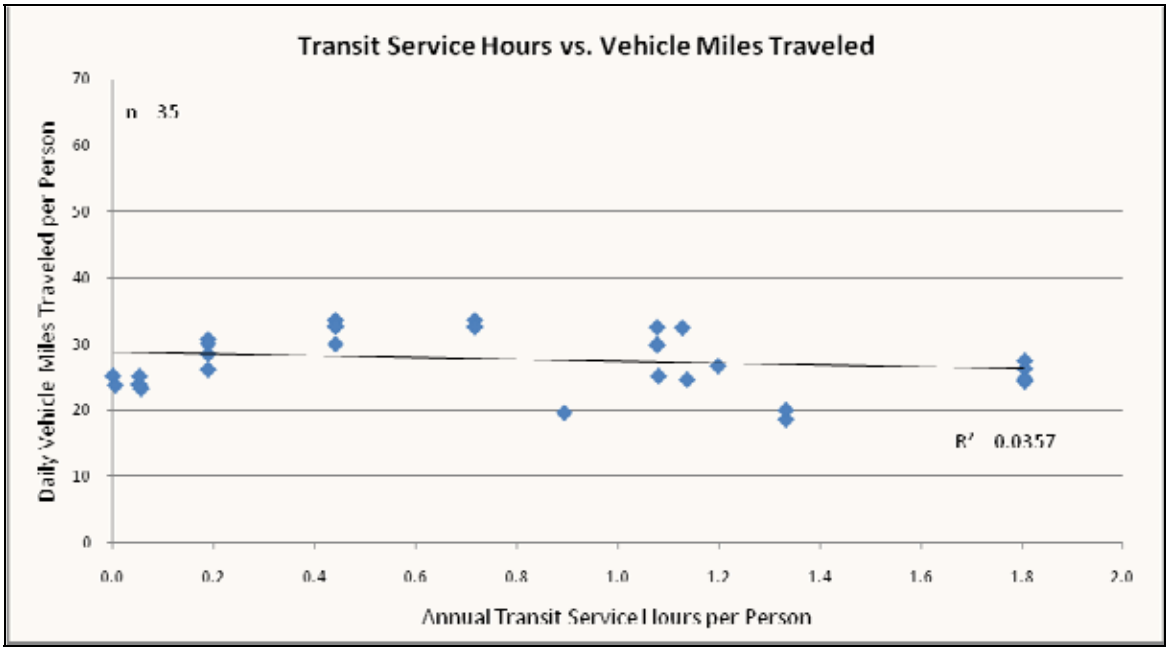


Figure 9. Scatterplot of annual transit revenue hours per person and vehicle miles traveled per capita.

*Density*

Figure 10 shows the development densities of the scenarios in this dataset, as expressed in persons per developed acre. The data show the density of *all* development at the planning horizon year—i.e., it includes development that pre-dates the base year of the scenario project, as well as new development occurring in between the base and horizon years. It also includes trend, as well as alternative, scenarios.

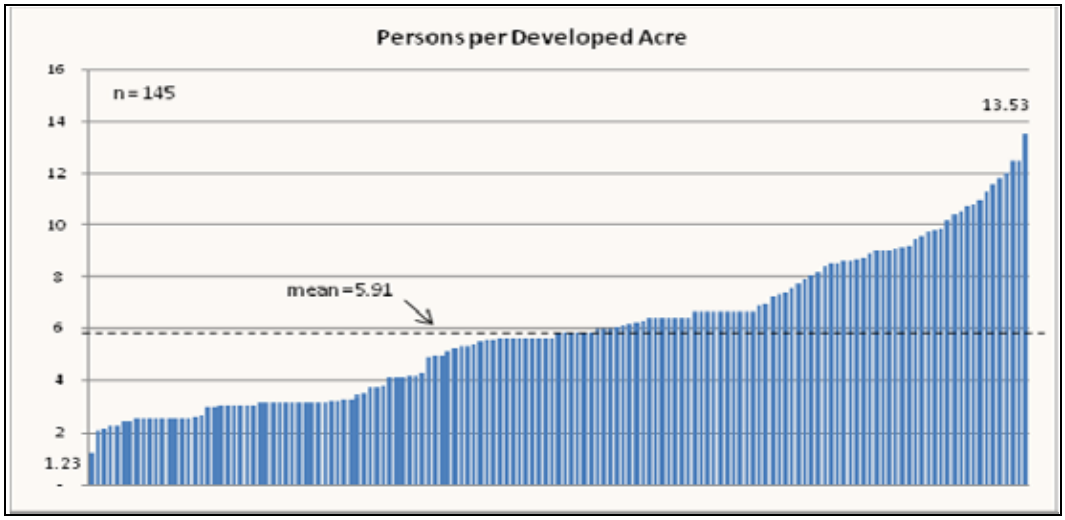


Figure 10. Density of all development in the planning horizon year.

Analysis of persons per acre and VMT per person (Figure 11) shows a moderate level of association, suggesting density's important but partial influence on travel demand, consistent with the land use-transportation literature (e.g., Ewing & Cervero, 2001).

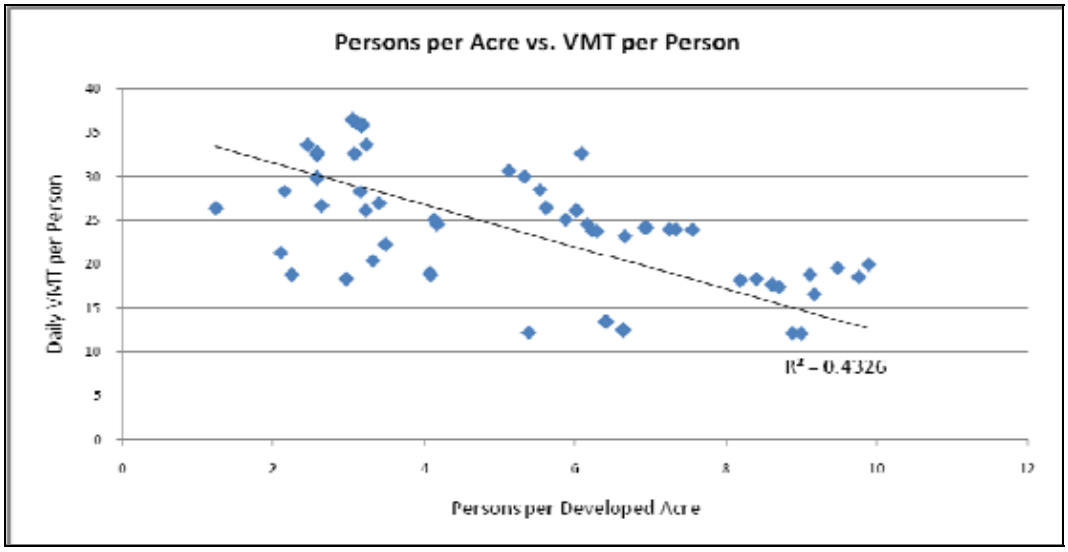


Figure 11. Scatterplot of persons per acre and vehicle miles traveled per person.

Because Figure 10 includes development pre-dating the project base year, it tends to mask the higher density development assumptions that are central to many alternative scenarios. Figure 12 shows development densities for only newly developed lands—those lands developed according to the policy assumptions of the scenarios between the base and planning horizon years. As expected, these data show a higher average density of persons per developed acre than the measure of density for all development (24 vs. 6 persons per acre). Figure 12, however, still includes trend scenarios, in addition to the normally denser alternative scenarios.

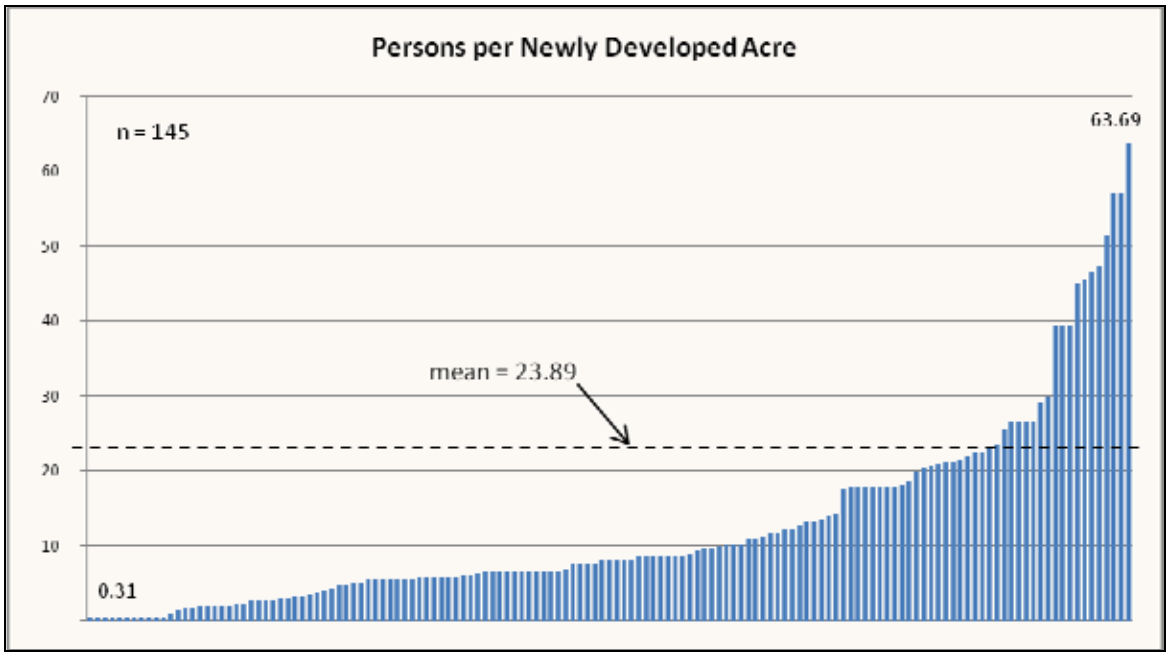


Figure 12. Density of development occurring between base and horizon years.

To better gauge the difference between alternative and trend scenarios, the research team calculated the percentage difference in density between each alternative scenario and its respective trend scenario (Figure 13). As shown in Figure 13, most alternative scenarios in this dataset are denser than their trend counterparts—only 4 of the 119 alternative scenarios are less dense and another 16 are as dense their respective trend scenarios. The remaining 99 scenarios range from 1 to 187 percent denser than the trend. The heavy weighting toward denser alternative scenarios is consistent with the findings of the 2005 scenario study, although the range is broader in this dataset than in the 2005 study, which included scenarios 15% less dense to 64% denser than the trend (Bartholomew & Ewing, 2009).

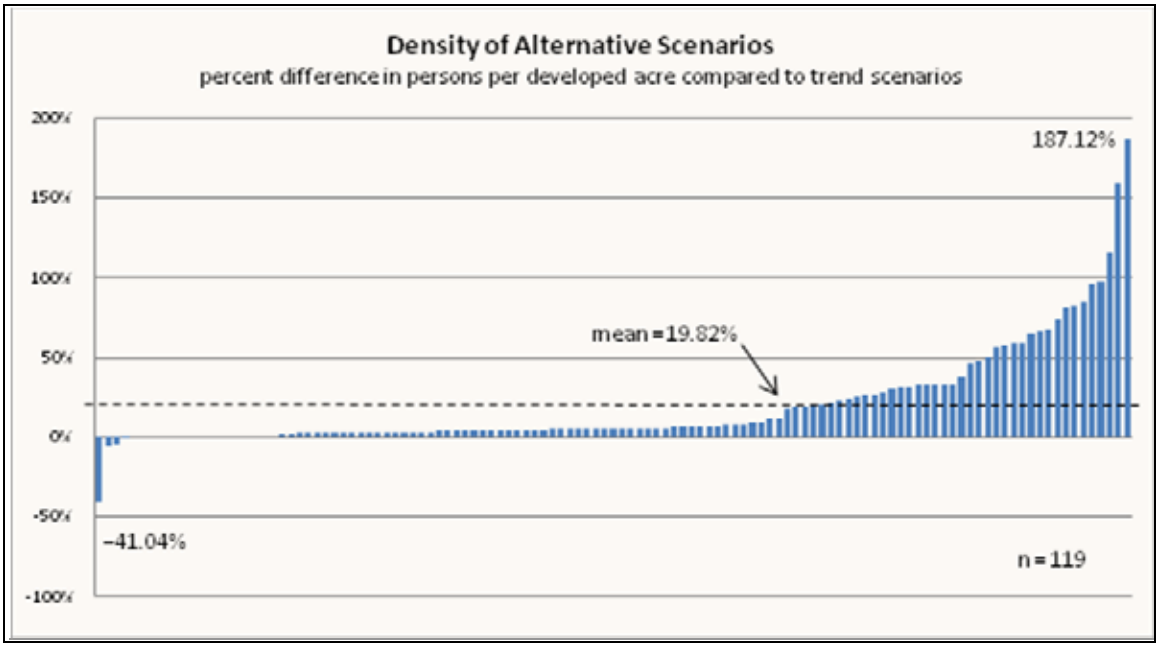


Figure 13. Percentage difference in persons per developed acre: alternative vs. trend scenarios.

This strong tendency toward denser scenarios matches the consistently expressed motivation on the part of project sponsors to explore future development options that have smaller footprints (i.e., are less land consumptive) than what would occur with the continuation of past practices (see Bartholomew, 2007a). The percentage difference in footprint of alternative scenarios compared to the trend is represented in Figure 14, showing expected weighting toward less land consumption.

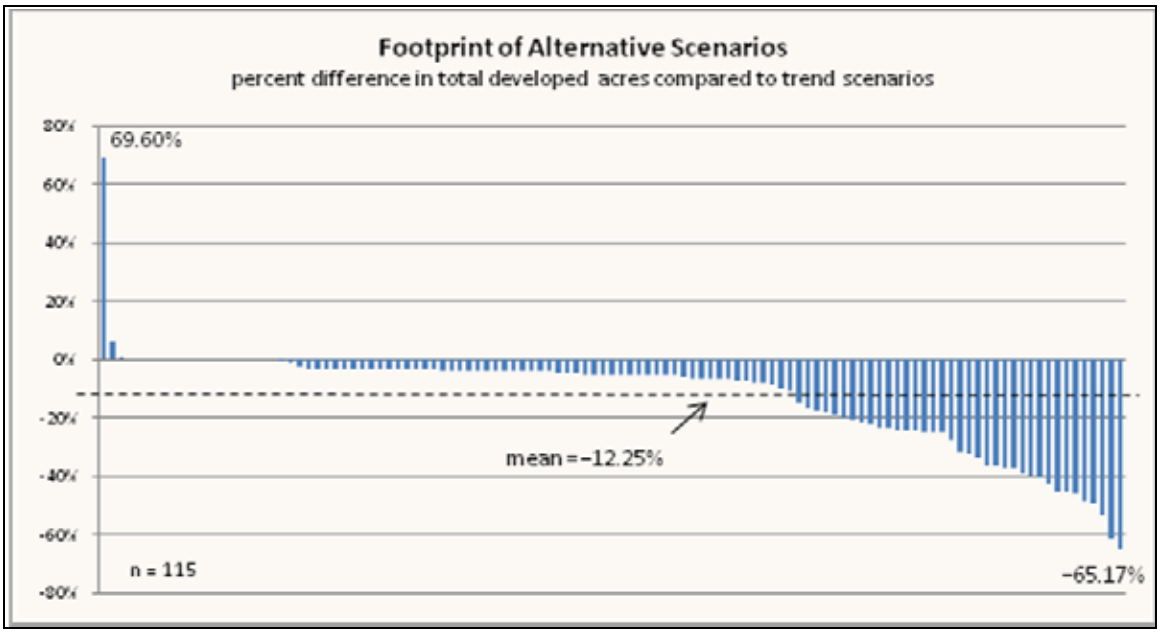


Figure 14. Percentage difference in developed acres: alternative vs. trend scenarios.

Figure 15 is a scatterplot showing the relationship between amount of developed land and VMT. The $R^2$ (0.8072) of the trendline indicates a strong relationship between the variables, which is not surprising—one would expect geographically larger regions to have higher VMT.

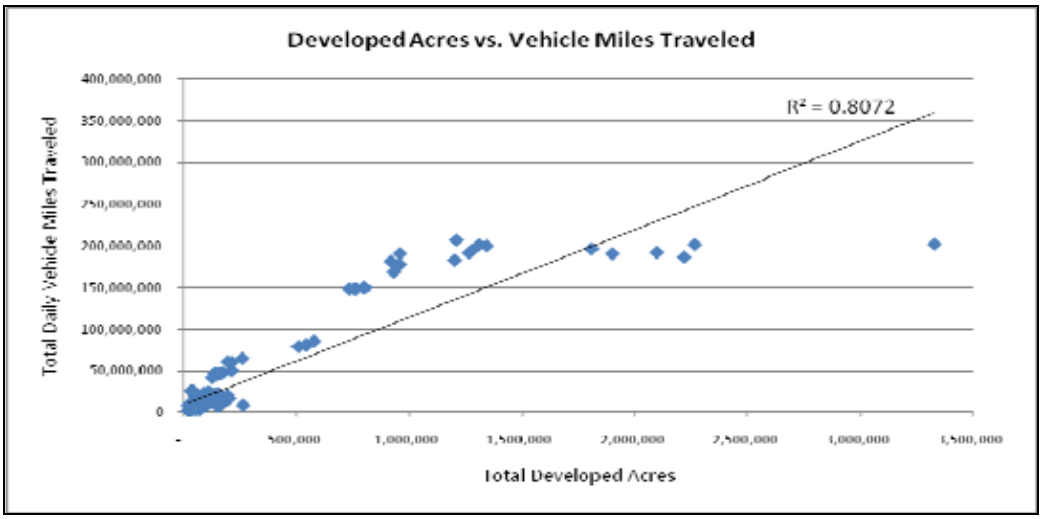


Figure 15. Scatterplot of developed acres and vehicle miles traveled.

*Distance to Transit*

The data on housing proximity to transit (Figure 16) indicates a very broad range of values, from less than 1% of total households near transit to more than 94%. The breadth of the range suggests possible data collection problems sourced in differing definitions transit proximity used by the scenario project sponsors. For example, it seems possible that some agencies may have been measuring households proximate to any type of transit service, no matter how slow or infrequent, while others may have been measuring only those households close to rail stations.

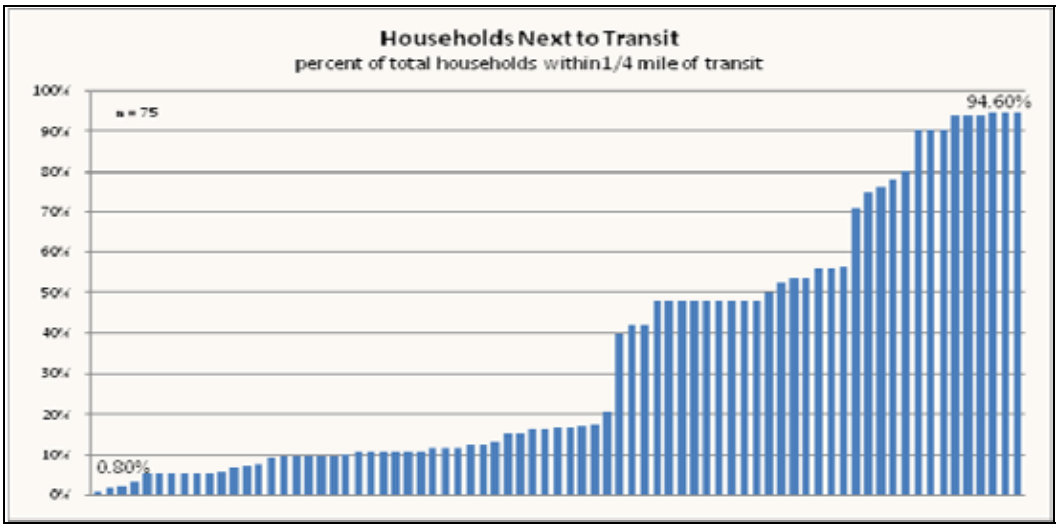


Figure 16. Percent of total households within ¼ mile of transit.

Bivariate analysis of the variable, nevertheless, shows some level of association with travel demand (Figure 17).

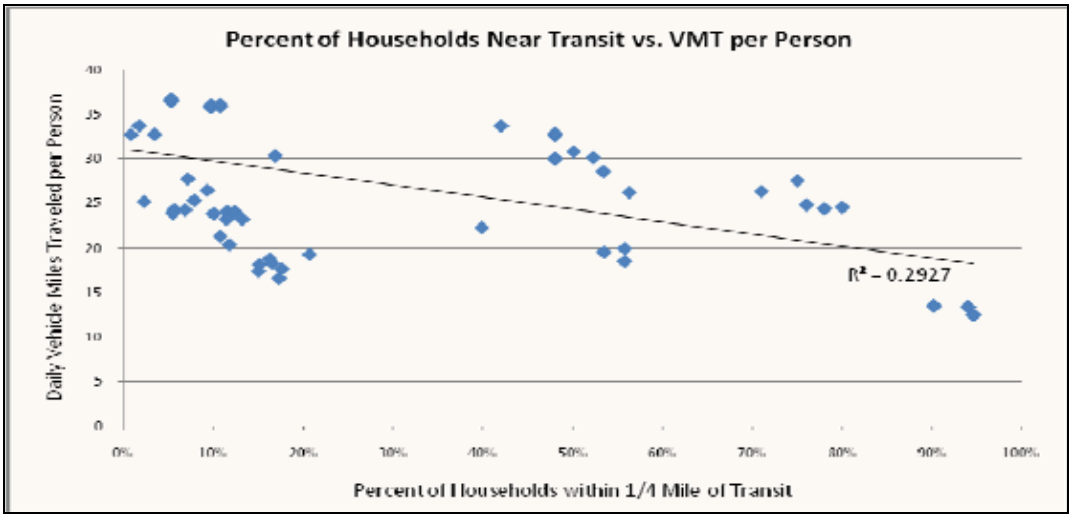


Figure 17. Scatterplot of percent of households near transit and vehicle miles traveled per person.

*Other Variables*

Destination accessibility—the degree to which desired destinations are easily accessible—has been identified as the most influential land use variable on VMT (Ewing & Cervero, 2001). Unfortunately, data relating to this variable were not consistently available, although several projects reported job accessibility by transit. For example, the Regional Mobility and Accessibility Study sponsored by the Washington Metropolitan Council of Governments, includes the following assessment of the study's six scenarios:

Table 4. Number and Percent of Households Able to Reach 1.5 million Jobs within 45 Minutes by Transit.

| Scenario | Number of Households | Percent of Regional Households |
|---|---|---|
| Base Case | 184,200 | 7.63% |
| Higher Households in Region | 267,000 | 11.06% |
| More Household Growth in Inner Areas | 298,700 | 12.37% |
| More Jobs in Outer Areas | 133,300 | 5.52% |
| Region Undivided | 404,100 | 16.74% |
| Transit-Oriented Development | 283,400 | 11.74% |

The research team considered the amount and percentage of newly developed acres (developed between base and horizon years) as a possible surrogate variable for destination accessibility. The rationale being that fewer newly developed acres might correlate with greater amounts of infill development, which would likely have greater accessibility levels compared to greenfield development. This proved to be unsatisfactory, with bi-variate $R^2$ values of less than 0.1. The team elected instead to craft dichotomous (i.e., yes or no) dummy variables for infill and node development, based on textual descriptions of scenarios, for the multivariate analysis reported below.

Limited data availability similarly led the team to create dummy variables for transportation pricing and land use diversity (heterogeneity).

## Modeling Capacity

With one exception, all of the models used in the scenario projects were some version of the standard four-step Urban Transportation Modeling System (UTMS). UTMS models, initially created to estimate demand for large-scale highway facilities (Pas, 1995), are insensitive to the impacts of land use variables (except, to a degree, destination accessibility) on travel mode and trip length. A recent survey of local and regional governments in California identified a number of features in current UTMS-based modeling structures and practices that limit their ability to evaluate smart growth land use strategies. These features include the inability to model trip chaining behavior; the total neglect of walk and bike trips; the use of fixed vehicle trip rates by land-use type; the failure to consider the effect of building, street, and sidewalk layout; the use of large travel analysis zones that blur land use patterns; and the failure of transportation system performance to feedback to land use allocation decisions (DKS Associates & University of California [DKS], 2007). These shortcomings are echoed in other recent critiques of modeling systems and practices (Beimborn, Kennedy, & Schaefer, n.d.; Cervero, 2006; Committee for Determination of the State of the Practice in Metropolitan Area Travel Forecasting, Transportation Research Board [TRB], 2007; Johnston, 2004; Walters, Ewing, & Schroeer, 2000).

The literature is replete with analyses showing the role that differences in modeling techniques can play on forecasted outcomes within a single region (e.g., 1000 Friends of Oregon, 1991; Johnston, Rodier, Abraham, & Hunt, 2001; Rodier, Johnston, & Abraham, 2002; Webster, Bly, & Paulley, 1988). Most critics identify advanced modeling such as tour-based modeling, activity-based modeling, supply-side modeling, or micro-simulation modeling as the preferred remedy for these problems. While these techniques hold great promise, they have yet to be deployed widely; in a recent count, activity-based models were in use or under development by only 11 of the nation's 385 MPOs (TRB, 2007, p. 101). Post-processing model outputs using travel elasticities are a simpler, cheaper way to overcome of the limitations of four-step models. Although more commonly used to estimate mobile emissions of criteria air pollutants (Cervero, 2006), some MPOs are using post-processing to predict factors needed for land use–

transportation scenario analysis, including land use density, diversity, design, destination accessibility, and distance to transit (DKS Associates & University of California, 2007).

In an effort to try to control for the effects of modeling capacity on travel demand outputs, the research team developed a simple survey to be completed by planners at the agencies sponsoring the scenario projects. The survey instrument was based on the work by DKS and the University of California, noted above. A key element of that study is the rank ordering of modeling components according to their relative importance in assessing the travel effects of Smart Growth strategies. Given the strong representation of Smart Growth elements in the scenarios included in this dataset, the DKS ranking seemed appropriate for evaluating modeling systems. Figure 18, taken from the DKS report, represents the report's rank ordering of modeling components with respect to Smart Growth sensitivity.

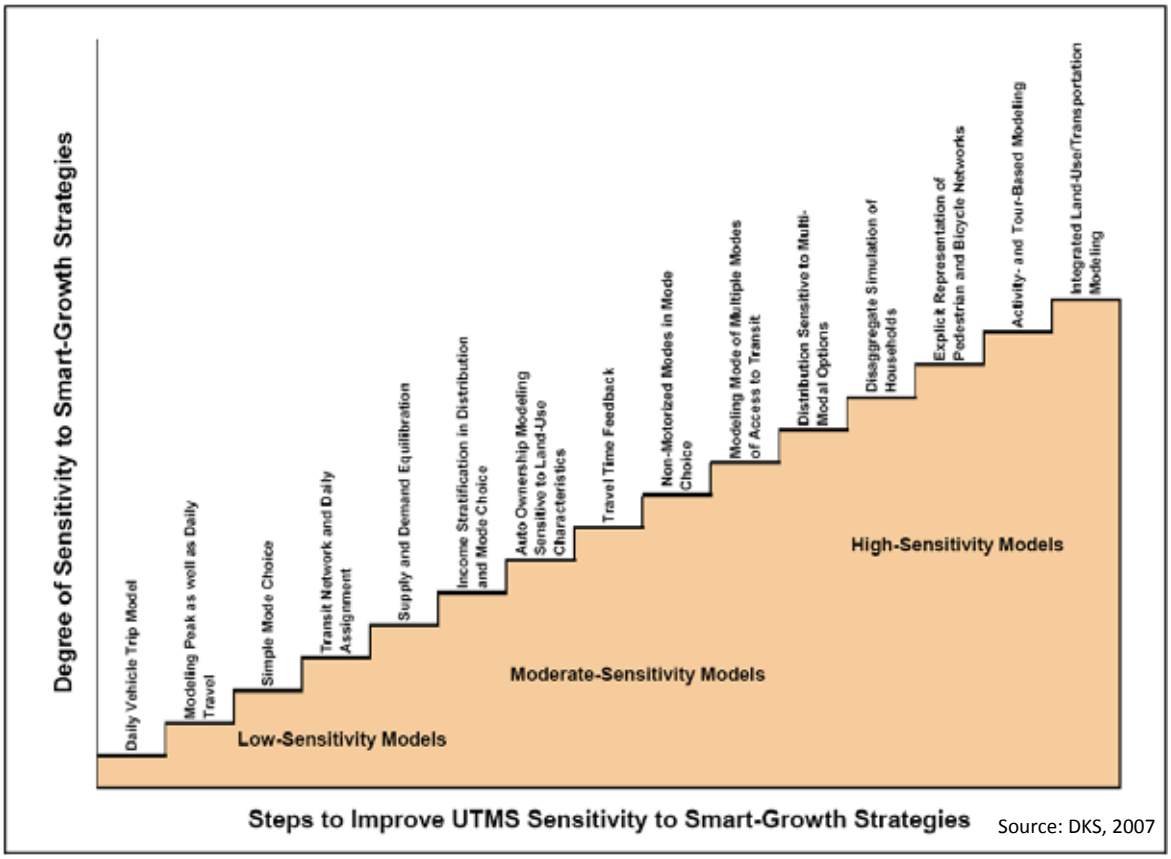


Figure 18. Logical progression of steps to improve UTMS sensitivity to Smart Growth strategies.

The survey created by the research team, which is included as part of Appendix B, lists all of the components contained in Figure 18, with a response line next to each component. The team included as an additional survey element the post-processing of land use variables. Although not included in Figure 18, that technique is recommended by the DKS study (and others, see Cervero, 2006) as a best-practice alternative to some of the higher-end components.

Respondents were directed to “place a mark (an X or check) next to each modeling component that is present, or topic that is addressed moderately to substantially, in the modeling process” used for the scenario project at issue.

The overall results of the survey are displayed in Table 5. The results show a wide range of Smart Growth modeling capacity, from the Cheyenne, Wyoming model, which contains only the first two elements, to the Puget Sound Regional Council model, which contains all of the elements listed (except post-processing, which is probably unnecessary given the other components of the agency’s modeling system). The progression from the most basic elements, on the left of the table, to the more advanced components, on the right, does not rigorously follow the progression depicted in Figure 18—there are frequent gaps in the middle of many of the responses. Nevertheless, the table does give an overall sense of evolution, from left to right, that is at the root of the DKS study.

Table 5. Results of Smart Growth Modeling Survey.

| | Daily vehicle trip model | Peak & daily travel | Transit/highway mode choice | Transit network & daily assignmt | Supply & demand equilibration | Income strat. in dist. & mode choice | Auto ownership sensitive to land use | Travel time feedback | Ped/bike in mode choice | Multiple modes of access to transit | Distrib. sensitive to multi-modes | Dissaggregate simulation of HHs | Ped/bike networks | Activity- and tour-based modeling | Post-processing of D variables | Integrated land use-transportation model |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| San Luis Obispo | X | X | | | | | | | | | | | | | X | |
| San Francisco Bay Area | X | X | X | X | X | X | X | | X | X | | | X | | | |
| SJVB: San Joaquin[1] | X | X | X | | | | | X | | | | | | | | |
| SJVB: Stanislaus | X | X | X | | | X | X | X | | | | | | | | |
| SJVB: Merced | X | | | | X | | | | | | | | | | | |
| SJVB: Madera | X | | | | X | | | X | | | | X | | | | |
| SJVB: Fresno | X | X | X | X | | X | | X | X | X | | | | | X | |
| SJVB: Tulare | X | X | | | X | | | X | | | | | | | | |
| SJVB: Kings | X | X | | | X | | | X | | | | | | | | |
| SJVB: Kern | X | X | X | X | | X | | X | X | X | X | | | | X | X |
| Shasta | X | X | X | X | | | | | X | | X | | | | | |
| Wilmington, DE | X | X | X | X | | | | X | | X | | X | | | | |
| Washington, DC | X | X | X | | X | | X | X | | X | X | | | | | |
| Central Florida | X | | X | X | X | | | | | X | | X | | | | |
| Atlanta | X | X | X | X | X | X | X | X | | X | X | X | | X | X | X |
| Boise, ID | X | X | | X | | | | | X | X | | | | | X | |
| Chicago | X | X | X | X | X | | X | X | | X | X | X | | | X | |
| Champaign, IL | X | | X | | X | | | X | | | | | | | | |
| Lansing, MI | X | X | X | X | | | X | X | | X | | | | | | |
| Missoula, MT | X | X | X | | | X | X | | | | | | | | | |
| Albany, NY | X | X | | | | | | X | | | | | | | | |
| Binghamton, NY | | X | | | X | | X | X | | | | | | | | |
| Durham, NC | X | X | X | X | X | X | | X | | X | X | X | | | | |
| Eugene, OR | X | | | | X | | | X | | | | X | | | | X |
| Brownsville, TX | X | X | | | | X | | X | | | | X | | | | |
| Waco, TX | X | | | | X | | | | | | | X | | | | |
| Logan, UT | X | X | X | X | X | X | X | X | X | X | | X | | | | |
| St. George, UT | X | | X | | | | | | | X | | | | | | |
| Salt Lake City, UT | X | X | X | X | X | X | X | X | X | X | | | | | | |
| Puget Sound, WA | X | X | X | X | X | X | X | X | X | X | X | X | X | X | | X |
| Cheyenne, WY | X | X | | | | | | | | | | | | | | |

[1] SLVB refers to the San Joaquin Valley Blueprint project, which utilized the individual travel demand models of the eight MPOs participating in the project. For more information, see page D-13.

## Growth

Scenario planning studies vary in the length of time horizons studied (from 20 years in Washington, D.C. to 48 years in Missoula, MT). They also vary in the annual rates of growth assumed (from 0.24 percent in Lansing, MI to 3.77 percent in St. George, UT). The percent change in population and employment between base and horizon years, represented in Figure 19, is useful for analysis because it incorporates *both* the time horizon length and the annual growth rate. Whether a region is growing quickly or slowly, or the planning horizon is long or short, will be reflected in the percent change in growth.

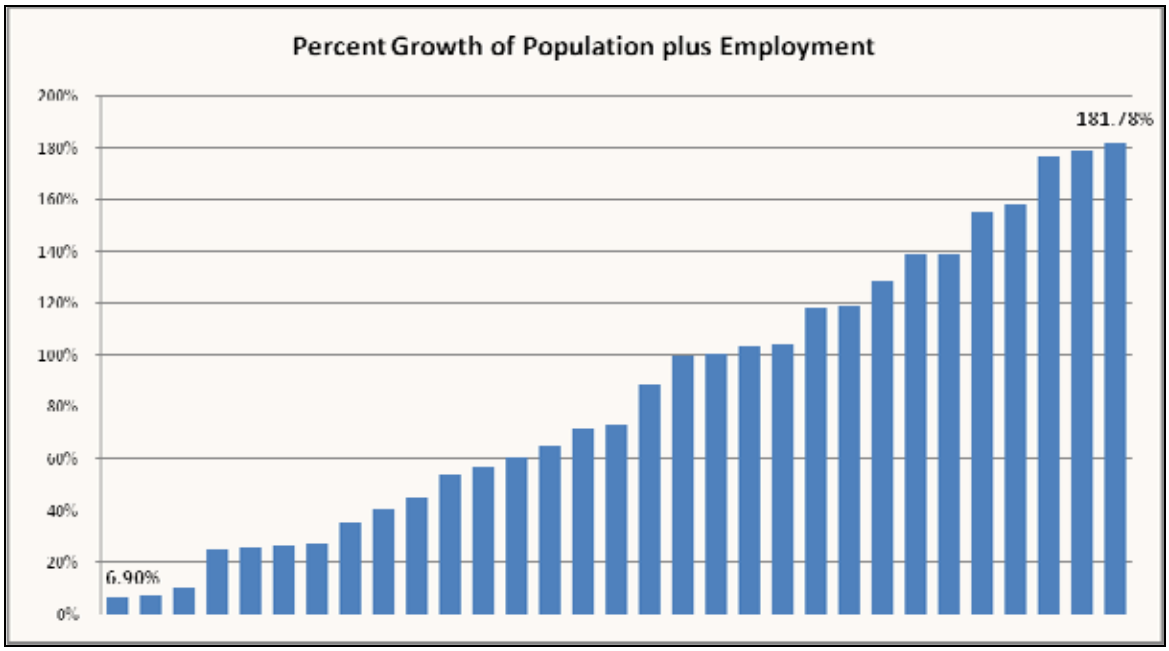


Figure 19. Percent change in population plus employment for all scenario projects.

Figure 20 plots the percent growth in VMT against the percent growth in population plus employment between base and horizon years. Not surprisingly, the greater the growth of population and employment, the greater the growth of VMT. However, the scatter around the trend line indicates that many factors other than planning horizons and growth rates are also in play. The instances of multiple VMT values associated with the same value of population plus employment growth represent different scenarios from the same project, each embodying different land use and transportation elements, but using the same growth assumptions. Because these scenarios all come from the same region, they are not truly independent of each other. Scenarios from a single region will share many economic, geographic, and other characteristics that are not shared between scenarios from different regions.

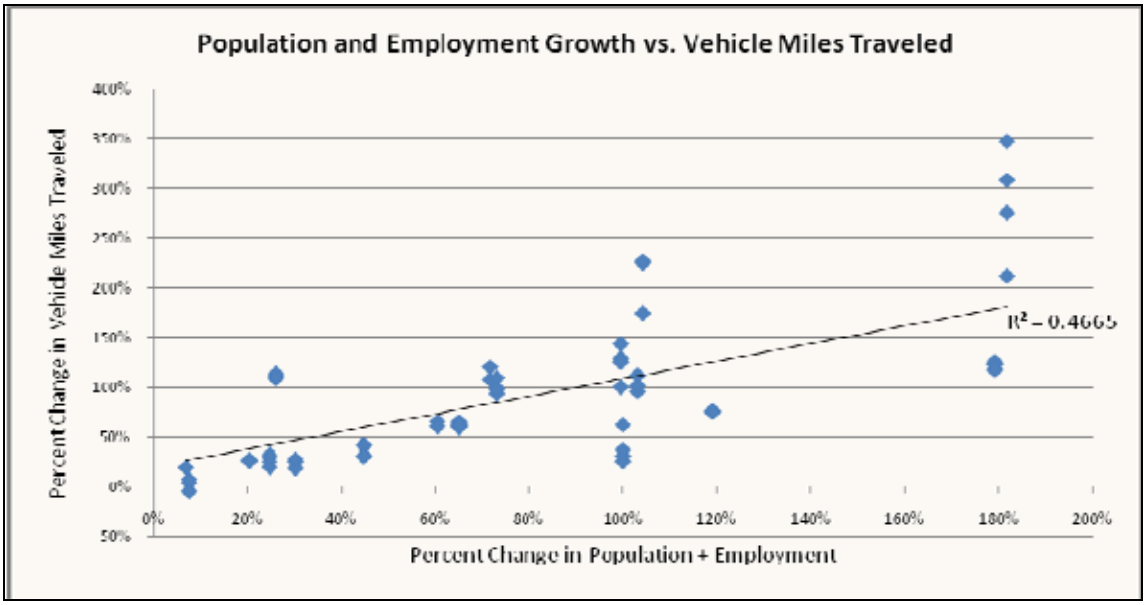


Figure 20. Scatterplot of percent change in population + employment and percent change in VMT

## Multivariate Analysis

To test the existence and strength of associations between the variables outlined above, the research team conducted a multivariate analysis using 18 of the 28 projects in the dataset. Projects included in the analysis were those that (1) are at a regional scale, (2) have consistent population and employment projections across scenarios, and (3) provide complete data on regional growth, population density, lane miles of highways, and VMT—the variables most closely related to travel demand, transportation supply, and automobile use. Together, these projects contain a total of 107 scenarios.

*Variables*

The dependent variable for the analysis is vehicle miles traveled (VMT), which is defined as the percentage change in VMT between base and horizon years for each of the scenarios (see Figure 21). The mean percentage growth of VMT, 76 percent, may seem like a big increment of VMT growth, but it is over a mean forecast period of 31 years. The percentage change in VMT ranges from −4 percent, for a compact growth scenario in slow-growing Lansing, MI, to +348 percent for the trend scenario in fast-growing St. George, UT.

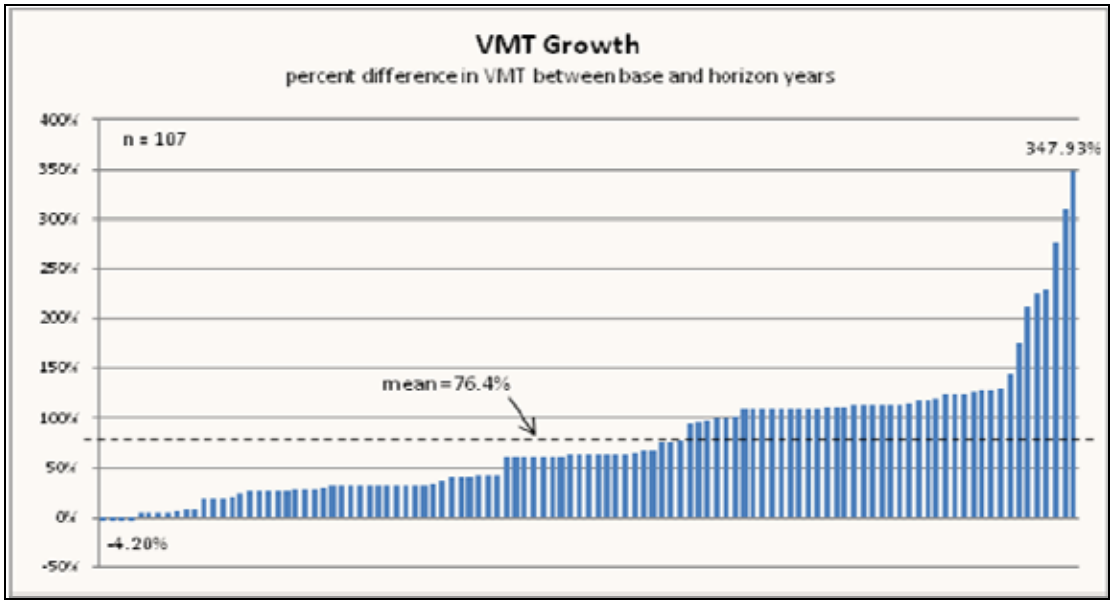


Figure 21. Percent difference in VMT between base and planning horizon years.

The analysis seeks to explain variations in VMT with a set of independent variables, drawn from the factors described in previous sections. The research team divided the variables into two sets: those that exhibit variance between scenarios and those that are constant between scenarios within the same project, but vary between projects. The following variables are of the first type—i.e., they differ scenario to scenario, even within the same project:

- DENSITY is a continuous variable that measures the percentage change in density between base and horizon years (pages 17-20).[2]
- LANEMI is also a continuous variable, measuring the percentage change between base and horizon years in lane miles of non-local roads (pages 15-17).
- MIX is a dichotomous (a.k.a dummy) variable that indicates whether or not a scenario emphasizes land use mixing.
- INFILL, also a dummy variable, designates whether a scenario focuses growth into central areas. INFILL is intended to represent the influence of destination accessibility (page 22).
- NODE is a dummy variable indicating whether a scenario focuses growth into activity centers or nodes. It, too, is intended to reflect destination accessibility.
- PRICING is a dummy variable, signifying whether a scenario incorporates transportation pricing policies.

[2] Page references are to other sections in this report that further discuss the variable.

The variables of the second type—that are common to all scenarios within a single project, but differ across projects—include the following:

- GROWTH is a continuous variable, measuring the percentage growth in population plus employment between base and horizon years (pages 26-27).
- MODEL is an ordinal variable representing the degree to which the model utilized in a scenario project incorporates the Smart Growth modeling components discussed above (pages 22-25).

*Analysis*

Scenarios are nested within regions, with the typical study having two or more scenarios in addition to the trend scenario. As noted above in the discussion about growth, scenarios for the same region are not independent of each other, as they share the characteristics of their respective regions. Conventional ordinary least squares (OLS) regression analysis cannot account for this lack of independence. For such region-level characteristics, OLS would underestimate standard errors of regression coefficients and produce inefficient regression coefficient estimates.

To overcome these limitations, the research team employed a hierarchical or multi-level modeling technique, using HLM 6 (Hierarchical Linear and Nonlinear Modeling) software. A hierarchical model accounts for the interdependence of scenarios in the same region and produces more accurate regression coefficient and standard error estimates (Bartholomew & Ewing, 2009; Raudenbush & Byrk, 2002). Within a hierarchical model, each level in the data structure is represented by its own sub-model. Each sub-model captures the structural relations occurring at that level and the residual variability at that level. Sub-models at the different levels are linked statistically.

In this analysis, the level 1 model relates VMT growth to scenario-specific characteristics plus a random error term. Thus, each region has a regression equation that describes the association between scenario characteristics and VMT growth within that region. The level 2 model treats the intercept and coefficients from level 1 as outcomes, and models them in terms of region-specific characteristics plus random effects.

Initially, all models assumed a “random intercept” form. Only the intercept term in the region-specific model was allowed to vary; all region-specific coefficients were taken as fixed. Then, this assumption was relaxed, and regression coefficients were allowed to vary as a function of region-specific characteristics. Equivalently, we can say that regional characteristics were allowed to interact with the scenario characteristics.

Interactions between regional and scenario characteristics were seldom significant, with an exception noted below. Hence, the only results reported in the next section are for random intercept models.

*Results*

The best-fit model is presented in Table 6. The model was estimated with no constant term (as a regression through the origin). If nothing changes from the base year, there should be no change in regional VMT.

Table 6. Hierarchical Model Predicting Percent Difference in VMT for 107 Scenarios.

| | Coefficient | t | p |
|---|---|---|---|
| GROWTH | 1.08 | 2.12 | 0.049 |
| MODEL | -0.19 | -0.02 | 0.98 |
| DENSITY | -0.30 | -4.26 | < 0.001 |
| LANEMI | 0.53 | 4.14 | < 0.001 |
| INFILL | -1.44 | -0.47 | 0.64 |
| NODE | 0.05 | 0.02 | 0.99 |
| MIX | -1.20 | -0.36 | 0.72 |
| PRICING | -8.05 | -2.00 | 0.048 |

Because the continuous variables are percentage changes, their coefficients can be interpreted as elasticities. An elasticity is a percentage change in one variable (VMT) with respect to a one percent increase in another variable (each independent variable).

Four coefficients are significantly different from zero, those of GROWTH, DENSITY, LANEMI, and PRICING. Each percent increase in population + employment is associated with a 1.08 percent increase in VMT. That is to say, VMT is slightly elastic with respect to population + employment growth. Each percent increase in density is associated with a 0.30 reduction in VMT. VMT is inelastic with respect to density, though not as inelastic as suggested by disaggregate travel studies (Ewing & Cervero, 2010). It seems likely that the density variable is soaking up effects of other variables that go hand-in-hand with density, particularly destination accessibility (Ewing & Cervero, 2010). Each percent increase in road lane miles is associated with a 0.53 percent increase in VMT. This elasticity falls somewhere between the short-run and long-run elasticities of VMT with respect to highway capacity estimated elsewhere in the literature (Cervero, 2002). All else being equal, the imposition of road user charges reduces VMT growth by 8.05 percent, a statistically significant reduction.

The other dummy variables are not significant, but with one exception, have the expected signs. Infill development is seen to reduce VMT growth by 1.44 percent. Mixed use development reduces VMT growth by 1.20 percent. Nodal development is seen to increase VMT growth by 0.5 percent, the weakest of all the relationships and, counterintuitively, a positive relationship. It is not surprising that these dummy variables are not significant, as they crudely represent the underlying constructs and, being dichotomous variables, incorporate minimal variance.

The model sophistication variable, MODEL, also proves insignificant in most of the formulations tested. It clearly has no effect on the value of the intercept in the level 1 regression equation. That is to say, the extent to which a modeling system has been refined neither increases nor decreases forecasts of VMT growth. The model sophistication variable does interact with two of the level 1 variables, LANEMI and MIX, but with signs that are difficult to interpret, negative and positive, respectively. We would have expected that more sophisticated models would pick up effects of highway induced traffic that increase VMT, and effects of mixed land uses that reduce VMT. We attribute the counterintuitive results to the imprecise nature of travel demand model characterizations.

We can estimate the effect of a shift to compact development on the growth of VMT by plugging realistic numbers into the best-fit model in Table 6. If such a shift increases average regional density by 50 percent in 2050, emphasizes infill, mixes land uses to a high degree, and increases the price of automobile use, the model predicts that VMT will be 25 percent lower than projected under trend conditions ((-30 x 0.50) – (1.44 x 1) – (1.20 x 1) – (8.04x1)).

Although 25 percent is, admittedly, not a very large number, it is very likely a conservative estimate for two reasons. First, limitations in the models and methods used to generate the data for this meta-analysis likely underestimated the degree to which the land use strategies in many of the scenarios would affect travel. Had we had more discriminating variables, rather than dummies, we might have seen larger effects. Second, all of the scenarios assumed the continuation of national and global economic and environmental trends, but it is very possible that these conditions will change in ways that would make continued reliance on personal vehicle travel less tenable, increasing the difference between the planning and trend scenarios.

## Other Findings

One of the reasons articulated by project sponsors for focusing on denser development is the anticipated savings in infrastructure costs associated with density. Consistent with the “cost of sprawl” literature (e.g., Burchell, et al., 2002), the findings from the 8 studies summarized in Figure 22 show substantial cost savings for virtually all of the denser alternative scenarios compared to their respective trend scenarios (N.B.: the one Salt Lake City scenario with greater costs is substantially less dense than the trend).

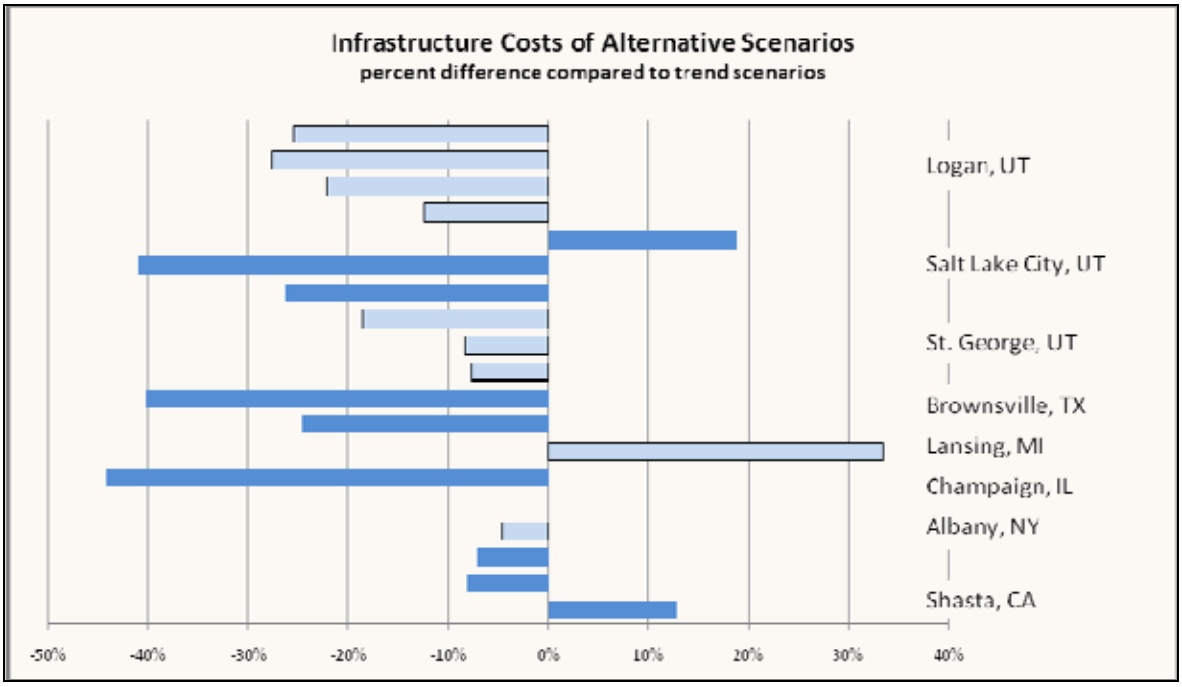


Figure 22. Percent difference in infrastructure costs between alternative and trend scenarios.

Another primary motivation articulated by sponsors of scenario planning projects is the reduction in land consumption. This rationale was particularly prevalent in regions facing possible future land scarcities or where open space conservation was a central value. These concerns are reflected in the measurement of agricultural land consumption (Figure 23) that was part of 9 of the scenario projects in the dataset.

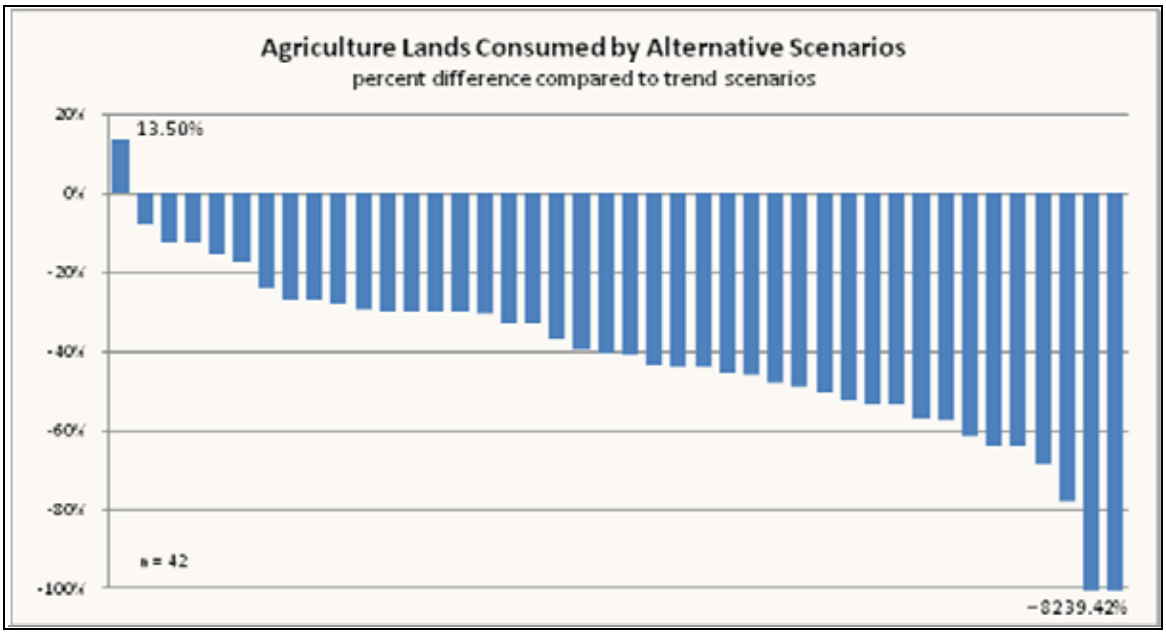


Figure 23. Percent difference in agricultural land consumption between alternative and trend scenarios.

Although air quality concerns are customarily central to most metropolitan-level transportation planning processes—thanks largely to the mandates of the federal Clean Air Act—the project documents for the scenario planning projects in this dataset are remarkably silent on air quality issues. Only 10 of the 28 projects contain air quality analyses. The data for those projects measuring $NO_x$ are displayed in Figure 24.

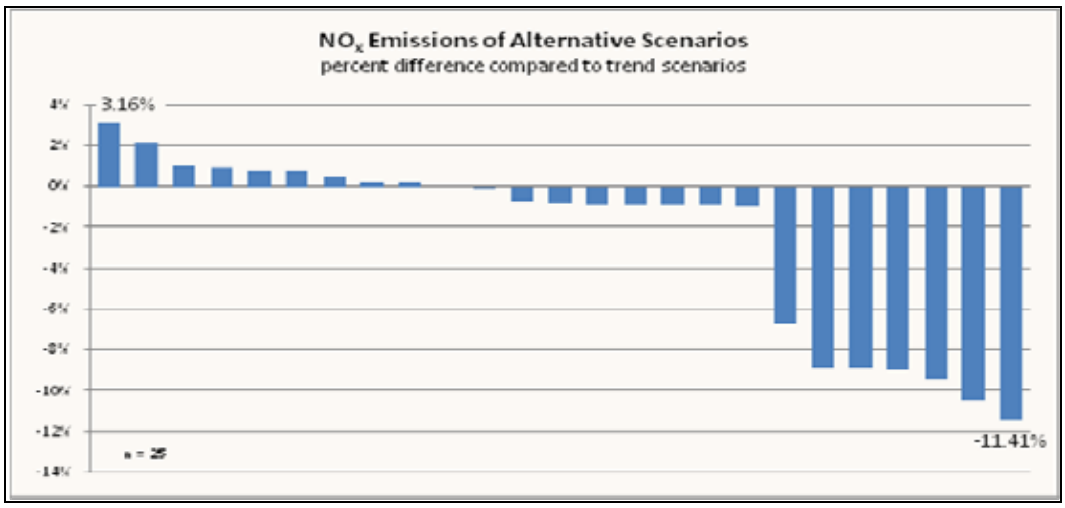


Figure 24. Percent difference in $NO_x$ emissions: alternative vs. trend scenarios.

Although VMT was the most often reported transportation statistic, many projects also included measures of vehicle hours of travel (VHT, Figure 25) and vehicle hours of delay (VHD, Figure 26). Immediately noticeable is how similar the VHT chart is to the one for VMT (Figure 5), but how different the chart for VHD is from both the VMT and VHT charts. The clear implication is that alternative scenarios, which tend to be denser, are associated with higher levels of congestion.

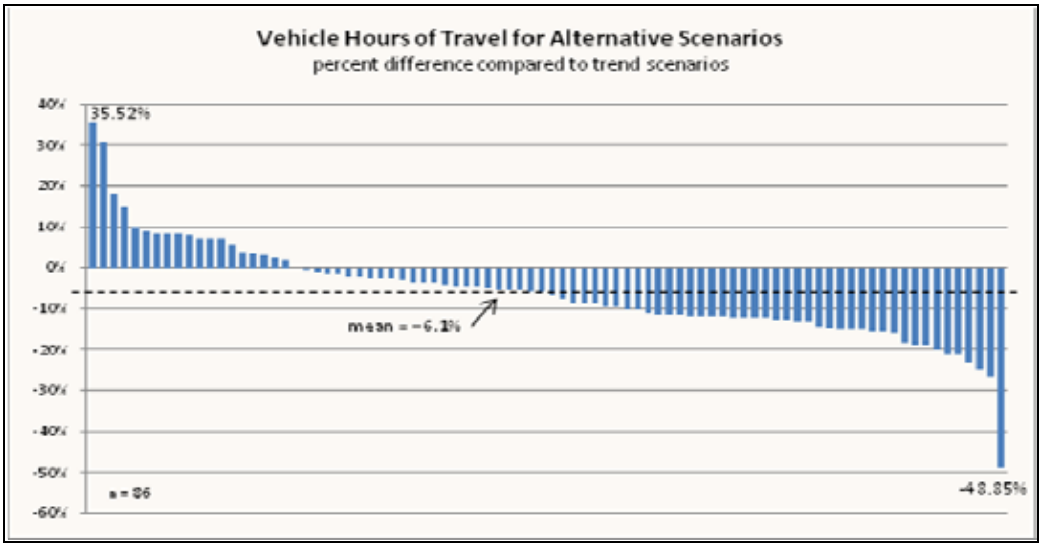


Figure 25. Percent difference in vehicle hours of travel: alternative vs. trend scenarios.

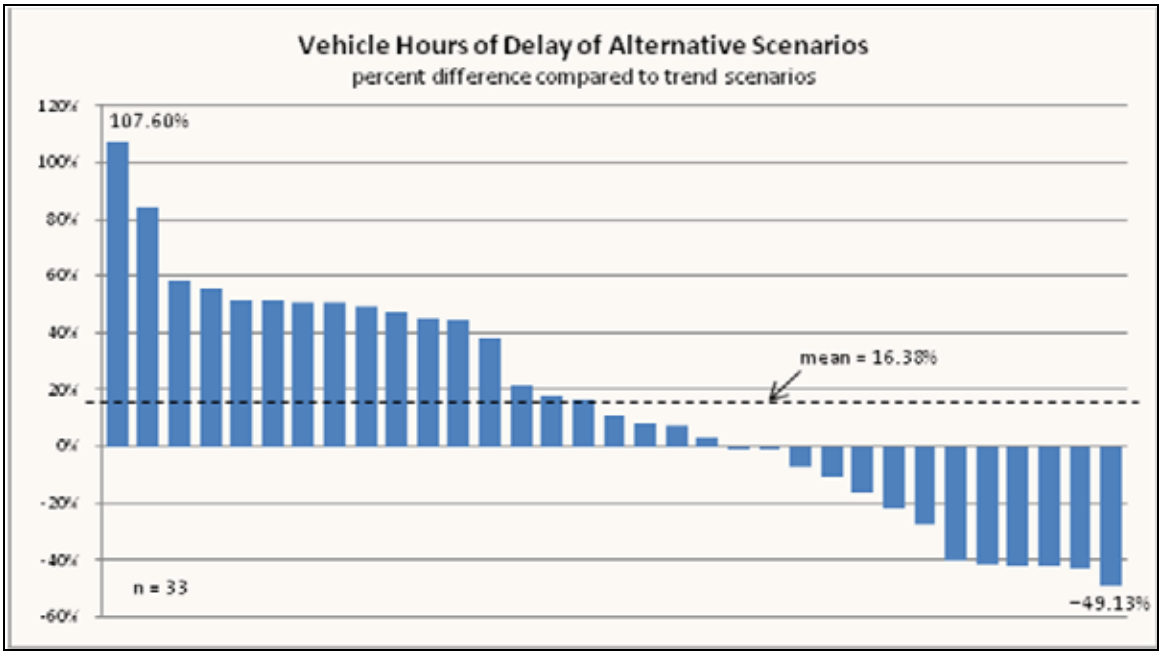


Figure 26. Percent difference in vehicle hours of delay: alternative vs. tend scenarios.

## Other Environmental and Economic Issues

As outlined in the introduction, the 2005 scenario study discovered a general lack of attention among scenario project sponsors to issues related to greenhouse gas (GHG) emssions and climate change, with only 10 projects out of 80 reporting any data on GHGs (Bartholomew & Ewing, 2008). Surprisingly, the scenario projects in the current study are not that different: only 7 of the 28 projects contain GHG data (see Figure 27). While proportionately higher than in the 2005 study, one might have reasonably assumed that the increased policy, media, and scientific attention to climate change issues in recent years would have translated into a greater focus on those issues in this newer dataset. What is not surprising is that four of the seven projects with GHG data come from California, where legislative and executive action on climate change has been ambitious. In fact, all four of the California projects were undertaken, at least in part, in anticipation of the implementation of Senate Bill 375, which requires MPOs to meet GHG emission reduction targets that will be announced by October 2010 (see discussion below).

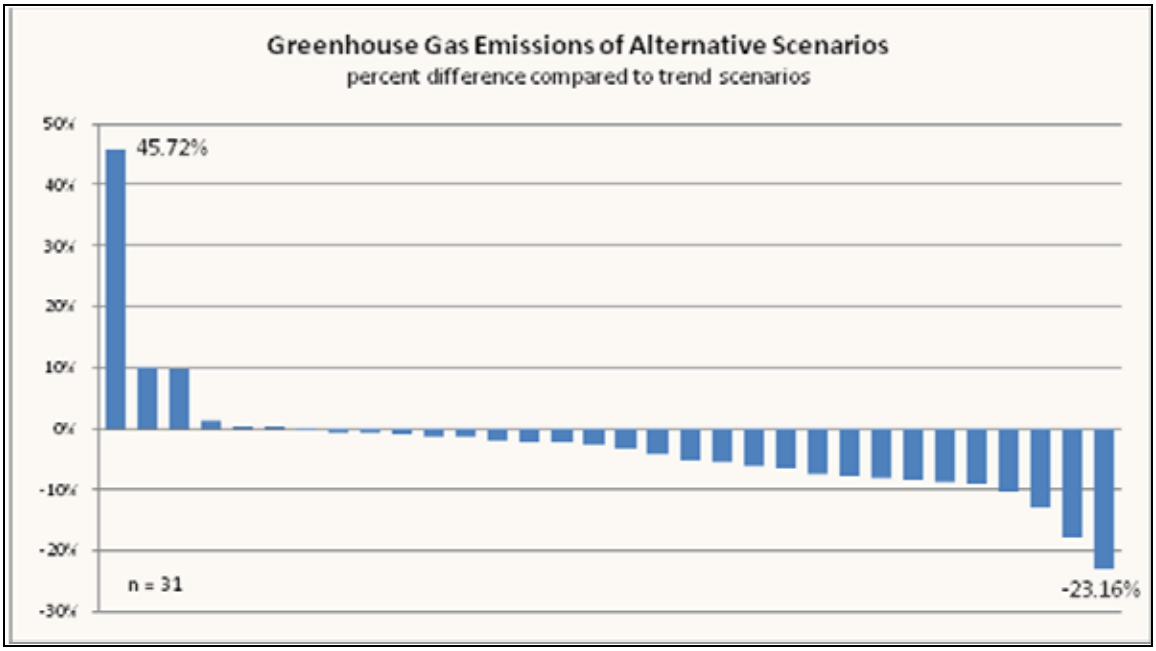


Figure 27. Percent difference in greenhouse gas emissions: alternative vs. trend scenarios.

Beyond the use of greenhouse gas emissions as an output measure is the larger question of using climate-change-related elements as input variables in scenario analyses. Many of the possible global-scale alterations in climate could have substantial local and regional impacts as well. For example, a steady increase in average winter temperatures in the Salt Lake City region would have notable effects on winter snow pack, triggering a cascade of economic effects on the Utah's tourist and ski manufacturing economies. It could also influence the state's ability to attract highly skilled work forces in other industries. These influences would likely affect levels of population and employment growth and household income, which in turn would affect travel patterns. Warming trends could also alter precipitation levels and water availability, which would limit carrying capacities that support population and economic growth. Despite the potentially large impacts these kinds of changes would have on regional growth, transportation, and livability, none of the scenario projects in this dataset—or in the 2005 dataset, for that matter—incorporated "adaptive" climate change factors as scenario variables, or employed climate change adaptation as an evaluative measure.

In addition to climate change, other large-scale economic/environmental impacts that could influence travel choices and patterns are the potential effects associated with peak oil. Large-scale discoveries of new oil reserves have declined steadily since the mid-1960s, while oil production and consumption have increased substantially (IHS Energy, 2006). Because of this mismatch, many observers anticipate a peak in oil production, followed by a long period of decline. Production peaking occurs because of the natural preference to mine the largest and most accessible, and hence least costly, sources first. As quantities from those sources diminish, production levels can be maintained only by mining smaller, less accessible sources, causing costs per unit of output to increase. Eventually, production levels become too costly to

maintain and overall production declines. This phenomenon has already occurred at a national level in countries around the world, with peaks in the lower 48 United States, Alaska, and Mexico occurring in 1971, 1989, 2004, respectively (Zittel & Schindler, 2007).

Researchers' estimates of when the global peak will occur vary widely, with some asserting that it has already occurred, and others projecting it early in the next century. A 2000 scenario analysis by the U.S. Energy Information Administration shows a range between 2021 and 2112 (Wood & Long, 2000). A more recent analysis by the U. S. General Accounting Office (2007) puts the date sometime before 2040, which is within the timeframe of many of the scenario projects included in this study. The variation in the projections is driven by the range and number of factors incorporated into the analyses, including estimated oil reserves, economic growth, technological innovations, and demand reductions in response to price increases. Regardless of the peaking date, all the analyses anticipate that oil prices will increase significantly; the only real debate is how fast (Haubrich & Meyer, 2007 ).

A recent multivariate analysis of travel and economic data in 84 U.S. urban areas between 1985 and 2005 found an elasticity of VMT with respect to fuel price of –0.17, meaning that for every 1% increase in the price of fuel, VMT decreased by 0.17% (Ewing et al., 2008, p. 123). Given that land use change lags well behind changes in the price of vehicle fuels (GAO, 2007, pp. 11-12), it is likely that the elasticity understates the possible impact of future fuel prices on travel.

Again, as with climate change, no project used peak oil as a scenario input variable, at least directly. Five projects did, however, employ some degree of transportation pricing policy. While pricing policies do not function in precisely the same fashion as the effects of peak oil, there are certainly some similarities in the ways in which the two sets of factors can influence travel demand. The important role that pricing can play in policy driven scenario analysis was emphasized in the Projections 2009: What If? project conducted by the Association of Bay Area Governments (ABAG, see page D-6). That project, which was designed to create a regional socioeconomic forecast, began with the establishment of numeric performance targets in seven key areas related to environmental and economic sustainability, social equity, and state law mandates on climate change. ABAG then attempted to craft an integrated land use-transportation scenario that would attain the performance targets. Although the scenario out-performed a trend projection, it failed to achieve the targets. In a section titled "Land Use Necessary, Not Sufficient," agency staff explained:

> There is a crucial inter-relationship between land use, infrastructure, pricing, technology, and individual behavior in meeting the regional targets. While powerful, land-use changes alone will not be sufficient in reducing our transportation-related emissions. Reducing emissions from the transportation sector will require new transportation infrastructure, like rail extensions, more buses and even some freeway improvements. Reducing emissions will also require technological improvements to our cars so that they burn cleaner and use less gasoline per mile. We will also need to

> implement pricing measures - like parking fees, toll lane charges and bridge tolls - so that more people become inspired through their wallets to use their cars less. We will need a major shift in personal behavior, where more people simply choose, for whatever reason, to drive less, walk or take transit over driving. If we seriously intend to reduce this region's transportation carbon emissions, each of these strategies will be necessary. There is no one solution. There will be no easy answers. And in all actuality, land use, infrastructure, technology, pricing, and behavioral changes are highly dependent on one another for any one measure to succeed.

Although peak oil did not serve as a scenario input in any of the projects, it did provide a qualitative evaluative measure in one project: New Visions 2030, conducted by the Capital District Transportation Committee (the MPO in the Albany, New York region). In assessing the study's four scenarios—Status Quo Trend, Concentrated Growth, Trend Hyper-Growth, and Concentrated Hyper-Growth—the MPO's Quality Region Task Force observed:

> If oil and gas remain widely available and relatively inexpensive, this would also support the likelihood of [the Status Quo Trend and Trend Hyper-Growth] scenarios. However, if oil becomes scarce, and its price subsequently skyrockets, then we will have no choice but to significantly alter the manner in which we build and travel. Non-motor travel, such as walking and biking, will become more common. We will need to live close to where we work, while the kind of work we do will likely change dramatically. We will need to assemble our entire built environment much closer together, at higher densities, to try and eliminate long distance travel for everyday tasks. We will also be forced to localize our economy, including producing much of our food from within the local region. Under these conditions, [the Concentrated Growth scenario] would likely be closest to representing the kind of land development pattern that would result.

The neglect of peak oil impacts, and the complete disregard for adaptive climate change effects, in the scenario projects is probably due, at least in part, to the complexity and uncertainty of these types of variables. Certainly, prognostications about the influence of climate change and global oil supplies on future conditions vary widely with respect to the nature, magnitude, location, and timing of anticipated impacts. This volatility, however, does not necessarily mean that such conditions should be excluded from scenario analysis: scenario planning technique was created precisely to deal with unknown and potentially volatile futures shaped by external conditions (Avin, 2007).

## Incorporating Scenario Outputs into Transportation Planning Processes

### Federal Law

Planning for metropolitan-wide transportation systems in the U.S. was institutionalized by the 1962 Federal Aid Highway Act. The planning practice that grew out of that Act, which generally did not include land use-transportation scenario techniques, remained largely unchanged until the passage of the Intermodal Surface Transportation Efficiency Act ("ISTEA") thirty years later. ISTEA revolutionized systems planning, principally, by allowing for greater flexibility in how federal transportation funds could be used, and by requiring MPOs to incorporate a more expansive list of planning factors in the development of systems plans. Included on this list was consideration of (1) the possible effects of transportation investments on development patterns and (2) the consistency of transportation plans with land use and development plans. Many of ISTEA's innovations were carried forward, first into the Transportation Equity Act for the 21st Century ("TEA-21") and then into the most recent transportation statute—the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users ("SAFETEA-LU").

By directing MPOs to look at land use and transportation interactions, ISTEA encouraged some MPOs to engage in the land use-transportation scenario projects included in this and the 2005 studies. What was unclear from ISTEA was how the output of scenario analysis might feed into standard long-range planning processes. Federal regulations require MPOs to base updates to long-range plans on "the latest available estimates and assumptions for population, land use, travel, employment, congestion, and economic activity" (23 C.F.R. 450.322(e)). In the context of a scenario analysis, what does the phrase "latest available estimates and assumptions" mean? Does it require the use of trend land use assumptions, notwithstanding that the scenario process may have resulted in the rejection of the trend scenario and the selection of a Smart Growth-type alternative scenario?

There is evidence from the 2005 scenario study that a number of MPOs involved in scenario projects thought this was the case. The history of regional scenario analysis in the Salt Lake City region, related above, shows precisely that storyline. Similar stories came from scenario projects in the Phoenix, San Diego, Denver, Wilmington, Minneapolis, and Philadelphia regions (Bartholomew, 2005). The standouts from the 2005 study were those regions—such as Portland, Oregon and Seattle—where MPOs have substantial authority over land use, and smaller regions—such as Gainesville, Florida—where the MPO includes virtually all of the political interests involved in land use issues: "[B]ecause the MTPO consists of all members of the City of Gainesville Commission and the Alachua County Board of County Commissioners and is the only routine occasion for those two boards to sit together as a single body, the MTPO is arguably in the best position to discuss and promote policies relating to the integration of land use and transportation on a broad, regional scale."

Though neither small nor having land use authority, the MPO in the Sacramento, California region nevertheless also achieved integration of scenario analysis and long-range transportation planning processes. At the conclusion of the Sacramento Region Blueprint scenario study, the Sacramento Area Council of Governments (SACOG) worked individually with the region's local governments to gauge each jurisdiction's level of commitment to the study's preferred scenario. As governments endorsed the scenario, SACOG altered the assumptions about future growth for that jurisdiction to match those from the preferred scenario, rather than from the trend projection. Many projects from the current dataset replicated this method, including the one from the Salt Lake City region outlined above.

As important as these developments are, however, they reflect only a small minority of the nation's metropolitan areas: thirty-one of the projects in the 2005 study were conducted by MPOs; this study adds another 26 MPOs to the tally. While a significant uptick in scenario practice, it still means that fewer than 15% of the country's 381 MPOs are using scenario techniques, and there is currently only limited federal authority to require such use. For all its purported advances in systems planning processes, the planning provisions in ISTEA/SAFETEA-LU are advisory only—they require only *consideration* of land use-related factors (23 U.S.C. § 134(h)(1)). Even that permissive standard is unenforceable: failure to consider any of the planning factors cannot be challenged in court (23 U.S.C. § 134(h)(2)) and the resulting systems plans are not reviewable under NEPA (23 U.S.C. § 134(p)).

## State Law

As in other policy areas, such as climate change, the real action in promoting scenario planning is happening at the state level. Justice William Brandeis famously wrote, "It is one of the happy incidents of the federal system that a single courageous state may, if its citizens choose, serve as a laboratory and try novel social and economics experiments without risk to the rest of the country" (New State Ice Co., 1932, p. 311). So it seems to be the case with climate policy and as states advance climate policy, they have also begun to advance land use-transportation scenario planning techniques.

### *California's Senate Bill 375*

More than any other state, California has taken a leading role in the development of climate change laws and policies. Over the past seven years, the state has adopted a comprehensive set of actions to cut greenhouse gas emissions and transition its economy, albeit gradually, away from fossil fuels. The state's actions are motivated, in part, by a series of projected impacts associated with climate change, including an estimated seven-inch rise in sea level along its coast, a decrease in annual snow pack in its mountains, and an increase in the number and severity of wildfires in its forests (California Climate Change Center, 2006). The state's fabled role as the heart of American car culture and sprawl development may also have been

an inspiration—Californians have seen what comes from the worst of auto-based sprawl and many are motivated to move back from the brink (Nichols, 2009).

The state's major entrance onto the climate policy stage came in 2002 with Assembly Bill 1493, the "Pavley" bill, which requires the California Air Resources Board (CARB) to set greenhouse gas auto emission standards by 2009. The central legislative action on climate, however, came in 2006 with the California Global Warming Solutions Act, better known as Assembly Bill 32, which sets a target for scaling back GHG emission rates to 1990 levels by 2020 and establishes a framework of indices, policies, and methods for achieving that target. The state's governor has been active, too, signing a series of executive orders between 2005 and 2008 that set long-term GHG emission targets (80% reduction from 1990 levels by 2050), create a cap and trade carbon market, establish low-carbon vehicle fuel standards, and determine renewable energy portfolio standards.

Senate Bill 375 is another star in California's climate policy constellation. Passed in 2008, the bill is motivated by the state legislature's understanding that the improved vehicle efficiency and low-carbon fuel standards from the Pavley bill and the governor's executive orders will not result in sufficient emission reductions to meet the state's GHG targets. What is additionally required is the reining in of the state's sprawled land use patterns: "without improved land use and transportation policy, California will not be able to achieve the goals of AB 32" (SB 375 § 1(c)).

The bill, which has been described both as a "bold experiment" (Nichols, 2009) and a "necessary collision" (Stern, 2008), requires CARB to set GHG emission reduction targets for passenger vehicles for each of the state's 18 MPOs. The MPOs are then required to adopt Sustainable Communities Strategies (SCSs) that meet the GHG targets set by CARB. The SCSs are to be included as elements of the regions' federally mandated regional transportation plans, and other elements of the plans—especially the project funding portions—are required to be consistent with the SCSs. CARB is in charge of determining whether the SCSs actually meet the assigned emission targets. If a region's SCS does not or cannot meet the emission targets, the MPO is obliged to create an Alternative Planning Strategy (APS) "showing how those greenhouse gas emission targets would be achieved through alternative development patterns, infrastructure, or additional transportation measures or policies" (Cal. Gov't Code § 65080(b)(2)(H)).

SB 375 does not specifically mandate a land use-transportation scenario planning process, but such a process is implied by several sections of the bill, particularly the provisions regarding APSs quoted above. This conclusion is further bolstered by the favorable mention in the legislative findings of the use of "blueprint" scenario planning projects by MPOs around the state. Four of those blueprint projects are included in this study (see D-1 to D-28).

For all the positive press SB 375 has received since its adoption, the law's ultimate effect is unclear. Compromises made during the legislative process, primarily at the request of local government interests, significantly limit the law's reach in two key areas. First and foremost, SB 375 eschews any change in the power structure that governs land use decisionmaking: neither the SCSs nor the APSs can regulate the use of land—cities and counties retain their exclusive monopoly on that authority and local government general plans do not have to be consistent with either the SCSs or the APSs. Second, unlike SCSs, APSs are not to be incorporated into regional transportation plans. Hence, they cannot affect the project funding portions of the plans. Both of these limitations are the subject of reasonably pointed policy critiques (Darakjian, 2009; Lampert, 2009), leading some observers to believe that other mechanisms, such as carbon offsets from smart growth-based developments in a cap-and-trade program, may do more to reduce emissions than SB 375 (Malaczynski & Duane, 2009).

*Oregon's House Bill 2001 and Senate Bill 1059*

In 2009-10, the Oregon Legislative Assembly produced two climate laws that address the implementation/enforcement issues dodged by SB 375, and as such are likely to result in greater impacts on the ground.

HB 2001 (the Oregon Jobs and Transportation Act) directs Metro, the Portland-area MPO, to "develop two or more alternative land use and transportation scenarios that accommodate planned population and employment growth while achieving a reduction in greenhouse gas emissions from motor vehicles" (HB 2001 § 37(2)(a) (2009)). The GHG emission reductions targets to be achieved by these scenarios, which are to be set jointly by the state land use and transportation agencies, must be based on the state's adopted goal of achieving emissions 10% below 1990 levels by 2020 and 75% below 1990 levels by 2050 (Ore. Rev. Stat. § 468A.205). Metro is required to formally adopt one of the land use-transportation scenarios and local governments in the metropolitan area must then amend their comprehensive plans and zoning ordinances to be consistent with the adopted scenario (HB 2001 § 37(3) (2009)).

Senate Bill 1059, passed during a special interim session, creates a process for the state transportation and land use agencies to craft a similar land use-transportation scenario planning mechanism for the state's five other MPOs.

## Conclusion

Land use-transportation scenario planning is an important planning tool whose popularity continues to increase. The technique's association with articulating more compact alternatives for future growth is further demonstrated by the projects in this dataset. These projects show, with stronger statistical evidence than in previous studies, how compact growth alternatives can increase regional livability by reducing vehicle travel demand. Also demonstrated in this

dataset is how scenario techniques can be effectively integrated into traditional long-range regional transportation planning processes.

These important advances in regional scenario practice are offset, to some degree, by several areas where limitations remain. Modeling capacity continues to be a concern. While several MPOs in this study host state-of-the-art modeling systems, most have only limited capacity to assess the impacts of land use-transportation scenarios. Another area of concern is the failure to incorporate important changes in global economic and environmental conditions, such as climate change and peak oil, both as input variables and as evaluation metrics. The current practice of land use-transportation scenario planning recognizes that single-allocation land use forecasts were based on a fictional assumption that land use patterns were immutably isolated from transportation investments and other influences. The practice should now recognize that global economic and environmental conditions underlying planning analyses are similarly mutable.

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# Appendix A – Initial Survey

The research team used this open-ended survey to obtain initial information on recent scenario planning projects from members of the Association of Metropolitan Planning Organizations (AMPO). Planning directors at the 385 AMPO member agencies received the survey via the AMPO email account in the fall of 2008. The recipients were directed to respond via email to a dedicated email account established for that purpose. The research team received 43 responses for a response rate of 11%. For more information about the survey (and ways the research team adapted to compensate for the low response rate), see the Data Collection section of this report.

Re: Land Use-Transportation Scenario Planning

Sir/Madam:

We are researchers at the University of Utah Department of City & Metropolitan Planning, and we are conducting a study of the state-of-the-practice in metropolitan land use-transportation scenario planning in the U.S. We are writing to ask you for any information you have about land use-transportation scenario planning projects that have occurred since 2000.

Land use-transportation scenario planning uses a variety of different land use development and transportation scenarios to assess future policy options for land use planning and transportation investment. Though the technique has older roots, it gained substantial popularity during the 1990s. Examples of the technique's use include:

- Portland's LUTRAQ study
- Envision Utah
- Sacramento Region Blueprint Transportation-Land Use Study

The study, which is being funded by the Federal Highway Administration (FHWA), will update earlier research, which is reported at the following sources:

- Bartholomew, K. & Ewing, R. (2008). Land use-transportation scenario planning in an era of global climate change. Presented at the 2008 Transportation Research Board Annual Meeting.
- Ewing, R., Bartholomew, K., et al. (2008). *Growing cooler: the evidence on climate change and urban development.* Washington, DC: Urban Land Institute.
- Bartholomew, K. (2007). Land use-transportation scenario planning: promise and reality. Transportation, 34(4), 397-412.
- Bartholomew, K. (2005). Integrating land use issues into transportation planning: scenario planning.

To begin this research update, all we need is any information you might have about similar types of planning projects and studies that have occurred since about 2000. While we would be delighted to get more detailed information from you, all we really need is the name and/or the agency-sponsor of the project. If you have contact information on the project(s), that would be helpful, too.

The results of this research will be shared with the Association of Metropolitan Planning Organizations (AMPO) and will be available through FHWA and the University of Utah.

To respond, simply send an email message to _____.

Thank you very much!

Keith Bartholomew
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University of Utah
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www.arch.utah.edu/bartholomew

# Appendix B – Data Request & Modeling Survey

The research team used the targeted data request contained in this appendix to obtain data on scenario planning projects. The request was structured according to a framework outlined by Bartholomew (2007) that groups the primary policy related influences on travel patterns into four categories: transportation infrastructure, transportation cost/price, public education and social marketing, and land use.

The appendix also contains a survey of modeling capacity that was designed to assess the ability of a transportation demand model to evaluate land use variables. The survey was structured according to *Assessment of Local Models and Tools for Analyzing Smart-Growth Strategies* by DKS (2007).

The research team sent both the data request and the model survey to agencies identified as sponsors of recent scenario planning projects. In most cases, extensive follow-up contact with agency staff was required. Even then, it was often not possible for the research team to obtain all of the requested information.

## Data Request

Dear _____,

I am working with Professor Keith Bartholomew from the University of Utah on a study funded by the Federal Highway Administration to assess recent developments in the practice of metropolitan land use-transportation scenario planning. As part of that study, we would like to learn more about your project.

1. Data on the inputs variables/parameters for each scenario. Ideally, we would like to obtain data on the following areas:

    a. transportation infrastructure (e.g., lane miles of highways/arterials, transit service hours)
    b. transportation pricing/cost assumptions
    c. land use variables, including;

        i. density (e.g., persons/sq. mile of developed land, housing units/acre);

        ii. land use mixing (e.g., jobs/housing balance, number of jobs w/i X travel time);

        iii. number of persons, jobs, or housing units w/i X distance of a major transit stop;

        iv. amount of developed land.

2. Output data for each scenario, such as vehicle miles traveled, vehicle trips, mode split, emissions of pollutants, etc.
3. Information on the modeling process used for the study. To assist with this function (and to standardize the responses), we have attached a simplified checklist that contains some of the key modeling procedures we are trying to track. The checklist is provided in two forms, for your convenience: an interactive PDF form that you can fill in on the screen and send by clicking on the email button, and a standard Word file that you also can fill in on the screen, save, and attach to an email.

We realize that we are asking for a lot of information and we understand the limitations on your time. Hence, we are grateful for whatever assistance you can provide for us. If you are interested in learning more about our work, we refer you to a recent article in the Journal of the American Planning Association that we authored--Land Use-Transportation Scenarios and Future Vehicle Travel and Land Consumption, vol. 75(1).

We appreciate any information you can provide.

Sincerely,

Gail Meakins

# Assessing Land Use-Transportation Scenario Planning

*Modeling Systems*

Project Name _____

This Federal Highway Administration-funded study seeks to understand recent developments in the practice of metropolitan land use-transportation scenario planning. The objective of the study is to advance prior research done on scenario planning that is reported in the publications listed in the footnote below.[1]

You have received this survey/checklist because your agency/organization has been identified as a sponsor of a recent land use-transportation scenario planning project. The title of that project is written in the top margin of this form. To further our understanding of your agency's project, we are looking for information on the land use/transportation modeling process used for the project.

To facilitate and simplify the information gathering, we have created the checklist on the following page, based on research conducted by DKS for the California Department of Transportation.[2] To complete the checklist, please place a mark (an X or check) next to each modeling component that is present, or topic that is addressed moderately to substantially, in the modeling process used for the above-listed project.

We acknowledge that the simplicity of this approach glosses over many important complexities in modeling systems. Yet, we are confident that even at this simplified level, the information you provide will be very helpful.

We thank you for your assistance.

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University of Utah
(801) 585-8944
bartholomew@arch.utah.edu

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[1] Bartholomew, K. (2007). Land Use-Transportation Scenario Planning: Promise & Reality. *Transportation, 34*, 397-412.

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[2] DKS, et al. (2007). *Assessment of Local Models and Tools for Analyzing Smart-Growth Strategies.* Sacramento, CA: CalTrans.

# Assessing Land Use-Transportation Scenario Planning

## Modeling Component/Process Checklist

(check all that apply)

Daily vehicle trip model _____

Modeling peak period as well as daily travel _____

Simple mode choice model (that separates transit and highway trips) _____

Transit network & assignment of daily trips that that network _____

Supply & demand model equilibration _____

Income stratification in distribution and mode choice models _____

Auto ownership modeling sensitive to land use characteristics _____

Travel time feedback loops between model components _____

Non-motorized modes (ped/bike) estimated in mode choice model _____

Modeling multiple modes of access to transit (e.g., ped. vs. park and ride) _____

Trip distribution sensitive to multi-mode options _____

Disaggregate simulation of households _____

Explicit representation of ped and bike networks _____

Activity- and tour-based modeling _____

Integrated land use-transportation modeling _____

Post-processing of land use (“D”) variables _____

# Appendix C – Scenario Data

The following table contains data for the scenario planning projects included in this study. The data were derived from project reports and other sources provided by the agencies responsible for the projects. The categorical information included in the Pricing and Land Use Mixing columns was determined from the textual descriptions of scenarios provided by the sponsoring agencies. The remaining data were taken from project tables and spreadsheets. For several projects, Total Developed Acres was estimated using the amount of newly developed acres (i.e., land developed in between the base and planning horizon years) provided by project documentation, added to the amount of "urbanized land" for that region reported in the 2000 Census.

# Appendix C - Scenario Data

| Project/Scenario Names | Road Lane Miles | Transit Revenue Hours | Pricing | Total Developed Acres | Land Use Mixing | New Developed Acres | Households Close to Transit | Jobs Close to Transit | Population--Base Year | Population--Forecast Year | Employment--Base Year | Employment--Forecast Year | VMT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **San Luis Obispo: Preliminary Sustainable Community Stategy** | | | | | | | | | 2008 | 2035 | 2008 | 2035 | |
| **2035 Scenario 1** | 8,991 | 60,500 | | 62,580 | | 36,023 | 70,633 | | 259,401 | 320,261 | 106,153 | 141,604 | 9,845,537 |
| **2035 Scenario 2** | 8,991 | 60,500 | √ | 60,158 | √ | 18,752 | 73,739 | | 259,401 | 320,531 | 106,153 | 141,472 | 9,631,804 |
| **2035 Scenario 3** | 8,991 | 60,500 | √ | 57,899 | √ | 12,631 | 75,313 | | 259,401 | 320,222 | 106,153 | 141,601 | 9,126,360 |
| **2035 Scenario 4** | 8,991 | 60,500 | √ | 53,279 | √ | 2,652 | 79,381 | | 259,401 | 319,758 | 106,153 | 141,509 | 8,374,551 |
| **San Francisco Bay Area: What If?** | | | | | | | | | 2000 | 2035 | 2000 | 2035 | |
| **Scattered Success** | 21,060 | 8,118,000 | | 959,040 | | 77,076 | 1,875,136 | | 6,783,762 | 9,048,800 | 3,753,460 | 5,242,960 | 177,671,400 |
| **Focused Future** | 21,060 | 12,100,000 | | 931,512 | √ | 49,548 | 1,956,090 | | 6,783,762 | 9,133,971 | 3,753,460 | 5,242,970 | 168,399,885 |
| **Final Projections** | 21,060 | 12,100,000 | | 919,088 | √ | 48,691 | 1,956,090 | | 6,783,762 | 9,073,700 | 3,753,460 | 5,107,390 | 181,347,609 |
| **San Joaquin Valley Blueprint** | | | | | | | | | 2006 | 2050 | 2006 | 2050 | |
| **Sceanrio A** | | | | 1,078,464 | | 533,000 | | | 3,797,132 | 9,455,181 | 1,144,800 | 1,942,638 | 240,000,000 |
| **Scenario B** | | | | 899,164 | | 353,700 | | | 3,797,132 | 9,455,181 | 1,144,800 | 1,942,639 | 233,000,000 |
| **Scenario C** | | | | 813,864 | | 268,400 | | | 3,797,132 | 9,455,181 | 1,144,800 | 1,942,640 | 225,000,000 |
| **Scenario B+** | | | | 899,164 | | 353,700 | | | 3,797,132 | 9,455,181 | 1,144,800 | 1,942,641 | 233,000,000 |
| **Shasta Forward** | | | | | | | | | 2004 | 2050 | 2004 | 2050 | |
| **Current Trend 2050** | 2,438 | | | 156,390 | | 101,819 | 14,167 | | 163,299 | 325,366 | 69,308 | 140,294 | 6,986,253 |
| **A: Rural & Peripheral** | 2,438 | | | 265,245 | | 210,674 | 12,271 | | 163,299 | 335,096 | 69,308 | 138,336 | 8,637,981 |
| **B: Urban Core & Corridors** | 2,438 | | | 98,725 | √ | 44,154 | 15,505 | | 163,299 | 324,102 | 69,308 | 136,253 | 6,674,371 |
| **C: Distinct Cities & Towns** | 2,438 | | | 94,042 | √ | 39,471 | 52,598 | | 163,299 | 324,373 | 69,308 | 138,136 | 7,300,024 |

# Appendix C - Scenario Data

| Project/Scenario Names | Road Lane Miles | Transit Revenue Hours | Pricing | Total Developed Acres | Land Use Mixing | New Developed Acres | Households Close to Transit | Jobs Close to Transit | Population--Base Year | Population--Forecast Year | Employment--Base Year | Employment--Forecast Year | VMT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Wilmington, DE: 2030 Plan** | | | | | | | | | 2005 | 2030 | 2005 | 2030 | |
| **Current Land Use** | | | | 146,157 | | 15,396 | | | 595,794 | 768,287 | 319,201 | 373,181 | 15,935,011 |
| **Accelerated Southern NCC Growth** | | | | 144,978 | | 14,217 | | | 595,794 | 768,287 | 319,201 | 373,181 | 15,708,288 |
| **Centralized Southern NCC Development** | | | | 140,595 | | 9,834 | | | 595,794 | 768,287 | 319,201 | 373,181 | 14,410,896 |
| **Northern NCC Redevelopment** | | | | 136,651 | | 5,890 | | | 595,794 | 768,287 | 319,201 | 373,181 | 15,027,827 |
| **Slower New Castle County Growth** | | | | 139,178 | | 8,417 | | | 595,794 | 768,287 | 319,201 | 373,181 | 15,641,187 |
| **District of Columbia : Regional Mobility & Accessibility Study** | | | | | | | | | 2000 | 2030 | 2000 | 2030 | |
| **CLRP + Scenario** | | | | 801,280 | | 65,280 | 134,500 | 743,400 | 4,552,400 | 6,182,977 | 2,740,400 | 4,063,700 | 149,800,000 |
| **Higher Households in Region** | | | | 775,040 | √ | 39,040 | 334,800 | 1,074,100 | 4,552,400 | 6,743,343 | 2,740,400 | 4,063,700 | 147,800,000 |
| **More Household Growth in Inner Areas** | | | | 759,040 | √ | 23,040 | 295,800 | 1,049,600 | 4,552,400 | 6,182,977 | 2,740,400 | 4,063,700 | 148,500,000 |
| **More Jobs in Outer Areas** | | | | 805,120 | | 69,120 | 163,400 | 800,900 | 4,552,400 | 6,182,977 | 2,740,400 | 4,063,700 | 149,700,000 |
| **Region Undivided** | | | | 768,640 | | 32,640 | 276,100 | 1,075,600 | 4,552,400 | 6,182,977 | 2,740,400 | 4,063,700 | 148,600,000 |
| **Transit-Oriented Development** | | | | 737,280 | √ | 1,280 | 294,000 | 1,112,500 | 4,552,400 | 6,182,977 | 2,740,400 | 4,063,700 | 148,300,000 |
| **Central Florida: How Shall We Grow?** | | | | | | | | | 2005 | 2050 | 2005 | 2050 | |
| **Trend** | | | | 3,325,141 | | 1,649,625 | | | 3,521,813 | 7,123,770 | 1,962,707 | 3,768,000 | #REF! |
| **Green Areas Scenario** | | | | 2,263,300 | √ | 587,784 | | | 3,521,813 | 7,123,770 | 1,962,707 | 3,966,000 | #REF! |
| **Centers Scenario** | | | | 2,215,681 | √ | 540,165 | | | 3,521,813 | 7,123,770 | 1,962,707 | 4,123,000 | #REF! |
| **Corridors Scenario** | | | | 2,097,843 | √ | 422,327 | | | 3,521,813 | 7,123,770 | 1,962,707 | 4,225,000 | #REF! |

# Appendix C - Scenario Data

| Project/Scenario Names | Road Lane Miles | Transit Revenue Hours | Pricing | Total Developed Acres | Land Use Mixing | New Developed Acres | Households Close to Transit | Jobs Close to Transit | Population--Base Year | Population--Forecast Year | Employment--Base Year | Employment--Forecast Year | VMT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Atlanta Region: Envision6** | | | | | | | | | 2000 | 2030 | 2000 | 2030 | |
| **Mobility 2030 Forecast & Network** | 20,153 | 4,180,000 | | 1,898,660 | | 1,266,372 | 18,578 | 281,342 | 3,630,560 | 5,871,024 | 2,067,000 | 3,309,903 | 190,470,099 |
| **Local Land Use Maps + Mobility 2030 Network** | 20,153 | 4,180,000 | | 1,808,298 | | 1,176,010 | 38,348 | 429,938 | 3,630,560 | 5,771,597 | 2,067,000 | 3,309,765 | 196,319,424 |
| **E6 Local Aspirations Plan + Mobility 2030 Network** | 20,153 | 4,180,000 | | 959,778 | √ | 327,490 | 79,706 | 423,951 | 3,630,560 | 5,854,968 | 2,067,000 | 3,312,121 | 190,578,448 |
| **Boise Region: Communities in Motion** | | | | | | | | | 2000 | 2030 | 2000 | 2030 | |
| **Trend Scenario** | 901 | 490 | | 194,556 | | 125,000 | | | 432,345 | 825,000 | 296,510 | 426,505 | 20,778,541 |
| **Community Choices** | 772 | 4,600 | | 111,556 | | 42,000 | | | 432,345 | 825,000 | 296,510 | 426,505 | 19,584,743 |
| **Chicago Region: GO TO 2040** | | | | | | | | | 2010 | 2040 | 2010 | 2040 | |
| **Original Reference Scenario** | | | | 1,344,000 | | 312,000 | 610,750 | | 8,643,000 | 11,000,000 | 4,168,000 | 5,335,000 | 199,842,335 |
| **Reinvest Scenario** | | | | 1,208,000 | | 176,000 | 656,250 | | 8,643,000 | 11,000,000 | 4,168,000 | 5,335,000 | 206,784,589 |
| **Preserve Scenario** | | | √ | 1,278,000 | | 246,000 | 710,500 | | 8,643,000 | 11,000,000 | 4,168,000 | 5,335,000 | 194,495,716 |
| **Innovate Scenario** | | | √ | 1,310,000 | | 278,000 | 666,500 | | 8,643,000 | 11,000,000 | 4,168,000 | 5,335,000 | 201,377,660 |
| **New Reference Scenario** | | | | 1,265,000 | | 233,000 | 606,250 | | 8,643,000 | 11,000,000 | 4,168,000 | 5,335,000 | 191,421,255 |
| **Preferred Scenario** | | | √ | 1,200,000 | | 168,000 | 698,750 | | 8,643,000 | 11,000,000 | 4,168,000 | 5,335,000 | 182,733,338 |

# Appendix C - Scenario Data

| Project/Scenario Names | Road Lane Miles | Transit Revenue Hours | Pricing | Total Developed Acres | Land Use Mixing | New Developed Acres | Households Close to Transit | Jobs Close to Transit | Population--Base Year | Population--Forecast Year | Employment--Base Year | Employment--Forecast Year | VMT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Champaign, IL: 2025 Plan** | | | | | | | | | 2000 | 2025 | 2000 | 2025 | |
| **Scenario 1A** | 651 | | | 26,208 | | 7,168 | 67,871 | | 126,009 | 167,796 | 70,997 | 117,631 | 2,269,746 |
| **Scenario 1B** | 651 | | | 26,208 | | 7,168 | 70,730 | | 126,009 | 167,796 | 70,997 | 117,631 | 2,252,729 |
| **Scenario 1C** | 615 | | | 25,299 | √ | 6,259 | 71,182 | | 126,009 | 167,796 | 70,997 | 117,631 | 2,097,395 |
| **Scenario 1B+C** | 615 | | | 25,299 | √ | 6,259 | | | 126,009 | 167,796 | 70,997 | 117,631 | 2,079,731 |
| **Scenario 1C Modified** | 615 | | | 25,299 | √ | 6,259 | | | 126,009 | 167,796 | 70,997 | 117,631 | 2,098,140 |
| **Scenario 2A** | 713 | | | 26,208 | | 7,168 | 67,871 | | 126,009 | 167,796 | 70,997 | 117,631 | 2,266,064 |
| **Scenario 2B** | 713 | | | 26,208 | | 7,168 | 70,730 | | 126,009 | 167,796 | 70,997 | 117,631 | 2,250,742 |
| **Scenario 2C** | 677 | | | 25,299 | √ | 6,259 | 71,182 | | 126,009 | 167,796 | 70,997 | 117,631 | 2,096,970 |
| **Scenario 2B+C** | 677 | | | 25,299 | √ | 6,259 | | | 126,009 | 167,796 | 70,997 | 117,631 | 2,079,818 |
| **Scenario 2C Modified** | 677 | | | 25,299 | √ | 6,259 | | | 126,009 | 167,796 | 70,997 | 117,631 | 2,098,284 |
| **Scenario 3A** | 713 | | | 26,208 | | 7,168 | 67,871 | | 126,009 | 167,796 | 70,997 | 117,631 | 2,265,193 |
| **Scenario 3B** | 713 | | | 26,208 | | 7,168 | 70,730 | | 126,009 | 167,796 | 70,997 | 117,631 | 2,249,529 |
| **Scenario 3C** | 677 | | | 25,299 | √ | 6,259 | 71,182 | | 126,009 | 167,796 | 70,997 | 117,631 | 2,097,713 |
| **Scenario 3B+C** | 677 | | | 25,299 | √ | 6,259 | | | 126,009 | 167,796 | 70,997 | 117,631 | 2,079,695 |
| **Scenarion 3C Modified** | 677 | | | 25,299 | √ | 6,259 | | | 126,009 | 167,796 | 70,997 | 117,631 | 2,098,457 |

# Appendix C - Scenario Data

| Project/Scenario Names | Road Lane Miles | Transit Revenue Hours | Pricing | Total Developed Acres | Land Use Mixing | New Developed Acres | Households Close to Transit | Jobs Close to Transit | Population--Base Year | Population--Forecast Year | Employment--Base Year | Employment--Forecast Year | VMT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Lansing, MI: 2035 Plan** | | | | | | | | | 2005 | 2035 | 2005 | 2035 | |
| **Trend/Business as Usual** | 4,553 | 216,881 | | 201,098 | | 120,612 | 89,424 | 182,783 | 454,667 | 491,808 | 280,786 | 299,644 | 16,548,000 |
| **Wise Growth** | 4,553 | 216,881 | | 191,002 | √ | 110,516 | 102,199 | 200,763 | 454,667 | 491,808 | 280,786 | 299,647 | 16,087,000 |
| **Build Out** | 4,553 | 216,881 | | 239,770 | | 159,284 | 102,633 | 235,173 | 454,667 | 1,163,761 | 280,786 | 489,944 | 34,530,000 |
| **Wise Growth Build Out** | 4,553 | 216,881 | | 191,002 | √ | 110,516 | 218,653 | 323,292 | 454,667 | 1,076,362 | 280,786 | 489,837 | 26,536,000 |
| **Alternative 1** | 4,553 | 554,335 | | 191,002 | √ | 110,516 | 102,199 | 200,763 | 454,667 | 491,808 | 280,786 | 299,647 | 15,994,645 |
| **Alternative 2** | 4,553 | 529,687 | | 191,002 | √ | 110,516 | 102,199 | 200,763 | 454,667 | 491,808 | 280,786 | 299,647 | 16,032,500 |
| **Alternative 3** | 4,553 | 216,881 | √ | 191,002 | √ | 110,516 | 102,199 | 200,763 | 454,667 | 491,808 | 280,786 | 299,647 | 14,764,988 |
| **Alternative 4** | 4,553 | 529,687 | √ | 191,002 | √ | 110,516 | 102,199 | 200,763 | 454,667 | 491,808 | 280,786 | 299,647 | 14,718,398 |
| **Alternative 5** | 4,545 | 529,687 | √ | 191,002 | √ | 110,516 | 102,199 | 200,763 | 454,667 | 491,808 | 280,786 | 299,647 | 14,709,315 |
| **Alternative 6A** | 4,545 | 216,881 | | 191,002 | √ | 110,516 | 102,199 | 200,763 | 454,667 | 491,808 | 280,786 | 299,647 | 16,091,948 |
| **Alternative 6B** | 4,545 | 216,881 | | 201,098 | | 120,612 | 89,424 | 182,783 | 454,667 | 491,808 | 280,786 | 299,644 | 16,544,143 |
| **Alternative 7** | 4,580 | 216,881 | | 191,002 | √ | 110,516 | 102,199 | 200,763 | 454,667 | 491,808 | 280,786 | 299,647 | 16,144,318 |
| **Alternative 8** | 4,535 | 529,687 | √ | 191,002 | √ | 110,516 | 102,199 | 200,763 | 454,667 | 491,808 | 280,786 | 299,647 | 14,708,605 |
| **Envision Missoula** | | | | | | | | | 2007 | 2055 | 2007 | 2055 | |
| **Business as Usual** | | | | 60,982 | | 37,696 | | | 97,194 | 200,000 | 58,081 | 117,229 | 10,045,970 |
| **Suburban Satellites** | | | | 31,158 | √ | 7,872 | | | 97,194 | 200,000 | 58,081 | 117,229 | 10,125,286 |
| **Focus Inward** | | | | 23,478 | √ | 192 | | | 97,194 | 200,000 | 58,081 | 117,229 | 8,495,961 |

# Appendix C - Scenario Data

| Project/Scenario Names | Road Lane Miles | Transit Revenue Hours | Pricing | Total Developed Acres | Land Use Mixing | New Developed Acres | Households Close to Transit | Jobs Close to Transit | Population--Base Year | Population--Forecast Year | Employment--Base Year | Employment--Forecast Year | VMT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Albany, NY: New Visions 2030** | | | | | | | | | 2000 | 2030 | 2000 | 2030 | |
| **Status Quo Trend** | | | | 154,549 | | 40,549 | | | 794,293 | 867,000 | 428,799 | 485,794 | 22,934,175 |
| **Concentrated Growth** | | | | 140,898 | | 26,898 | | | 794,293 | 867,000 | 428,799 | 486,129 | 21,338,965 |
| **Trend Hyper-Growth** | | | | 260,855 | | 146,855 | | | 794,293 | 1,023,634 | 428,799 | 600,698 | 27,010,503 |
| **Concentrated Hyper-Growth** | | | | 191,657 | | 77,657 | | | 794,293 | 1,023,633 | 428,799 | 602,099 | 24,457,935 |
| **Binghamton, NY: Transportation Tomorrow** | | | | | | | | | 2005 | 2030 | 2005 | 2030 | |
| **Inward No-Growth/No-Build** | | | | 53,275 | | 125 | 13,650 | 18,679 | 187,721 | 187,722 | 92,875 | 96,360 | 5,504,103 |
| **Inward No-Growth/Build** | | | | 53,275 | | 125 | 13,650 | 18,679 | 187,721 | 187,722 | 92,875 | 96,360 | 5,493,435 |
| **Inward Growth/No-Build** | | | | 53,325 | | 175 | 14,538 | 20,239 | 187,721 | 197,700 | 92,875 | 102,260 | 5,980,907 |
| **Inward Growth/Build** | | | | 53,325 | | 175 | 14,538 | 20,239 | 187,721 | 197,700 | 92,875 | 102,260 | 5,992,215 |

# Appendix C - Scenario Data

| Project/Scenario Names | Road Lane Miles | Transit Revenue Hours | Pricing | Total Developed Acres | Land Use Mixing | New Developed Acres | Households Close to Transit | Jobs Close to Transit | Population--Base Year | Population--Forecast Year | Employment--Base Year | Employment--Forecast Year | VMT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Durham-Chapel Hill, NC: 2035 Plan** | | | | | | | | | 2005 | 2035 | 2005 | 2035 | |
| **Comprehensive Transportation Plan/Baseline** | | | √ | 117,532 | | 13,747 | | | 414,628 | 660,075 | 234,747 | 412,706 | 17,204,339 |
| **Comprehensive Transportation Plan/Buildout** | | | √ | 167,085 | | 63,300 | | | 414,628 | 1,041,062 | 234,747 | 626,095 | 25,987,013 |
| **Intensive Higway/Baseline** | | | √ | 117,532 | | 13,747 | | | 414,628 | 660,075 | 234,747 | 412,706 | 17,703,440 |
| **Intensive Higway/Constrained** | | | √ | 109,734 | | 5,949 | | | 414,628 | 569,918 | 234,747 | 372,848 | 16,185,055 |
| **Intensive Highway/Corridor** | | | √ | 112,974 | | 9,188 | | | 414,628 | 660,075 | 234,747 | 412,706 | 17,533,311 |
| **Intensive Fixed Guideway/Baseline** | | | | 117,532 | | 13,747 | | | 414,628 | 660,075 | 234,747 | 412,706 | 17,333,966 |
| **Intensive Fixed Guideway/Corridor** | | | | 112,974 | | 9,188 | | | 414,628 | 660,075 | 234,747 | 412,706 | 17,188,087 |
| **Intensive Fixed Guideway/Transit Nodes** | | | | 110,016 | √ | 6,231 | | | 414,628 | 660,075 | 234,747 | 412,706 | 17,302,220 |
| **Intensive Bus Transit/Baseline** | | | √ | 117,532 | | 13,747 | | | 414,628 | 660,075 | 234,747 | 412,706 | 17,366,268 |
| **Intensive Bus Transit/Corridor** | | | √ | 112,974 | | 9,188 | | | 414,628 | 660,075 | 234,747 | 412,706 | 17,254,460 |
| **Intensive Bus Transit/Transit Nodes** | | | √ | 110,016 | √ | 6,231 | | | 414,628 | 660,075 | 234,747 | 412,706 | 17,364,161 |
| **Moderate Multimodal/Baseline** | | | | 117,532 | | 13,747 | | | 414,628 | 660,075 | 234,747 | 412,706 | 17,264,268 |
| **Moderate Multimodal/Corridor** | | | | 112,974 | | 9,188 | | | 414,628 | 660,075 | 234,747 | 412,706 | 17,323,513 |
| **Moderate Multimodal/Transit Nodes** | | | | 110,016 | √ | 6,231 | | | 414,628 | 660,075 | 234,747 | 412,706 | 17,103,212 |
| **2035 Existing & Committed/Baseline** | | | | 117,532 | | 13,747 | | | 414,628 | 660,075 | 234,747 | 412,706 | 17,397,077 |
| **Eugene, OR: Region 2050** | | | | | | | | | 2000 | 2050 | 2000 | 2050 | |
| **Rural Growth** | | 555,069 | | 175,907 | | 120,117 | | | 306,007 | 463,500 | 134,631 | 215,000 | 12,370,000 |
| **Satellite Communities Growth** | | 526,664 | | 111,307 | | 55,516 | | | 306,007 | 463,500 | 134,631 | 215,000 | 11,402,000 |
| **Compact Urban Growth** | | 500,566 | | 112,248 | | 56,458 | | | 306,007 | 463,500 | 134,631 | 215,000 | 11,651,000 |

# Appendix C - Scenario Data

| Project/Scenario Names | Road Lane Miles | Transit Revenue Hours | Pricing | Total Developed Acres | Land Use Mixing | New Developed Acres | Households Close to Transit | Jobs Close to Transit | Population--Base Year | Population--Forecast Year | Employment--Base Year | Employment--Forecast Year | VMT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Brownsville, TX: Transp & Land Use Study** | | | | | | | | | 1999 | 2035 | 1999 | 2035 | |
| **Scenario A** | | | | 67,700 | | 31,008 | | | 168,257 | 364,028 | 43,318 | 99,740 | 4,430,000 |
| **Scenario B** | | | | 41,000 | √ | 4,308 | | | 168,257 | 364,028 | 43,318 | 99,740 | 4,400,000 |
| **Scenario C** | | | | 40,500 | √ | 3,808 | | | 168,257 | 364,028 | 43,318 | 99,740 | 4,390,000 |
| **Waco, TX: Future Land Use Study** | | | | 81,037 | | | # | | 2005 | 2030 | 2005 | 2030 | |
| **Trend + No Build** | | | | 91,014 | | 9,977 | 5,771 | 7,529 | 221,347 | 277,502 | 79,311 | 102,839 | 10,118,756 |
| **Trend + Committed** | | | | 91,014 | | 9,977 | 5,771 | 7,529 | 221,347 | 277,502 | 79,311 | 102,839 | 10,105,266 |
| **Trend + Planned Funded** | | | | 91,014 | | 9,977 | 5,771 | 7,529 | 221,347 | 277,502 | 79,311 | 102,839 | 10,113,845 |
| **Trend + Planned Unfunded** | | | | 91,014 | | 9,977 | 5,771 | 7,529 | 221,347 | 277,502 | 79,311 | 102,839 | 10,121,872 |
| **Trend + Alternative** | | | | 91,014 | | 9,977 | 5,771 | 7,529 | 221,347 | 277,502 | 79,311 | 102,839 | 10,181,418 |
| **Suburban Centers + No Build** | | | | 87,950 | √ | 6,913 | 10,654 | 10,882 | 221,347 | 277,502 | 79,311 | 101,075 | 9,923,496 |
| **Suburban Centers + Committed** | | | | 87,950 | √ | 6,913 | 10,654 | 10,882 | 221,347 | 277,502 | 79,311 | 101,075 | 9,924,905 |
| **Suburban Centers + Planned Funded** | | | | 87,950 | √ | 6,913 | 10,654 | 10,882 | 221,347 | 277,502 | 79,311 | 101,075 | 9,929,078 |
| **Suburban Centers + Planned Unfunded** | | | | 87,950 | √ | 6,913 | 10,654 | 10,882 | 221,347 | 277,502 | 79,311 | 101,075 | 9,928,546 |
| **Suburban Centers + Alternative** | | | | 87,950 | √ | 6,913 | 10,654 | 10,882 | 221,347 | 277,502 | 79,311 | 101,075 | 9,981,456 |
| **Urban Centers + No Build** | | | | 87,709 | √ | 6,672 | 11,764 | 11,684 | 221,347 | 277,502 | 79,311 | 100,948 | 9,936,844 |
| **Urban Centers + Committed** | | | | 87,709 | √ | 6,672 | 11,764 | 11,684 | 221,347 | 277,502 | 79,311 | 100,948 | 9,935,775 |
| **Urban Centers + Planned Funded** | | | | 87,709 | √ | 6,672 | 11,764 | 11,684 | 221,347 | 277,502 | 79,311 | 100,948 | 9,945,940 |
| **Urban Centers + Planned Unfunded** | | | | 87,709 | √ | 6,672 | 11,764 | 11,684 | 221,347 | 277,502 | 79,311 | 100,948 | 9,956,069 |
| **Urban Centers + Alternative** | | | | 87,709 | √ | 6,672 | 11,764 | 11,684 | 221,347 | 277,502 | 79,311 | 100,948 | 10,008,841 |

# Appendix C - Scenario Data

| Project/Scenario Names | Road Lane Miles | Transit Revenue Hours | Pricing | Total Developed Acres | Land Use Mixing | New Developed Acres | Households Close to Transit | Jobs Close to Transit | Population--Base Year | Population--Forecast Year | Employment--Base Year | Employment--Forecast Year | VMT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Logan, UT: Envision Cache Valley** | | | | | | | | | 2008 | 2040 | 2010 | 2040 | |
| **Baseline** | 6,670 | | | 57,829 | | 33,280 | | | 110,025 | 219,467 | 65,357 | 130,706 | 4,515,565 |
| **Eastside/Westside Benches** | 6,935 | | | 53,349 | | 28,800 | | | 110,025 | 219,467 | 65,357 | 130,706 | 4,796,180 |
| **Town Centers/Clustering** | 6,518 | | | 45,029 | √ | 20,480 | | | 110,025 | 219,467 | 65,357 | 130,706 | 4,458,784 |
| **Urban Centers/Rural Edge** | 6,459 | | | 39,269 | √ | 14,720 | | | 110,025 | 219,467 | 65,357 | 130,706 | 3,941,760 |
| **Vision Scenario** | 6,665 | | | 44,389 | √ | 19,840 | | | 110,025 | 219,467 | 65,357 | 130,706 | 4,425,705 |
| **St. George, UT: Vision Dixie** | | | | | | | | | 2007 | 2035 | 2007 | 2035 | |
| **Scenario A** | | | | 149,269 | | 122,880 | 11,250 | 9,000 | 140,908 | 400,878 | 75,917 | 210,095 | 11,095,207 |
| **Scenario B** | | | | 80,789 | | 54,400 | 12,375 | 18,302 | 140,908 | 400,878 | 75,917 | 210,095 | 10,130,346 |
| **Scenario C** | | | | 69,269 | √ | 42,880 | 20,813 | 28,125 | 140,908 | 400,878 | 75,917 | 210,095 | 9,311,341 |
| **Scenario D** | | | | 51,989 | √ | 25,600 | 32,625 | 47,250 | 140,908 | 400,878 | 75,917 | 210,095 | 7,736,566 |
| **Salt Lake City: Wasatch Choices** | | | | | | | # | | 2005 | 2040 | 2005 | 2040 | |
| **Business as Usual** | 8,757 | 175,349 | | 546,406 | | 216,320 | 65,226 | 739,448 | 1,788,809 | 3,398,557 | 1,154,287 | 1,696,818 | 81,200,000 |
| **Transit Station Villages** | 8,147 | 191,849 | | 510,566 | √ | 180,480 | 136,702 | 1,039,595 | 1,788,809 | 3,398,557 | 1,154,287 | 1,696,818 | 79,000,000 |
| **Interconnected Network of Complete Streets** | 9,099 | 181,849 | | 540,646 | √ | 210,560 | 119,692 | 882,804 | 1,788,809 | 3,398,557 | 1,154,287 | 1,696,818 | 80,900,000 |
| **Centers of Employment** | 9,067 | 181,349 | | 579,046 | | 248,960 | 26,930 | 469,649 | 1,788,809 | 3,398,557 | 1,154,287 | 1,696,818 | 85,400,000 |
| **Salt Lake City: West Salt Lake Transit Study** | | | | | | | # | | 2007 | 2040 | 2007 | 2040 | |
| **2040 Base Medium Capacity** | | 834,400 | | 58,683 | | 25,113 | 113,419 | 155,881 | 194,973 | 744,628 | 105,113 | 317,192 | 13,824,201 |
| **2040 Express BRT** | | 1,072,800 | | 58,683 | | 25,113 | 113,419 | 155,881 | 194,973 | 744,628 | 105,113 | 317,192 | 13,824,201 |
| **2040 Higher Speed West Bench** | | 737,550 | | 58,683 | | 25,113 | 113,419 | 155,881 | 194,973 | 744,628 | 105,113 | 317,192 | 13,824,201 |
| **Build-Out Higher Speed West Bench** | | 749,840 | | 65,071 | | 31,501 | 110,488 | 175,447 | 194,973 | 823,807 | 105,113 | 361,691 | 15,117,138 |
| **Optimized Land Use -- Higher Speed West Bench** | | 830,000 | | 67,301 | √ | 33,731 | 157,366 | 236,662 | 194,973 | 960,466 | 105,113 | 423,175 | 16,632,800 |

# Appendix C - Scenario Data

| Project/Scenario Names | Road Lane Miles | Transit Revenue Hours | Pricing | Total Developed Acres | Land Use Mixing | New Developed Acres | Households Close to Transit | Jobs Close to Transit | Population--Base Year | Population--Forecast Year | Employment--Base Year | Employment--Forecast Year | VMT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Seattle: Vision 2040** | | | | | | | | | 2000 | 2040 | 2000 | 2040 | |
| **Growth Targets Extended** | 13,111 | 9,000,000 | √ | | | | 1,526,939 | 2,304,000 | 3,276,000 | 4,988,000 | 1,853,000 | 3,072,000 | 137,104,450 |
| **Metropolitan Cities** | 13,111 | 9,000,000 | √ | | √ | | 1,628,735 | 2,457,600 | 3,276,000 | 4,988,000 | 1,853,000 | 3,072,000 | 122,230,199 |
| **Larger Cities** | 13,111 | 9,000,000 | √ | | √ | | 1,588,016 | 2,396,160 | 3,276,000 | 4,988,000 | 1,853,000 | 3,072,000 | 121,397,615 |
| **Smaller Cities** | 13,111 | 9,000,000 | √ | | | | 1,445,502 | 2,181,120 | 3,276,000 | 4,988,000 | 1,853,000 | 3,072,000 | 131,058,440 |
| **Preferred Growth** | 13,111 | 9,000,000 | √ | | √ | | 1,547,298 | 2,334,720 | 3,276,000 | 4,988,000 | 1,853,000 | 3,072,000 | 123,543,512 |
| **PlanCheyenne** | | | | | | | | | 2000 | 2030 | 2000 | 2030 | |
| **Current Comprehensive Plan + Existing and Committeed Roadway Facilities** | 3,015 | | | 74,700 | | 53,031 | | | 73,306 | 167,387 | 29,540 | 113,040 | 3,154,049 |
| **Current Comprehensive Plan + Current Composite Roadway Plan** | 3,563 | | | 74,700 | | 53,031 | | | 73,306 | 167,387 | 29,541 | 113,040 | 3,136,154 |
| **Urban Service Areas Focus Plan + Existing and Committed Roadway Facilities** | 3,015 | | | 41,100 | | 19,431 | | | 73,306 | 172,706 | 29,540 | 121,940 | 3,181,383 |
| **Urban Service Areas Focus Plan + Current Composite Roadway Plan** | 3,563 | | | 41,000 | | 19,331 | | | 73,306 | 172,706 | 29,541 | 121,940 | 3,133,674 |
| **Neighborhoods Centers + Existing and Committed Roadway Facilities** | 3,015 | | | 56,500 | √ | 34,831 | | | 73,306 | 171,806 | 29,540 | 124,440 | 3,073,641 |
| **Neighborhoods Centers + Current Composite Roadway Plan** | 3,563 | | | 56,500 | √ | 34,831 | | | 73,306 | 171,806 | 29,541 | 124,440 | 3,059,259 |

# Appendix D – Annotated Bibliography

Appendix D contains summary descriptions of the scenario planning projects included in this study. The projects were identified using the approaches described in the Data Collection section of this report. The research team drafted the summaries using project reports and other materials provided by the agencies that sponsored the projects. The draft summaries were provided to staff members of those agencies for their review, comment, and editing.

The summaries attempt to address the following questions:

- What was the purpose or motivation for the study?
- What are the general land use features of the scenarios that were developed for the study?
- How were transportation system elements treated in the scenarios?
- What other policy elements were included (e.g., transportation demand management, transportation system management, pricing mechanisms)?
- What indices were selected to evaluate/compare the scenarios?
- What technical tools were used to measure the selected indices?
- What were the outputs from the evaluation process?
- How were the results presented to stakeholders and the public?
- How did elected officials and the public participate in the study process?
- What follow-on actions were taken by the sponsor or other entities as a result of the study?
- Were any institutional changes made to increase land use-transportation integration?

The summaries address these questions using textual descriptions, graphics and excerpts of data taken from project reports and other sources provided by the sponsoring agencies, and agency responses to surveys and questions from members of the research team.

With respect to modeling capacity issues, the research team distributed the survey included in Appendix B to each agency that sponsored a scenario planning project. The survey was intended to assess the capacity of each agency's travel demand model to evaluate variations in land use assumptions. The survey was constructed based on a study by DKS of Smart Growth modeling issues (2007) that identifies key components associated with the evaluation of land use variables in transportation demand modeling. Through the survey, the research team sought to determine the degree to which the travel demand models used for scenario planning projects incorporate Smart Growth components. The survey was not intended to provide complete or detailed information about each agency's model system or process. Hence, the

Smart Growth modeling tables in the following summary descriptions should be read only as an assessment of the degree to which a particular model includes the components identified in the DKS study, and not as a comprehensive assessment of that model.

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## California

San Luis Obispo Council of Governments, *Preliminary Sustainable Communities Strategy* D-1

Association of Bay Area Governments, *Projections 2009: What If?* D-6

San Joaquin Valley Regional Policy Council, *San Joaquin Valley Blueprint* D-13

Shasta County Regional Transportation Planning Agency, *ShastaFORWARD>> Regional Blueprint Project* D-18

## Delaware/Maryland

Wilmington Area Planning Council, *2030 Regional Transportation Plan* D-25

## District of Columbia

National Capital Region Transportation Planning Board, *Regional Mobility and Accessibility Scenario Study* D-29

## Florida

Hillsborough County Metropolitan Planning Organization, *Transit Concept for 2050* D-35

East Central Florida Regional Planning Council, et al., *How Shall We Grow?* D-41

## Georgia

Atlanta Regional Commission, *Envision6: Regional Transportation Plan & Regional Development Plan* D-47

Atlanta Regional Commission, *2009 Livable Centers Initiative Indicators and Benefits Study* D-53

## Idaho

Community Planning Association of Southwest Idaho, *Communities in Motion* D-59

## Illinois

Chicago Metropolitan Agency for Planning, *GO TO 2040* D-63

Champaign Urbana Urbanized Area Transportation Study, *Long Range Transportation Plan 2025* D-68

## Michigan

Tri-County Regional Planning Commission, *Regional 2035 Transportation Plan* D-75

## Montana

Missoula Office of Planning and Grants, *Envision Missoula* D-83

## New York

Capital District Transportation Committee, *New Visions 2030* D-89

Binghamton Metropolitan Transportation Study, *Transportation Tomorrow* D-94

## North Carolina

Durham-Chapel Hill-Carrboro MPO, *2035 Long Range Transportation Plan Alternatives Analysis Report* D-99

## Oregon

Lane Council of Governments, *Region 2050* D-105

## Pennsylvania

Southwestern Pennsylvania Commission, *2035 Transportation and Development Plan* D-109

## Texas

Brownsville Metropolitan Planning Organization, *Transportation and Land Use Study* D-115

Waco Metropolitan Planning Organization, *Future Land Use Study for McLennan County* D-119

## Utah

Cache Valley Regional Council, *Envision Cache Valley* D-125

Washington County Commission, *Vision Dixie* D-131

Wasatch Front Regional Council, et al., *Wasatch Choices 2040* D-136

Utah Transit Authority, et al., *West Salt Lake County Transit Study* D-141

## Washington

Puget Sound Regional Council, *Vision 2040* D-147

## Wyoming

Cheyenne Metropolitan Planning Organization, et al., *PlanCheyenne* D-153

# California

**Project Title:** Preliminary Sustainable Communities Strategy

**Sponsor:** San Luis Obispo Council of Governments

**Completion Date:** 2010

**Planning Horizon**: 2035

**Source**: Preliminary Sustainable Communities Strategy: 2035 Land Use and Traffic Modeling Report (draft)

The Preliminary Sustainable Communities Strategy study was initiated to respond to California Senate Bill 375, passed in 2008, which requires each of the 18 MPOs in the state to adopt a "sustainable communities strategy" (SCS) as part of their long-range transportation plans. Using available land use and transportation strategies, SCSs are required to demonstrate compliance with a certain greenhouse gas emissions reduction target that will be set for each MPO by the California Air Resources Board (ARB). Although the ARB is not scheduled to establish the final targets until September 2010, the San Luis Obispo Council of Governments (SLOCOG) did not want to wait until that point to begin developing policy strategies with its member jurisdictions for the development of the SCS: "Waiting to start the development of an SCS until final targets are adopted by ARB will put our region at a disadvantage in achieving needed emission reductions by 2020 and 2035." SLOCOG staff identified the need to develop and improve land use and travel model capacities in-house in order to facilitate the MPO-ARB interaction for the process to set draft targets for consideration by ARB in June 2010.

The Preliminary SCS study was built on a 2008 regional "blueprint" growth study, titled *Community 2050*. It was also designed to inform the region's next long-range transportation plan update, currently underway and scheduled for completion in 2010.

<u>The nature of the scenarios</u>

The study employed four land use-transportation scenarios.

**2035 Scenario 1:** Scenario 1 assumes a future development pattern that follows development trends of the recent past, resulting in a low density development pattern throughout the region. Generally, new development in this scenario occurs in an outward growth pattern, with limited reinvestment in existing commercial corridors. This scenario also assumes that development in the rural unincorporated areas of region continues at its present pace.

**2035 Scenario 2:** Scenario 2 assumes intensification within the region's designated Target Development Areas, which are the existing villages, downtowns, and commercial corridors throughout the county. Twenty percent of new residential units are accommodated in mixed-use and medium- to high-density development in the Target Development Areas. The scenario also assumes some reduction in the scale of proposed land use projects that are outside county communities and cities' spheres of influence. This scenario assumes development continues to occur in the rural unincorporated areas to a lesser degree than in Scenario 1.

**2035 Scenario 3:** Scenario 3 assumes additional intensification in the existing commercial corridors than what occurs in Scenario 2. Twenty-five percent of new residential units are accommodated in mixed-use and medium- to high-density development in the Target Development Areas. The scenario also assumes further reduction in the scale of proposed land use projects that are outside county communities and cities' spheres of influence. Some intensification occurs in medium- and high-density residential areas where additional capacity exists in the general plan. This scenario also assumes limited development occurs in rural unincorporated areas.

**2035 Scenario 4:** Scenario 4 assumes additional intensification in the existing commercial corridors than what occurs in Scenario 3. About a third of new residential units are accommodated in mixed-use developments along these commercial corridors. The scenario also assumes no growth is allocated to proposed land use projects that are outside county communities and cities' spheres of influence. This scenario also assumes no new subdivisions occur on land zoned for agriculture in the rural unincorporated area. Under this scenario, intensification occurs in medium- and high-density residential areas where additional residential capacity exists in the general plan.

As explained below, the existing regional road network was assumed for all of the scenarios. Transit service parameters (and demand management policies) were introduced as at several levels through a post-processing method.

<u>The evaluation process</u>

Agency staff used three modeling systems to create and evaluate the scenarios: I-PLACE$^3$S, TransCAD, and EMFAC 2007. I-PLACE$^3$S is a regional land use model that allows the operator to allocate future anticipated growth at the parcel level and produces a set of land use performance measures such as residential and employment density and developed acreage for each land use scenario created. Most of the scenario development process was accomplished outside of the I-PLACE$^3$S model using a geographic information system (GIS) that was employed to develop a regional land use information system from a countywide parcel base layer. The output file from I-PLACE$^3$S for each regional land use scenario becomes the input file for the TransCAD model. TransCAD is a regional traffic model that uses land use alternatives as an input and, using its inherent road network, estimates transportation performance measures such

as vehicle miles of travel (VMT), vehicle speeds, congestion, and delay through trip assignments to meet the demands of those land uses.

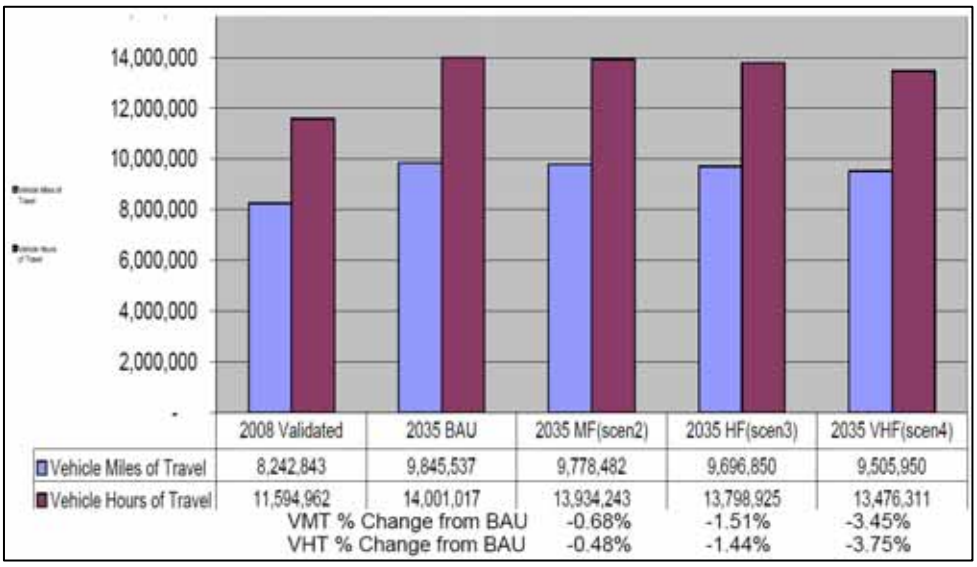
A post-processor tool is used to adjust for alternative modes (i.e., transit, ridesharing, and biking) after the TransCAD model is run. Up to four land use scenarios may be examined with similar, or differing, levels of investment or modifications to nine transportation-related variables. These variables are based on current (2008) conditions and established elasticities using available data (collection of local data is necessary to refine these variables). Each variable change results in a shift (up or down) in the mode split percentage. Without changes from the current conditions, the tool applies current mode split percentages to increments of new growth. The variables used for this study included transit fare, transit service frequency, transit service coverage, park-and-ride spaces, rideshare enrollment, number of vanpools, miles of bike lanes, telecommuting, and cost of parking.

Taken together, the TransCAD model and the post-processor tool, create a modeling system containing the following Smart Growth features:

| **Smart Growth Model Feature** | |
|---|---|
| Daily vehicle trip model | X |
| Modeling peak period as well as daily travel | X |
| Post-processing of land use ("D") variables | X |

The output file from TransCAD for each regional land use scenario is finally inputted into the EMFAC 2007 model. EMFAC 2007 is a regional air quality model that produces performance measures for greenhouse gas emissions and criteria air pollutants for all vehicle types based on VMT, vehicle type, fuel type and vehicle speed. The primary output from EMFAC 2007 is metric tons of carbon dioxide equivalents ($MTCO_2e$).

<u>Evaluation results</u>



The TransCAD model, operating without the post-process application of the transit service and transportation demand measures (TDM), produced VMT data for scenarios 2, 3, and 4, showing reductions of between 0.68% to 3.45%, compared to Scenario 1.

Possible explanations for this relatively narrow range of results include an anticipated low population growth rate during the study period (23% over 27 years), plus the decision to maintain across the four scenarios a narrow range of variation in housing unit types (66% to 60% single family) and little variation in the geographic distribution of employment. The inclusion of the transit and TDM elements significantly broadened the range of results.

| Transit/TDM % Reduction | 2035 BAU | 2035 MF (scen2) | 2035 HF (scen3) | 2035 VHF (scen4) |
|---|---|---|---|---|
| No Adjustmnt>> | 9,845,537 | 9,778,482 | 9,696,850 | 9,505,950 |
| 1.50% | 9,697,854 | 9,631,804 | 9,551,397 | 9,363,361 |
| 2.00% | 9,503,897 | 9,439,168 | 9,360,369 | 9,176,094 |
| 2.50% | 9,266,300 | 9,203,189 | 9,126,360 | 8,946,692 |
| 3.00% | 8,988,311 | 8,927,093 | 8,852,569 | 8,678,291 |
| 3.50% | 8,673,720 | 8,614,645 | 8,542,729 | 8,374,551 |

The study generated many other types of data for evaluating the scenarios. A sample of that data is included in the following table:

| | Scenario | | | |
|---|---|---|---|---|
| | 1 | 2 | 3 | 4 |
| Linear miles of streets with full sidewalks | 240 | 300 | 360 | 360 |
| Percent VMT reduction from transit and TDM* | 0.0% | 1.5% | 2.5% | 3.5% |
| Ratio of single-family to multi-family units | 73 : 27 | 70 : 30 | 68 : 32 | 66 : 34 |
| Dwelling units per acre | 2.62 | 2.76 | 2.90 | 3.23 |
| Total developed non-farm acres | 62,580 | 60,158 | 57,899 | 53,279 |
| Percent of households within ½ mile of transit | 50.9% | 53.3% | 54.2% | 57.0% |
| Daily VMT (thousands) | 9,846 | 9,632 | 9,126 | 8,375 |

* Percents chosen by author to correspond with the general purpose of each scenario.

Elected Official Participation/Public Involvement

The Preliminary SCS study was directed by a Joint Policy Committee of six elected officials from the region. A Working Team composed of planning directors and planning staff of member jurisdictions, regional air district, and the local agency formation commission met over the course of eight months in 2009 to provide input on the development of land use scenarios and to review land use and traffic model results. No other public involvement is evident from the study's documents. However, substantial public involvement occurred during the development of the *Community 2050* blueprint regional growth strategy process. As part of *Community 2050* regional blueprint planning effort, SLOCOG conducted several scenario planning workshops where the I-PLACE$^3$S land use modeling software was used to offer real-time results with the assistance of Sacramento Area Council of Governments (SACOG) staff. Additionally, SLOCOG conducted several public workshops with issue-area experts to determine the range of inputs for land use modeling, and issue-area experts on smart growth planning and implementation. Additional public involvement is anticipated for the development of the agency's 2010 Regional Transportation Plan.

Resulting actions

The recommendation action at the close of the study was the selection of 2035 Scenario 2 as the preferred growth scenario to carry forward for both SB 375 and the long-range plan update processes.

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San Luis Obispo
Council of Governments

**Project Title:** Projections 2009: What If?

**Sponsor:** Association of Bay Area Governments

**Completion Date:** 2009

**Planning Horizon**: 2035

**Source**: http://www.abag.ca.gov/rss/pdfs/whatif.pdf

This study was part of the Association of Bay Area Governments' (ABAG) biennial 25-year forecast of future population, housing, and jobs for the San Francisco Bay region. The primary motivation for using a scenario-based process for the 2035 forecast was to explore ways to effectively reduce carbon emissions and increase transportation options.

The nature of the scenarios

The study began with the establishment of numeric performance targets in seven key areas related to environmental and economic sustainability, social equity, and state law mandates, including Assembly Bill 32 (the California Global Warming Solutions Act). The targets, which were established in cooperation with the Metropolitan Transportation Commission (MTC, the region's MPO), include the following:

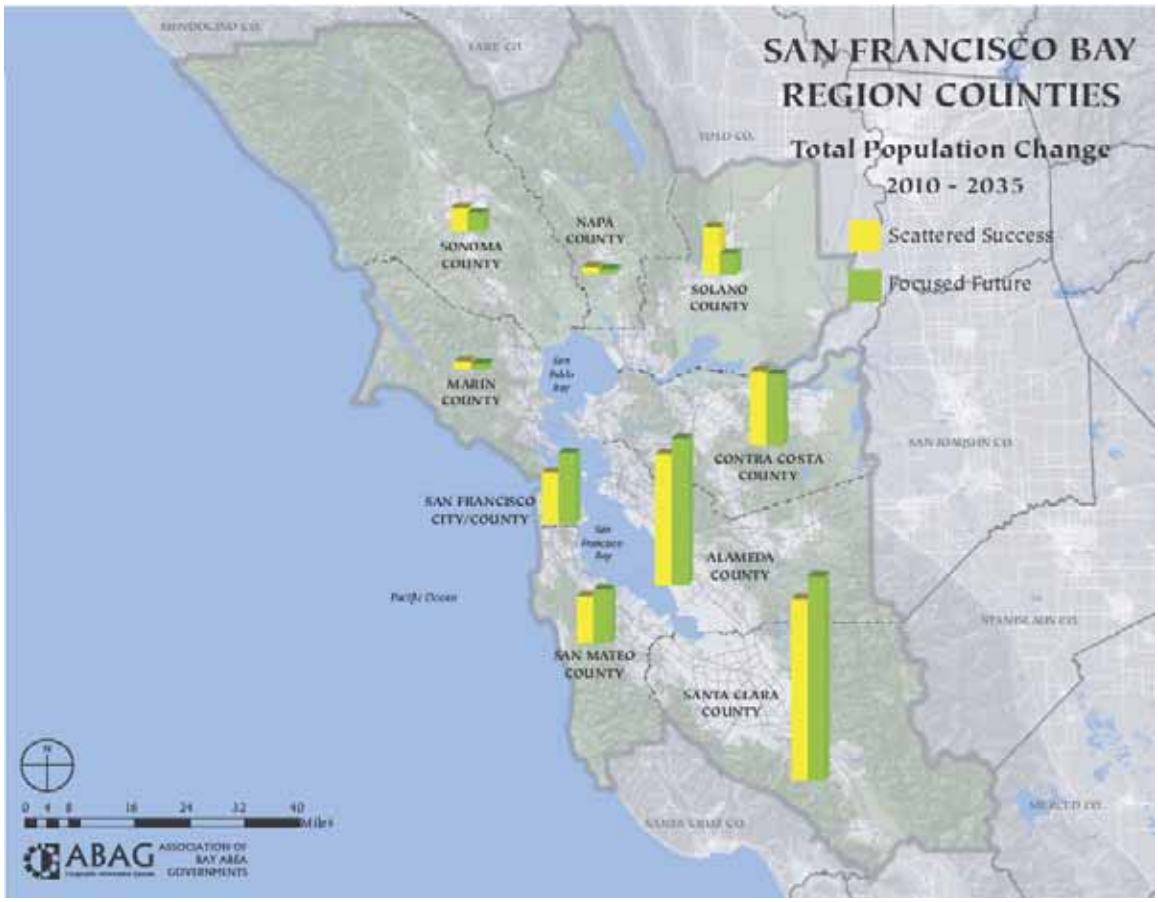
- Reduce driving (vehicle miles traveled (VMT) per person) by 10% below 2009 levels
- Reduce traffic congestion (vehicle hours of delay (VHD)) by 20% below 2009 levels
- Reduce CO2 emissions by 40 percent below 1990 levels
- Reduce fine dust particles (PM 2.5) by 10% below 2009 levels
- Reduce coarse particulate (PM 10) by 45% below 2009 levels
- Limit development of greenfield lands to 900 acres per year for the next 25 years
- Increase access to jobs and services via transit or walking by 20% above 2009 levels

ABAG staff then created two initial scenarios, one representing the continuation of recent trends and one intended to optimize for attainment of the performance targets:

**Scattered Success:** This "business-as-usual" scenario assumes that local and regional policymakers have made limited progress in developing more transportation efficient land use projects. The scenario essentially projects forward the region's current level of success in promoting TOD. Most of the rest of the new land use development is low-density, auto-dependent, and single-use. Transit remains largely unavailable and walking is nearly impossible in many parts of the region.

**Focused Future:** In this scenario, the region has succeeded in creating an "incredible" amount of region-wide development and redevelopment around light- and heavy-rail

stations, major bus stops, and ferry terminals. Transit services have been expanded and improved and existing auto-dependent suburbs have been transformed into walkable downtowns and mixed use neighborhoods through redevelopment and infill.




In reaction to the first two scenarios, ABAG created a third, preferred scenario:

**Final Projections:** This scenario is a modified version of Focused Future that was adjusted in response to stakeholder and local government input. One of the more significant adjustments was the shift of 100,000 jobs from San Francisco to the San Jose area to better meet planners' estimates of likely future growth patterns.

## The evaluation process

ABAG uses a multi-step land allocation modeling process that progressively allocates housing and jobs at increasingly specific geographic units, starting at the regional level then progressing to smaller and smaller areas down to the census tract level. The system generally uses existing employment, existing housing, and available land as significant factors. See http://www.abag.ca.gov/planning/currentfcst/modeling1.html. For Projections 2009, the agency used the usual modeling process for allocations for the Scattered Success scenario. For the Focused Future and Final Projections scenarios, staff used the normal allocation modeling down to the county level. Below that level, the staff, working with local government staff, adjusted the normal allocations to achieve the scenarios' objectives of focusing development in transit-served locations.

The scenario allocations were then modeled for transportation and air emissions impacts by the MTC using its Baycast travel demand model. The version of the Baycast model used for the What If project included the following Smart Growth features:

| **Smart Growth Model Feature** | |
|---|---|
| Daily vehicle trip model | X |
| Modeling peak period as well as daily travel | X |
| Simple mode choice model (that separates transit and highway trips) | X |
| Transit network & assignment of daily trips to that network | X |
| Supply & demand model equilibration | X |
| Income stratification in distribution and mode choice models | X |
| Auto ownership modeling sensitive to land use characteristics | X |
| Non-motorized modes (ped/bike) estimated in mode choice model | X |
| Modeling multiple modes of access to transit (e.g., ped. vs. park and ride) | X |
| Explicit representation of ped and bike networks | X |

## Evaluation results

As outlined in the graphs below, the Focused Future scenario outperformed the Scattered Success scenario in each target area specified at the beginning of the planning process. Under that scenario, VMT per capita is expected to decrease by 0.6 miles per day, compared to a 0.7 mile per day increase under the Scattered Success scenario. Similarly, carbon emissions in the Focused Future scenario are projected to go down by over 4,500 tons per day, compared to 2006 level. Focused Future is also projected to improve congestion levels in the region, leading to four fewer hours are spent in traffic each year, per person, than in 2006. Finally, the Focused Future scenario is estimated to limit the conversion of open lands into developed lands to 1,980 acres per year, or a total of 49,500 acres over the 25-year period.

## Target 1. Reduce VMT (driving/capita)

*The regional target is to reduce daily vehicle miles traveled (VMT) per capita by 10 percent, compared to 2006 levels. That equals a reduction of 1.9 Miles per person/per day. Under **Scattered Success**, daily per person miles increase by 0.7 miles. A **Focused Future** would decrease daily VMT by 0.6 miles per person.*

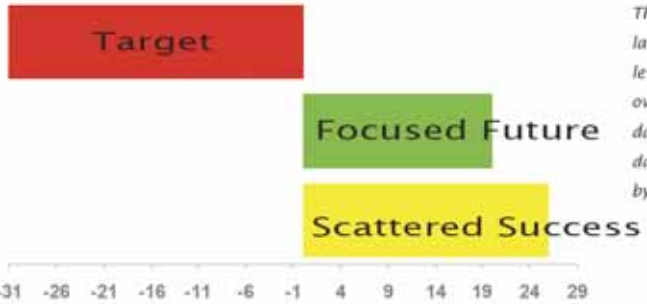
## Target 2. Reduce Carbon Emissions

*The regional target is to reduce transportation-related carbon emissions by 40 percent, compared to 1990 levels. That is equivalent to -38 thousand pounds per day over 2006 levels. This target is consistent with California's Global Warming Solutions Act, Assembly Bill 32. Under **Scattered Success**, daily carbon emissions increase by 2,400 tons per day. A **Focused Future** would decrease daily emissions by 4,500 tons per day.*

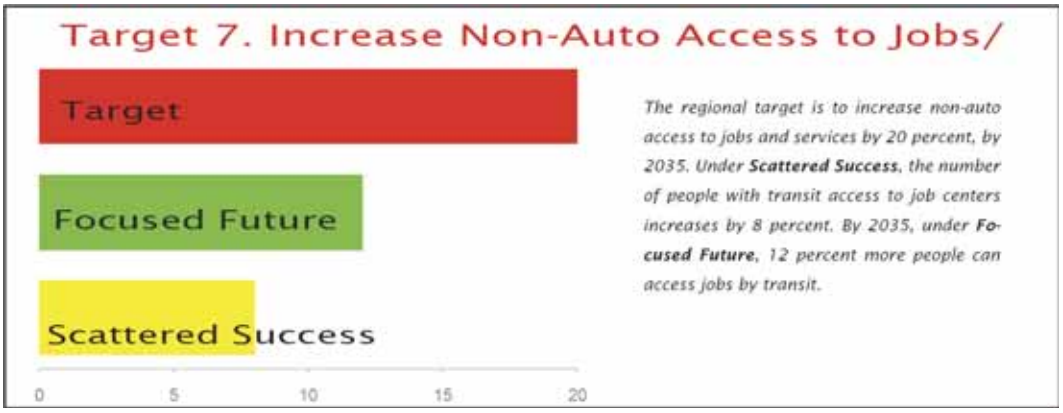
## Target 3. Reduce Traffic Delay

*The regional target is to reduce traffic congestion, or delay, by 20 percent over today's levels. That is equivalent to 5.4 hours of delay per person over 2006 levels. Under **Scattered Success**, daily delay increases by 13 hours per person. A **Focused Future** would decrease daily delay by 3.8 hours.*

## Target 4. Reduce Particulate Matter$_{10}$




*The regional target is to reduce coarse particulate matter, PM10, by 45 percent over today's levels. That is equivalent to 31 tons per day over 2006 levels. Under **Scattered Success**, daily PM10 emissions increases by 26 tons per day. A **Focused Future** would increase PM10 by 20 tons per day.*




As the graphs show, however, while the Focused Future scenario is projected to move the region closer to reaching its target objectives, it does not achieve those objectives. In a section titled "Land Use Necessary, Not Sufficient," agency staff explain:

> There is a crucial inter-relationship between land use, infrastructure, pricing, technology, and individual behavior in meeting the regional targets. While powerful, land-use changes alone will not be sufficient in reducing our transportation-related emissions. Reducing emissions from the transportation sector will require new transportation infrastructure, like rail extensions, more

buses and even some freeway improvements. Reducing emissions will also require technological improvements to our cars so that they burn cleaner and use less gasoline per mile. We will also need to implement pricing measures - like parking fees, toll lane charges and bridge tolls - so that more people become inspired through their wallets to use their cars less. We will need a major shift in personal behavior, where more people simply choose, for whatever reason, to drive less, walk or take transit over driving. If we seriously intend to reduce this region's transportation carbon emissions, each of these strategies will be necessary. There is no one solution. There will be no easy answers. And in all actuality, land use, infrastructure, technology, pricing, and behavioral changes are highly dependent on one another for any one measure to succeed.

The Final Projections scenario, being based on the Focused Future scenario, shares the latter's performance characteristics in some, but not all, of the key target areas.

| | **Scenario** | | |
|---|---|---|---|
| | Scattered Success | Focused Future | Final Projection |
| Peak transit service hours | 36,900 | 55,000 | 55,000 |
| Total developed acres | 959,040 | 931,512 | 919,088 |
| % of homes w/i ½ mile of transit | 73.3% | 74.6% | 74.6% |
| Total daily VMT | 177,671,400 | 168,399,885 | 181,347,609 |
| Annual VHD per person | 39.7 | 22.9 | 46.1 |
| PM 2.5 tons per day | 25.8 | 24.2 | 19.3 |
| CO2 tons per day | 94,400 | 85,451 | 71,000 |

Elected Official Participation/Public Involvement

Because the 2035 forecast process was substantially different from methods used in prior years, agency staff developed a comprehensive schedule of meetings to provide outreach and collect input from planning staffs, elected officials, and other stakeholder groups. Beginning in March 2008, ABAG began a series of outreach meetings to lay out its strategy and begin discussing the targets and land use scenarios. Subsequent meetings focused on details of the initial two scenarios and the results of the performance target analysis. In February 2009, ABAG staff hosted a workshop to present the draft Final Projections scenario and solicit additional feedback from local jurisdictions.

Resulting actions

As with all growth projections from ABAG, the Final Projections scenario will be used by local governments in the region for a variety of planning purposes and by the MTC for regional transportation planning. ABAG also anticipates that the scenario will provide a basis for complying with the planning requirements of Senate Bill 375, the 2008 California law requiring MPOs to development Sustainable Community Strategies that meet specified CO2 emission reduction targets.

This project represents a substantial departure from prior standard practice with respect to forecasting future metropolitan-level growth. Instead of starting the process with typical local government-led negotiations on the likely location of growth (sometimes referred to as "mud-wrestling for growth"), ABAG staff began the numeric targets for environmental, economic, and quality of life issues listed above. This essentially creates an allocation process analogous to performance-based zoning: specify the desired outcomes first and then build the allocations most likely to achieve those outcomes. This, in turn, can provide the basis for a "back-casting" style of policy development: having identified the optimal spatial allocation for growth, the task becomes focuses on the development of policy mechanisms best designed to achieve that allocation.

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**Project Title:** San Joaquin Valley Blueprint

**Sponsor:** San Joaquin Valley Regional Policy Council

**Completion Date:** In Progress

**Planning Horizon**: 2050

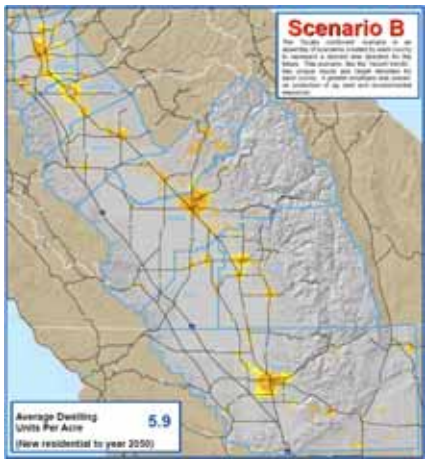
**Source**: http://valleyblueprint.org/index.html

The eight counties comprising the 27,000 square mile mega-region of the San Joaquin Valley worked together to secure funding from the California Department of Transportation's Regional Blueprint grant program to develop a valley-wide transportation, land use, and environmental vision for the year 2050. The project—the San Joaquin Valley Blueprint—was conducted as a regional planning exercise by the region's eight councils of government (COGs; one in each of the eight counties), which together share a common air basin, socioeconomic and growth challenges, and a large agricultural economy. In the next 40 years, the region expects to more than double in population, from 3.9 million to 9.5 million. Such a high growth rate presents challenges to the region's environment, quality of life, public facilities, and economic base. The Valley Blueprint project was developed to begin the process of addressing these issues.

The nature of the scenarios

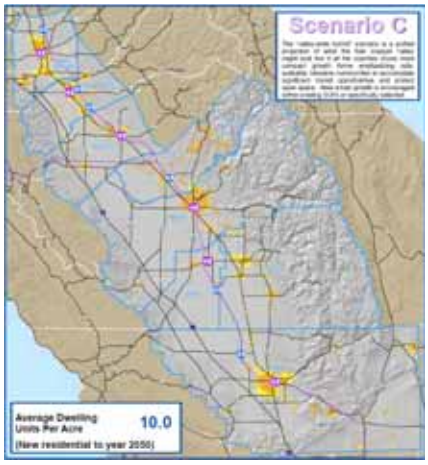
Central to the study process were four scenarios that were initially specified by each COG and then combined for the entire region.

**Scenario A:** Scenario A is the "recent trends" scenario—an effort to portray a continuation of development patterns from the recent past forward into the future.

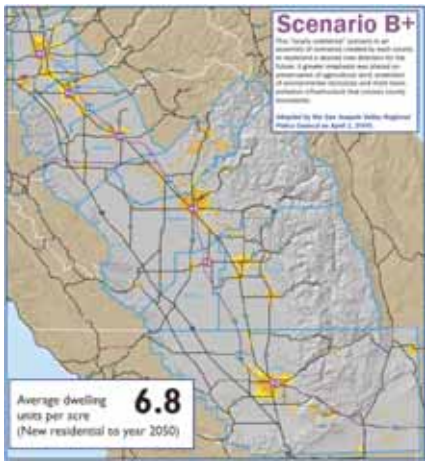



**Scenario B:** As the "locally combined" scenario, Scenario B assembles the scenarios created by each county to represent a desired new direction for the future. Although the scenario contains unique inputs and target densities for each county, the overall emphasis is on protection of agricultural land and environmental resources.

**Scenario C:** Scenario C—the "valley-wide hybrid" scenario—is a unified projection of what the San Joaquin Valley might look like if all the counties chose more compact growth forms emphasizing safe, walkable, bikeable, and transit-oriented communities while protecting open space. To achieve this outcome, the scenario focuses new urban growth within existing urban areas.




**Scenario B+:** Scenario B+ is the preferred scenario selected through the public involvement processes outlined below. The scenario reflects the land use assumptions of Scenario B, but provides more region-wide transit infrastructure.




The evaluation process

Each COG conducted their own process to draft their portions of the scenarios, which were then combined at the regional level. The scenarios were constructed in their final forms using the UPLAN model at UC Davis. UPLAN is a GIS land use model that relies on a series of development attractions and impedances that either encourage or discourage future development in particular locations. The model also incorporates land development policies and environmental constraints.

The growth projected by UPLAN for each scenario was exported into each COG's transportation analysis zones (TAZ) and was classified to match the needs of each COG's transportation model. The growth projections from UPLAN were then combined with each transportation model's base demographic tables to produce a future year TAZ table for use in trip generation and assignment.

The road networks and transit service levels in the transportation models were kept essentially fixed for all scenarios, leaving land use as the primary variable. The one exception was for Scenario B+, which incorporated additional regional transit facilities and services, including the proposed California high speed rail network.

As outlined in the following table, the capacities of the eight MPO models varied widely in their abilities to estimate the impacts of Smart Growth features.

| **Smart Growth Model Feature** | Fresno | Kern | Kings | Madera | Merced | S.J. | Stan. | Tulare |
|---|---|---|---|---|---|---|---|---|
| Daily vehicle trip model | X | X | X | X | X | X | X | X |
| Modeling peak period | X | X | X | | | X | X | X |
| Simple mode choice model | X | X | | | | X | X | |
| Transit network & assignment | X | X | | | | | | |
| Supply & demand model equilibration | | | X | X | X | | | X |
| Income stratification | X | X | | | | | X | |
| Auto ownership sensitive to land use | | | | | | | X | |
| Travel time feedback loops | X | X | X | X | | X | X | X |
| Non-motorized modes in mode choice | X | X | | | | | | |
| Modeling multiple modes of transit access | X | X | | | | | | |
| Trip distribution sensitive to multi-modes | | X | | | | | | |
| Disaggregate simulation of households | | | | X | | | | |
| Integrated land use-transport modeling | | X | | | | | | |
| Post-processing of land use variables | X | X | | | | | | |

Air quality and mobile source emissions were computed using the results from the transportation model and applying the EMFAC2007 model. Other measures were computed directly from GIS analysis of the new growth footprints in comparison to standard GIS datasets.

Evaluation results

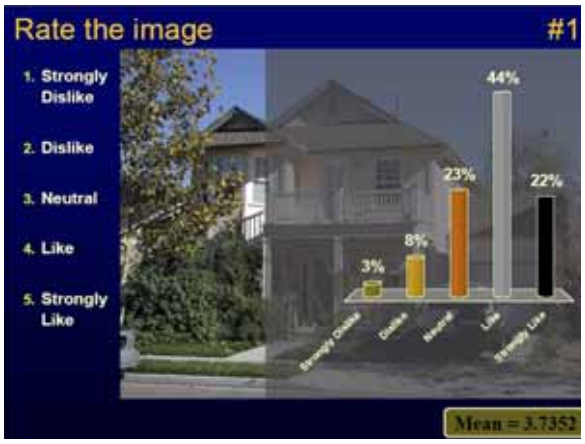
The staff coordinating the valley-wide portions of the project used the output of the various models to synthesize region-wide results.

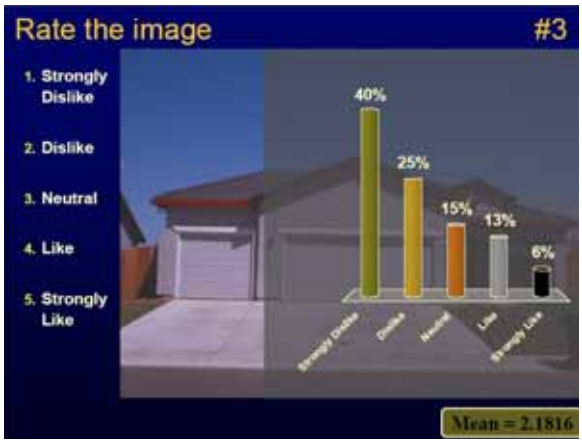
| | **Scenario** | | | |
|---|---|---|---|---|
| | **A** | **B** | **C** | **B+** |
| Average dwelling units per acre (new development) | 4.3 | 6.8 | 10 | 6.8 |
| Acres of new development (000's) | 533 | 370 | 251 | 370 |
| Acres of farmland consumed (000's) | 326.7 | 227.7 | 152.7 | 228.6 |
| Average daily vehicle miles traveled (millions) | 240 | 233 | 225 | 233 |
| Transport-related GHG emissions (000's tons/day) | 173 | 169 | 164 | 169 |

Elected official participation/public involvement

The Valley Blueprint project used a bottom-up approach that relied on local public involvement at the individual county/MPO level for crafting scenarios, reviewing analyses, and selecting a preferred scenario. The process began with each MPO gathering community input on values and visions for future growth. This led to the articulation of goals, objectives, and performance measures, which in turn informed the creation of the scenarios used for the project. Collectively, the MPOs conducted hundreds of meetings and outreach events that reached thousands of individuals. They also engaged in media campaigns that included television, radio, newspaper, and web-based components.

The project made use of a "visual preference survey" that rated citizen's reactions to certain design features associated with different types of housing. The design variables incorporated in the survey included the look of the building, the size of the building, the size of the lot/yard, landscaping, and parking options. Participants were asked to rate each image using a five-point Likert scale (Strongly Dislike, Dislike, Neutral, Like, and Strongly Like). Participants generally preferred street-facing buildings that de-emphasize garages and parking and include some amount of front landscaping (at least for the single-family and row housing types).




The recommendation of a preferred scenario involved nearly 600 citizens that attended a Valleywide Blueprint Summit. As part of the Summit, participants voted on which scenario best represented their values and visions for the future. Using a five-point Likert scale of Strongly Support, Support, Neutral or Don't Care, Don't Support but Won't Oppose, and Don't Support and Will Oppose, an overwhelming majority (85%) indicted they did not support Scenario A, with 67% indicating they would actively oppose it. At the other end of the scale, 63% signified some level of support for Scenario C, with 44% indicating strong support. More respondents opposed than supported Scenario B, but those numbers flipped for Scenario B+, with just over 50%

supporting the alternative. When asked to rank the four scenarios, participants favored Scenario C by a substantial margin.

Resulting actions

The final report for the project has yet to be published at the time of this writing. However, acting on the recommendations from the Valleywide Blueprint Summit, the Blueprint Regional Advisory Committee, and the eight COGs, the San Joaquin Valley Regional Policy Council has adopted Scenario B+ as the preferred scenario, plus a set of Smart Growth Principles. Together, these are expected to be used by the 62 cities and 8 counties in the region to update their general plans and related implementing ordinances. Additional future activities include analysis of how the Valley Blueprint project might inform the COGs' responses to the requirements of state mandates on greenhouse gas emission reductions (especially, AB 32 and SB 375).

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**Eight San Joaquin Valley COG's Comparison of Blueprint Principles/Concepts/Goals**

| PRINCIPLES OF SMART GROWTH * | Create a Range of Housing Opportunities & Choices | Create Walkable Neighborhoods | Encourage Community & Stakeholder Collaboration | Foster Distinctive, Attractive Communities with a Strong Sense of Place | Make Development Decisions Predictable, Fair & Cost Effective | Mix Land Uses | Preserve Open Space, Farmland, Natural Beauty & Critical Environmental Areas | Provide a Variety of Transportation Choices | Strengthen & Direct Development Towards Existing Communities | Take Advantage of Compact Building Design | Enhance the Economic Vitality of the Region | Support Actions that Encourage Environmental Resource Management |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fresno COG Blueprint Concept & Goals | ◆ | ◆ | ◆ | ◆ | ◆ | ◆ | ◆ | ◆ | ◆ | ◆ | ◆ | ◆ |
| Tulare COG Blueprint Goals | ◆ | ◆ | | ◆ | | ◆ | ◆ | ◆ | ◆ | ◆ | ◆ | ◆ |
| San Joaquin COG Blueprint Guiding Principles | ◆ | ◆ | | ◆ | ◆ | ◆ | ◆ | ◆ | ◆ | ◆ | ◆ | ◆ |
| Kern COG Blueprint Principles | ◆ | ◆ | ◆ | ◆ | ◆ | ◆ | ◆ | ◆ | ◆ | ◆ | ◆ | ◆ |
| Stanislaus COG Blueprint Guiding Principles | | ◆ | ◆ | ◆ | ◆ | ◆ | ◆ | ◆ | ◆ | ◆ | ◆ | ◆ |
| Madera CTC Blueprint Vision | ◆ | ◆ | | ◆ | | ◆ | ◆ | ◆ | | | ◆ | ◆ |
| Merced CAG Blueprint Vision | ◆ | ◆ | ◆ | ◆ | ◆ | ◆ | ◆ | ◆ | ◆ | ◆ | ◆ | ◆ |
| [illegible] | ◆ | ◆ | ◆ | ◆ | ◆ | ◆ | ◆ | ◆ | ◆ | ◆ | ◆ | ◆ |
| CA Partnership for the SJV – Goals | ◆ | ◆ | ◆ | ◆ | | ◆ | ◆ | ◆ | ◆ | ◆ | ◆ | ◆ |
| * *"Enhance the Economic Vitality of the Region" and "Support Actions that Encourage Environmental Resource Management" were added to the Principles of Smart Growth.* | | | | | | | | | | | | *Mar-09* |

**Project Title:** Shasta*FORWARD*>> Regional Blueprint Project

**Sponsor:** Shasta County
Regional Transportation Planning Agency

**Completion Date:** 2010

**Planning Horizon**: 2050

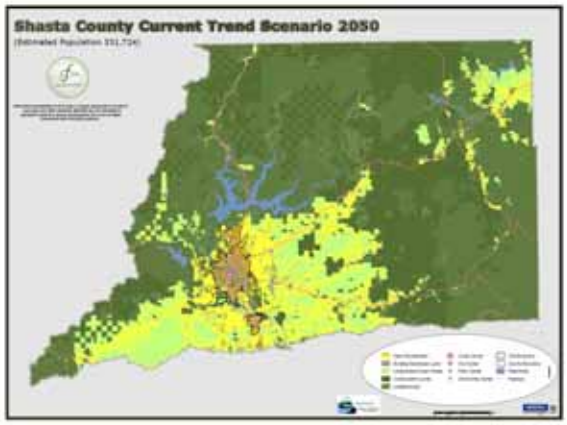
**Source**: http://shastaforward.com

Shasta*FORWARD*>> is the first integrated scenario planning study ever conducted in the Shasta region surrounding Redding, California. Funded through a grant from the California Department of Transportation Regional Blueprint program, the project's initial goal was simply to "maximize public input needed for the many difficult decisions lying ahead." Chief among those decisions is how to respond to recent state legislation on climate change, particularly Senate Bill 375. SB 375 requires MPOs to craft and adopt Sustainable Community Strategies (SCSs) as part of their long-range transportation plans. The SCSs are required to demonstrate how the MPO will achieve greenhouse gas emission reduction targets that will be established for each MPO by the state Air Resources Board before October 2010. Shasta*FORWARD*>> is intended to begin the process for crafting an SCS, even though the region's emissions target has yet to be set.

The project began with a community values study, outlined below, that identified three primary areas of concern with regard to the future of the Shasta region: access to natural amenities, economic development, and mobility. Consensus among study participants indicated moderate to strong apprehension that these three issue areas would be negatively impacted by continuing with a "business as usual" approach to growth.

The nature of the scenarios

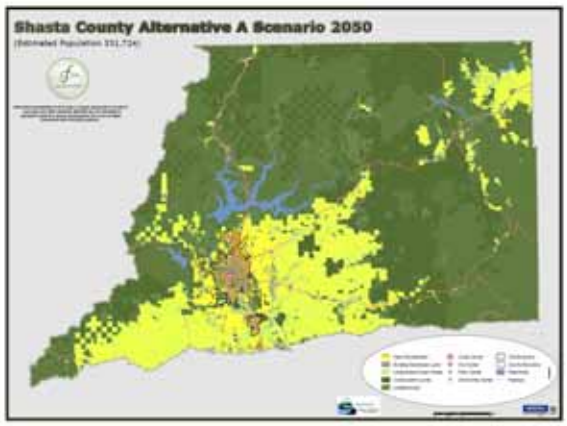
Using input from the extensive public involvement campaign outlined below, the project team assembled four scenarios: one representing current trends and three alternatives to that trend.



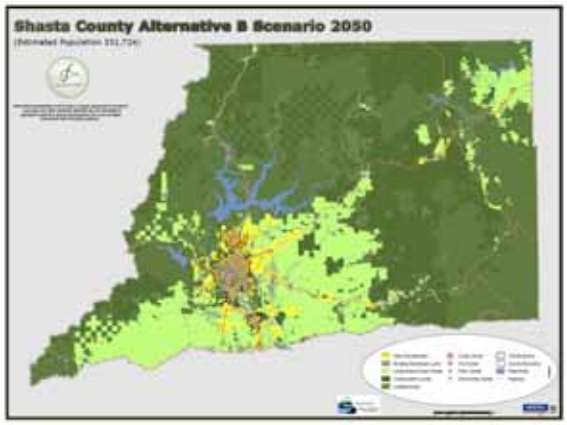

Current Trend 2050: The 'Current Trend' scenario is based on present-day plans, policies, and practices projected into the future. Over time, the I-5 corridor and surrounding areas blend into one large metropolitan area. Except for a few rural towns, the intensity of development fades as the distance from I-5 increases. The

places people live and the places people go are generally separated. Retail development is grouped in large, regional centers near freeway on/off ramps and at major intersections. Residential development gradually expands outward at the urban fringe.

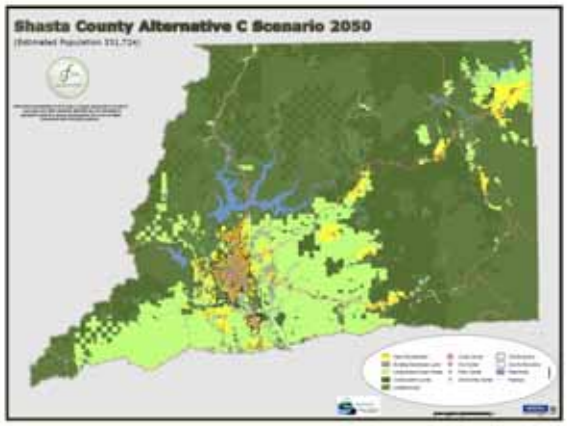
**Scenario A: Rural & Peripheral:** Growth and development in Scenario A is spread throughout the region rather than confined to cities and towns. Lot sizes grow substantially, but all new growth and development is accommodated within existing plans. There is a clear and deliberate separation between residential and non-residential areas. Employment and commercial centers are located at freeway ramps and major intersections.




**Scenario B: Urban Core & Corridors:** Scenario B resembles a 'hub and spoke' development pattern. Employment, commerce, and regional destinations are focused within an urban 'hub'. Radiating outward along a select number of transportation corridors are linear communities containing a mix of housing types and traditional neighborhoods. Between these corridors, a network of interconnected open space enhances urban and natural connections.




**Scenario C: Distinct Cities & Towns:** Rather than have Shasta County's cities and towns grow together into one large metropolitan area, in Scenario C individual communities focus their energies inward. Each 'micropolitan' area contains a well-defined city or town built around an appropriately-scaled downtown and community gathering places. Surrounding open spaces serve as buffers between towns and help meet the functional needs of the natural environment and nearby agriculture production.



The evaluation process

Indices used to measure the scenarios included percentage of developable land actually developed, amounts of environmentally sensitive and prime agricultural lands converted to development, emissions of air pollutants (including CO2), amount of gas and diesel consumed for local (in county) trips, infrastructure costs for new development, percent of households within ¼ mile of shopping and transit, average commute time, average daily vehicle miles traveled (VMT) per household per day, and amount of water consumed.

The study utilized the UPlan model from the Information Center for the Environment at UC Davis. UPlan is a "rule-based" GIS land use model that relies on allocation rules that attempt to mimic real estate markets. Each cell in the model's raster grid is associated with a series of development attractions and impedances that either encourage or discourage future development in that grid. The model also incorporates land development policies (such as city and county general plans) and environmental constraints (such as water bodies, steep slopes, and floodplains).

Project staff made use of UPlan for the construction of the project's four scenarios. Outputs from the model were translated into data sets recognizable to the region's travel demand model, which was then employed to generate the transportation related assessment data. That modeling system includes the following Smart Growth modeling features:

| **Smart Growth Model Feature** | |
|---|---|
| Daily vehicle trip model | X |
| Modeling peak period as well as daily travel | X |
| Simple mode choice model (that separates transit and highway trips) | X |
| Transit network & assignment of daily trips to that network | X |
| Non-motorized modes (ped/bike) estimated in mode choice model | X |
| Trip distribution sensitive to multi-mode options | X |

Evaluation results

Except in the area of water consumption, scenarios B and C posted the best performances on the study indices. Scenario C consumes less land overall (30% of the total, compared to 35% for Scenario B) and less environmentally sensitive and agricultural land. Scenario B, on the other hand, outperformed on most other indices, including air quality, fuel consumption, greenhouse gas emissions, and VMT. Scenario A, with its focus on rural residential development, was the most land consumptive, with twice the amount of agricultural land and three times the amount of environmentally sensitive land, compared to Scenario C. Given the water intensive nature of typical agricultural practices, Scenario A's high level of agricultural land conversion, however,

makes it the least water consumptive among the four scenarios. The highly dispersed nature of Scenario A also makes it the most transportation consumptive—104.2 vehicle miles traveled per day per household compared to Scenario B's 58.7.

| | Scenario | | | |
|---|---|---|---|---|
| | **Trend** | **A** | **B** | **C** |
| Average lot size (acres) | 1 | 1.7 | 0.63 | 0.6 |
| Single-family : multi-family housing ratio | 82 : 18 | 93 : 6 | 63 : 37 | 64 : 36 |
| Total developed residential acres | 156,390 | 265,245 | 98,725 | 94,042 |
| % of housing w/in ¼ mile of shopping & transit | 15% | 12% | 22% | 18% |
| Average daily VMT per household | 64.6 | 104.2 | 58.7 | 62.1 |
| Costs for new capital infrastructure (millions) | $7,690 | $8,670 | $7,060 | $7,140 |
| Gallons of water per day (billions) | 172.3 | 151.2 | 181 | 178.4 |
| Tons of on-road CO2 emissions per day | 7 | 11 | 6 | 7 |

Elected Official Participation/Public Involvement

Similar to the Envision Utah and Wasatch Choices 2040 in Utah and the How Shall We Grow? project in Florida, the Shasta*FORWARD*>> study process began with a community values assessment. The assessment used multiple methods, including telephone and internet surveys and "small-group outreach sessions." In these group sessions, participants were presented with information about the Current Trend 2050 Scenario and its anticipated impacts on quality of life measures. Participants were then asked about their views and opinions on growth-related issues. The core values that emerged from the study were natural setting, economic development, and mobility. Of particular interest were statements made by participants regarding mixed land uses:

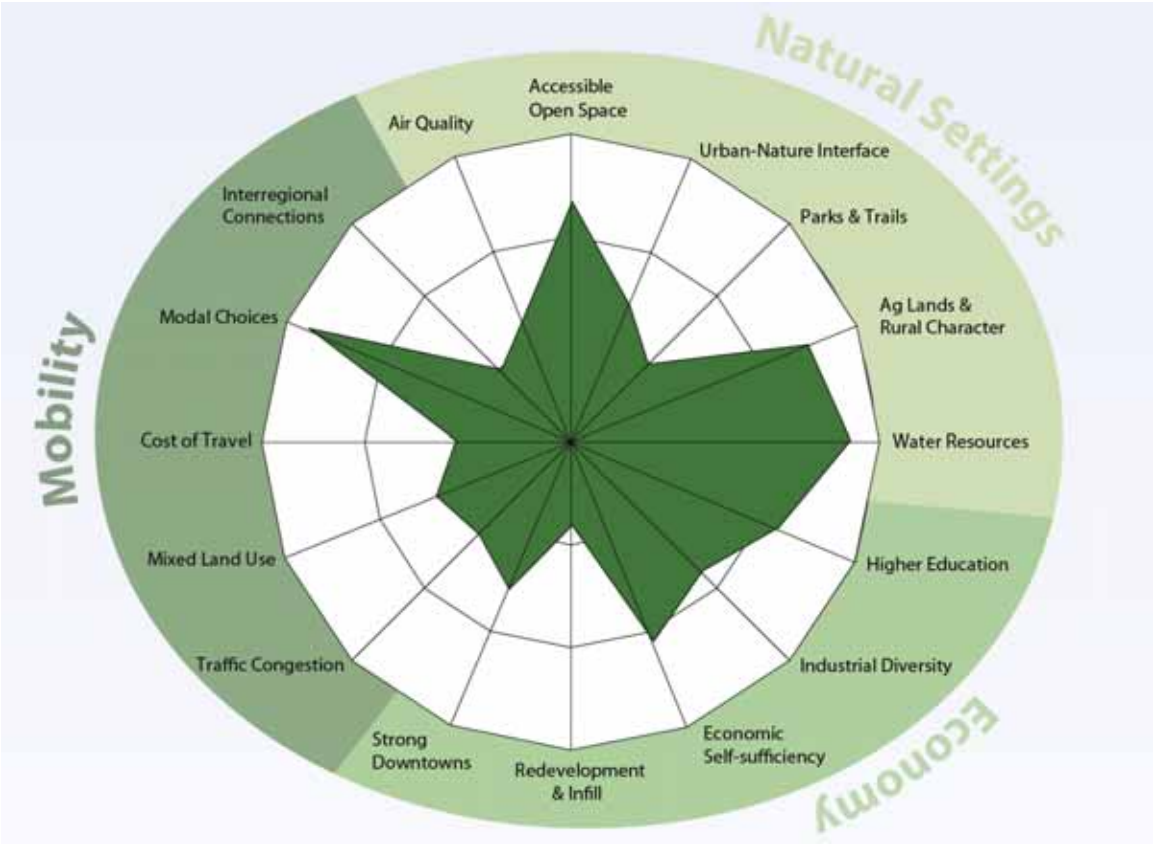
> Many residents felt their neighborhoods did not relate well to the community as a whole. They desired less segregation between land uses and communities that aren't "chopped up" and "segmented" from everyday destinations. One resident explained, "We are not self-contained within each area; rather we have to criss-cross all over the place for shopping, jobs, etc." "There should be "more basic amenities located closer to homes," added another resident.

In addition to the small group outreach sessions, the project sponsor created various media vehicles to reach as broad a range of the public as possible and encourage their participation. This included a 30-minute special for the local public broadcasting television station and a concerted earned media campaign through local news outlets. All efforts directed audience members to the project's website, which facilitated interaction and feedback on growth-related issues.

Project staff also conducted a series of workshops throughout the region where participants were asked to weigh the previously identified community values and priorities, outline long-range community outcomes, and develop specific strategies for achieving their goals. Using a narrative-based approach, participants were asked to imagine themselves as the protagonist in the Rip Van Winkle tale, having awakened in the year 2050 with no knowledge about the period between then and the present. Participants were then allowed to ask a limited number of yes/no-answered questions, forcing them to prioritize those issues of most concern to them. Examples of questions asked include:

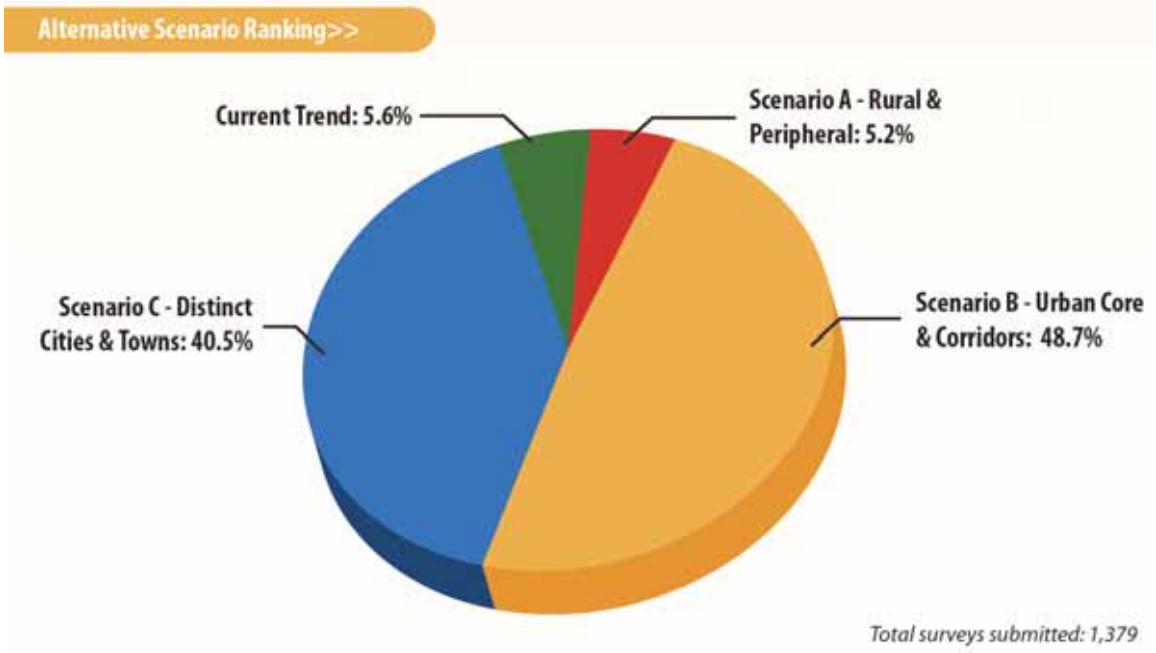
- Is all of the fertile farmland gone?
- Have the cities grown together?
- Is there adequate water?
- Is there preservation of open space between the three cities?
- Do we have a 4 year public university?
- Do all homes require solar energy?
- Has climate change affected Shasta County in a significant way?
- Do salmon still migrate in local rivers and streams?
- Is Interstate 5 congested/are the freeways clogged?
- Is the County bicycle friendly?

Participants then used the results, plus other information, to rank their top five local priorities. Although there were sub-regional variations, a regional consensus of the rankings emerged:




These values rankings led to a range of seven scenario concepts: agriculture and natural resources, rural character, open space, downtown and community center focus, mobility and transportation choices, dispersed areas of economic activity, and low cost infrastructure and services. Using input from an on-line community survey, staff consolidated these concepts into the three alternative scenarios (A, B, and C) presented above.

After analyzing the relative impacts of the four scenarios, project staff initiated a phase II involvement campaign to obtain feedback on the scenarios with the intention of identifying a preferred regional growth vision. The staff printed and distributed approximately 30,000 scenario booklets and conducted a series of community-level workshops. The local public television station produced a second program on the process that was broadcast 31 times, a local news channel provided regular progress reports on the project, and local newspapers provided consistent coverage. All of the outreach was directed at encouraging citizen response to a mail or online survey about the scenarios. A total of 1,379 surveys were received. The results indicated a decided preference for scenarios B and C and a dislike of the trend and Scenario A.




The survey responses, supplemented by open-ended comments, indicated a blend of scenarios B and C would probably best represent the public opinion received.

Resulting actions

The project's final report, dated March 2010, recommends concluding the formal Shasta*FORWARD*>> process and blending the project's findings into a focused process for producing a regional SCS for SB 375 compliance purposes. In addition, the report recommends a series of interim implementation steps, including developing a "mobility assessment" GIS tool that can identify areas for development that will have the highest potential for reducing VMT and crafting a "regional priorities compact" that "packages the community's values, preferred land use patterns, and specific implementation activities for local agency consideration." These actions will also pave the way for ultimate SCS adoption.

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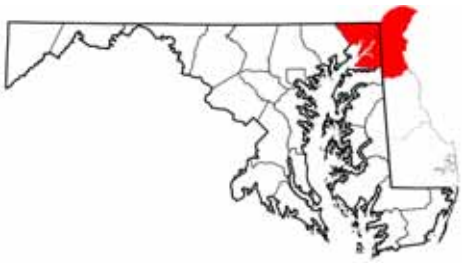


**Project Title:** 2030 Regional Transportation Plan

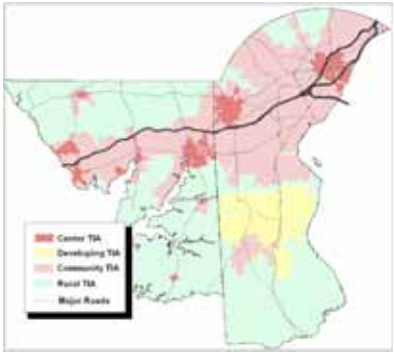
**Sponsor:** Wilmington Area Planning Council

**Completion Date:** 2007

**Planning Horizon**: 2030

**Source**: http://www.wilmapco.org/RTP/index.htm

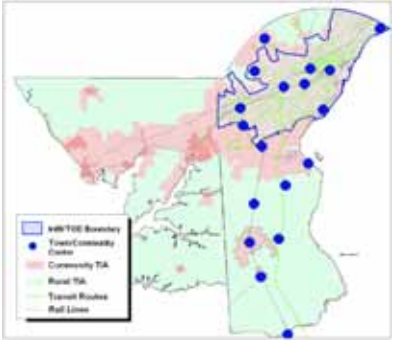
As part of the update of the regional transportation plan (RTP), the Wilmington Area Planning Council (WILMAPCO) crafted a set of "what-if" regional land use scenarios and tested them for their impacts on transportation and air quality measures. WILMAPCO has used similar scenario processes in the development of previous plans, including for the 2025 Regional Transportation Plan and for a transit-oriented redevelopment plan. This analysis was done in conjunction with an update of the New Castle Council Comprehensive Plan.



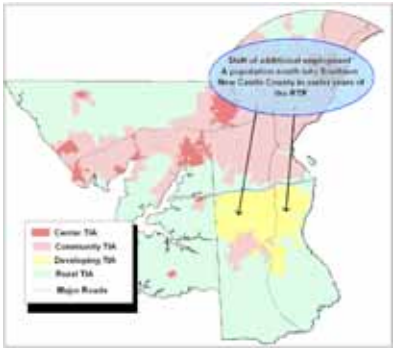
The nature of the scenarios

WILMAPCO developed six scenarios for this analysis.

**Current Land Use Scenario:** The Current Land Use Scenario is based on current trends and existing land use plans.

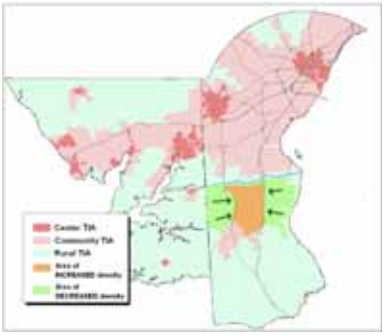


**Town/Community Centered Development Scenario**: In this scenario, 50% of expected new households and jobs are shifted to areas designated as a City/Town Center, a Community/Village Center, or within the region's Infill/TOD boundary. The density of the new development is assumed to be medium to high, and the scenario assumes full construction of all rail/transit projects in the current regional transportation plan.

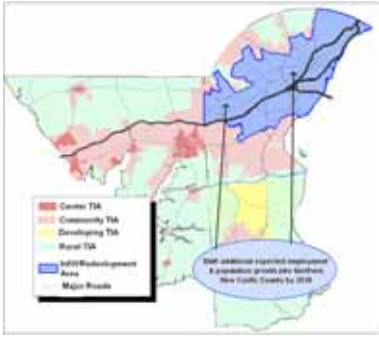


**Accelerated Southern NCC Growth Scenario:** This scenario allocates 60% of all new household growth and 50% of new job growth in New Castle County to areas south of the Chesapeake and Delaware Canal, but assumes no changes to existing plans.

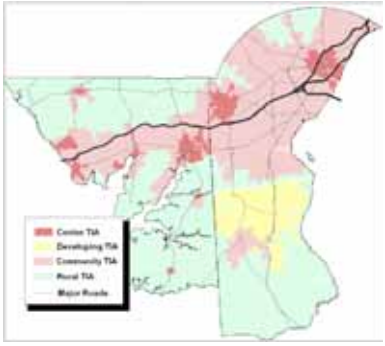
**Centralized Southern NCC Development Scenario:** Maximizing the expected availability of sewer capacity in the central portion of southern New Castle County is the basis for this scenario, which allocates 75% of growth south of the Chesapeake and Delaware Canal in medium-density developments in and near Middletown. The scenario assumes that transit services will be focused into this new, more dense corridor.



**Northern NCC Re-Development Scenario:** This scenario is based on allocating 75% of all expected new household and employment growth to the northern part of the county.



**Slower New Castle County Growth Scenario:** For this scenario, 25% of all expected household growth is shifted out of New Castle County to other nearby counties by the year 2030. The scenario assumes no changes to existing land use plans, however.



<u>The evaluation process</u>

The scenarios were analyzed for their impacts on the amount of travel on local and collector roads, average trip length, vehicle miles traveled, annual crossings of the Chesapeake and Delaware Canal, transit ridership, air quality, and land consumption. The region's travel demand model, which was used to make these measurements, contains the following Smart Growth components:

| **Smart Growth Model Feature** | |
|---|---|
| Daily vehicle trip model | X |
| Modeling peak period as well as daily travel | X |
| Simple mode choice model (that separates transit and highway trips) | X |
| Transit network & assignment of daily trips to that network | X |
| Travel time feedback loops between model components | X |
| Modeling multiple modes of access to transit (e.g., ped. vs. park and ride) | X |
| Disaggregate simulation of households | X |

Evaluation results

| | Scenario | | | | |
|---|---|---|---|---|---|
| | Current Land Use | Accelerated South | Central South | Northern Redev | Slower Growth |
| Roadway miles | 1594 | 1594 | 1621 | 1621 | 1621 |
| Transit assumptions | Base | Base | +10% | +10% | +10% |
| % of pop living in transit supportive density areas | 38.3% | 35.7% | 38.7% | 43.1% | 34.5% |
| % of county with transit supportive densities | 10.9% | 9.9% | 11% | 11.8% | 9.7% |
| Daily vehicle miles (000s) | 15,935 | 17,708 | 14,411 | 15,028 | 15,641 |
| Daily vehicle hours | 357,557 | 348,609 | 303,701 | 320,342 | 334,249 |

The evaluation revealed that the scenario most likely to meet "the future needs in a cost-effective, environmentally prudent and infrastructural efficient manner" was a combination of the Northern Redevelopment and Central Southern NCC Growth scenarios. Based on this assessment, the agency determined that 60% of future growth should occur in northern portions of the county.

Elected Official Participation/Public Involvement

WILMAPCO conducts a telephone public opinion survey annually to gage how the region's residents feel about transportation and land use issues and proposed policies. The 2006 survey, which was used to guide the development of the 2030 RTP, tested residents' attitudes about transportation planning, use of public transit, bicycle, and pedestrian modes, and preferences for growth and development. The survey results showed that transportation is the number one "critical" issue facing the region in the next 5 to 10 years and a majority (79%) feel that there is "not enough planning" with regard to transportation and new development. By nearly the same percentage, respondents agreed that placement of new development should be in existing towns and designated growth areas rather than where developers and landowners decide. In addition to the survey, public participation for the RTP update process included several open houses and public meetings, mailed newsletters and an interactive website. Aside from these more general public involvement efforts, it does not appear that the development or assessment of the scenarios, or the selection of a preferred scenario, was the direct subject of a public involvement effort.

Resulting actions

In addition to providing the basis for the region's long-range transportation plan, the scenario analysis resulted in the drafting of a new future land use plan for New Castle County, based on the amalgam of the Northern Redevelopment and Central Southern NCC Growth scenarios. This new draft plan meets the objective of accommodating 60% of future growth in the New Castle County Primary Service Area. Another 15% will be accommodated within an Existing Community Zone and 20% within a New Community Development Zone. Only 2% will be accommodated in the Resource and Rural Preservation Area. In addition, the draft plan increases the number of mixed use centers, village/hamlet, and traditional neighborhood development communities.

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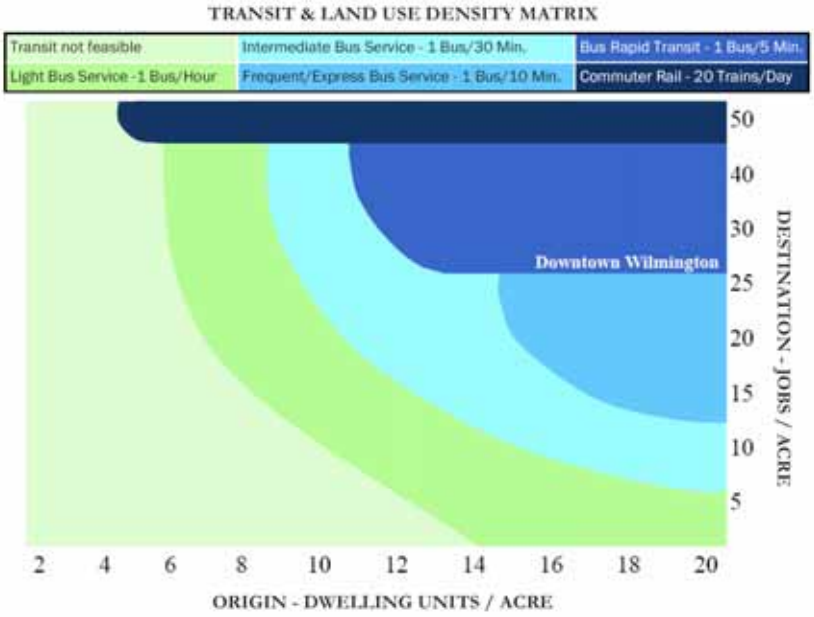
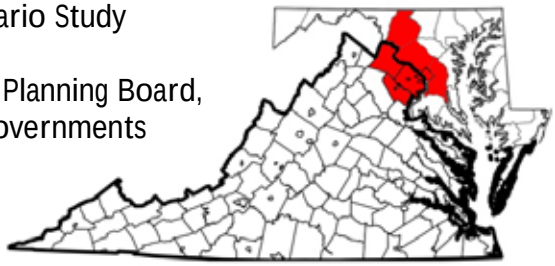


# District of Columbia



**Project Title:** Regional Mobility and Accessibility Scenario Study

**Sponsor:** National Capital Region Transportation Planning Board, Metropolitan Washington Council of Governments

**Completion Date:** 2006

**Planning Horizon**: 2030

**Source**: http://www.mwcog.org/transportation/activities/regional/

The Regional Mobility and Accessibility Study grew out of the dissatisfaction among members of the National Capital Region Transportation Planning Board (TPB) with projections showing a continued worsening in levels of regional traffic congestion, despite implementation of the region's fiscally constrained long-range transportation plan. The existing plan predicted a 37% increase in daily vehicle miles traveled by the year 2030 and increasing stop-and-go traffic—a "sobering picture of what the future will look like if current trends continue." With limited funds likely to prevent even approved transportation projects from being constructed, the TPB realized that looking outside the normal processes and limitations used to create the long-rang plan was necessary. Hence, the function of the Regional Mobility and Accessibility Scenario Study was to explore additional transportation improvements, beyond those that could be included in the financially constrained plan, plus potential changes in future growth patterns. The hope was that together these two interventions could be effective in reducing congestion levels.

<u>The nature of the scenarios</u>

To examine the possible effects of such a strategy, the agency initially crafted five alternative land use-transportation scenarios. As explained below, two additional scenarios were developed subsequently. The primary elements that varied between scenarios included the location of projected future housing and jobs, and the location and amount of future transit service and facilities.

**Base Case Scenario:** This scenario includes the current financially constrained long-range plan and the officially forecasted allocation of future growth.

**Higher Households in Region Scenario:** This scenario was designed to test the transportation impacts of reducing the forecast growth in long distance commuting trips to the Washington region from external areas outside of the region by assuming that more housing than is currently in local plans would be built in the region by 2030. With this additional housing, more future workers who worked in the region could also live there and this would lessen the need for in-commuting from areas outside the region. This scenario asked "What if more people who work here lived here?" and added 216,000 new households above the number currently predicted in land use plans. These additional households would be located near regional activity centers. The scenario also assumed a greatly expanded transit network that connected regional activity clusters, transit centers, and other areas where the increased housing growth in the region was assumed.

**More Household Growth in Inner Areas**: This scenario was designed to test the transportation impacts of reducing average commuting distances in the region by assuming that more of the region's 2010 to 2030 household growth could be placed closer to employment centers in core area and inner suburban jurisdictions in a way that would provide an opportunity for more workers to live closer to their jobs. The scenario assumed a shift of 84,000 households between jurisdictions projected to have large jobs/housing imbalances. As with the previous scenario, most of the shifted households would be located in regional activity clusters and other areas of concentrated employment growth in core area jurisdictions. The target was to bring all jurisdictions in the region closer to a 1.6 jobs-to-households ratio. The scenario also assumed an expanded transit network that would enhance transit connectivity among region activity clusters in core area and inner suburban jurisdictions, as well as the transportation corridors receiving increased household growth.

**More Jobs in Outer Areas Scenario**: This scenario was designed to test the transportation impacts of reducing average commuting distances by assuming more of the region's 2010 to 2030 job growth could be placed closer to residential areas in the outer suburban jurisdictions. Where the previous scenario sought to balance jobs and housing by shifting future households, this scenario explores the opposite strategy, assuming a shift of 82,000 jobs from core area jurisdictions to regional activity clusters in outer suburban jurisdictions. The transit improvements for this scenario were designed to improve transit service to the areas receiving additional job growth in this scenario, provide greater system-wide transit accessibility, and facilitate more reverse commuting by transit to outer suburban job centers from the inner suburbs and core areas of the region.

**Region Undivided Scenario:** This scenario was designed to test the transportation impacts of enabling more workers to live closer to their jobs by assuming some shifts in future job and household growth from the western portion of the region to the eastern portion. In this scenario, all of the forecast 2010-2030 job growth outside of regional activity clusters in the western portion of the region (114,000 jobs) was reallocated to regional activity clusters, transit centers, and other areas in the eastern portion of the region where it was believed that this additional job growth increment could be accommodated. In a similar way, the scenario assumed a shift of 57,000 households from the western to the eastern portion of the region. The assumed job and household growth shifts from the western portion of the region to the eastern portion were designed to achieve equivalent jobs-to-households ratio in both western and eastern sides of the region. Except for the planned Metrorail Dulles line extension, the scenario targeted all transit improvements for the eastern side of the region.

**Transit-Oriented Development Scenario:** This scenario was designed to test the transportation impacts of concentrating more of the region's 2010 to 2030 growth in areas that could be efficiently served by an expanded regional transit network. This scenario assumed a shift, to the maximum extent possible (150,000 jobs and 125,000 households), of forecasted 2010 to 2030 growth from non-transit locations to areas within ½-mile of current or planned Metrorail stations, commuter rail stations, or other current or potential transit centers. Most of the shifts occurred within the same jurisdiction, but some growth was shifted between jurisdictions in cases where land availability was constrained. This scenario assumed the same transit network as was used in the Higher Households In Region Scenario.

After reviewing the transportation impacts of these five scenarios, plus three road pricing scenarios from another study, the agency elected to create two additional scenarios. The scenarios, described below, are being developed, in part, to help craft regional land use growth forecasts for the development of a 2030 long-range transportation plan. As of this writing, both scenarios are still in development.

**CLRP Aspirations Scenario:** This scenario represents realistic yet ambitious levels of transportation investment and accompanying land use changes. Its elements are drawn from the five previously studied scenarios, along with other strategies. Elements include increasing the number of households in the region and moving jobs and households closer to one another to high quality transit. Transportation strategies in the scenario include a 1600 mile lane-mile network of variably priced freeway lanes and a 500-mile network of bus rapid transit (using the priced lanes as bus lanes), plus additions to the region's rail transit networks.

**What Would It Take Scenario:** This scenario starts from a set objective—a 37% reduction in CO2 levels compared to 2005—and examines how such a goal could be achieved through different combinations of implementation steps. The emissions reduction target was derived from a separate study of transportation-related climate change issues sponsored by the Transportation Planning Board (TPB) that set a target of 2050 emission levels 80% below those of 2005. Incorporating emission reductions from the improved CAFE standards from recent Congressional and administrative actions, and adjusting the target for 2030 instead of 2050, and agency identified -37% as the target to be addressed by land use and transportation strategies.

The evaluation process

The travel demand and air quality impacts of the alternative land use and transportation scenarios were analyzed using the latest version of the TPB's travel demand forecasting and air quality emissions models. The travel demand model includes the following Smart Growth modeling features:

| **Smart Growth Model Feature** | |
|---|---|
| Daily vehicle trip model | X |
| Modeling peak period as well as daily travel | X |
| Simple mode choice model (that separates transit and highway trips) | X |
| Supply & demand model equilibration | X |
| Auto ownership modeling sensitive to land use characteristics | X |
| Travel time feedback loops between model components | X |
| Modeling multiple modes of access to transit (e.g., ped. vs. park and ride) | X |
| Trip distribution sensitive to multi-mode options | X |

Land use, environmental and other impacts of these scenarios were also evaluated using selected "measures of effectiveness" and "measures of information" identified by the agency specifically for this study. Each scenario attempted to address certain challenges, however they were all evaluated based upon their impacts in the following areas:

- Change in congestion
- Change in transit use
- Vehicle miles of travel
- Long and short term effects
- Local and regional effects

Evaluation results

| | Scenario | | | | | |
|---|---|---|---|---|---|---|
| | **Base Case** | **Higher HHs** | **HHs In** | **Jobs Out** | **Undivided** | **TOD** |
| Square miles needed for 90% of development | 1,252 | 1,211 | 1,186 | 1,258 | 1,201 | 1,152 |
| Jobs to workers ratio in activity centers | 2.2 | 1.8 | 2.0 | 2.2 | 2.2 | 2.0 |
| Households able to reach 1.5 million jobs within 45 mins. by transit | 184,200 | 267,000 | 298,700 | 133,300 | 404,100 | 283,400 |
| % development w/in ½ mile of transit | | | | | | |
| Households | 16% | 28% | 26% | 19% | 26% | 27% |
| Jobs | 35% | 45% | 44% | 39% | 45% | 47% |
| Average daily VMT (millions) | 149.8 | 147.8 | 148.5 | 149.7 | 148.6 | 148.3 |
| Total daily vehicle trips (millions) | 17.6 | 18.7 | 17.3 | 17.6 | 17.2 | 17.3 |
| Lane miles with volume to capacity ratios > 1 (AM peak hour) | 2562 | 2398 | 2385 | 2525 | 2493 | 2444 |
| Percent of trips on transit | 5.7% | 6.2% | 6.1% | 5.6% | 6.3% | 6.3% |
| Daily walk & bicycle trips | 246,000 | 292,000 | 262,000 | 244,000 | 255,000 | 264,000 |

The results of the analysis indicate that concentrating more of the region's future housing growth in regional activity clusters supported by an expanded regional transit network would increase transit use and daily walking and biking trips, while decreasing driving and congestion relative to current plans and growth trends. Scenarios that increased the concentration of future household and employment growth in regional activity centers also had small, but favorable impacts on regional accessibility, land use, and air quality. Specifically, the analysis showed that:

- Transit use would increase for all scenarios except for the Jobs Out
- Vehicle miles traveled and congestion would decrease for all scenarios
- Short term impacts are modest, but long term effects are large
- While local impacts are large, regional impacts are small

- Moving jobs and households closer together around high-quality transit stations results in large increases in transit trips, and bicycle and pedestrian work trips.

Elected official participation/public involvement

The alternative land use and transportation scenarios analyzed in this study were developed by a Joint Technical Working Group (JTWG) composed of state and local jurisdiction staff serving in their role as members of the TPB Technical Committee, the Planning Directors' Technical Advisory Committee, and the Metropolitan Washington Air Quality Committee (MWAQC) Technical Advisory Committee. In addition, members of the TPB Citizen Advisory Committee and the citizen advisory committees to MWAQC and the Council of Government's (COG) Metropolitan Development Policy Committee (MDPC) were also invited to participate in the meetings of the JTWG.

Resulting actions

The Regional Mobility and Accessibility Study has been designed as a "what if" study, not a "how to" study. It intentionally did not look at questions regarding implementation, including political challenges and funding shortfalls. Nevertheless, TPB members and staff have started to investigate how to integrate the study into the development of the TPB's Constrained Long-Range Transportation Plan (CLRP) and into planning efforts at the state and local levels.

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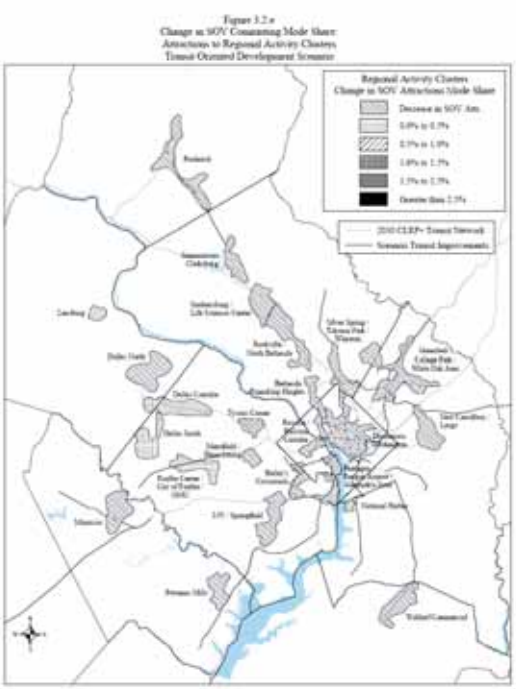

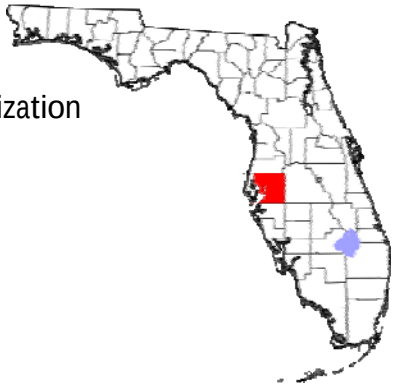

**Project Title:** Transit Concept for 2050

**Sponsor:** Hillsborough County Metropolitan Planning Organization

**Completion Date:** 2007

**Planning Horizon**: 2050

**Source**: http://www.mpotransit.org/

Hillsborough County is projected to grow by 400,000 people over the next 20 years and will likely double in population by 2050. Such high levels of growth have created concern among Hillsborough region citizens about the location and nature of that growth and how it will impact the region's livability. The Hillsborough MPO initiated the Transit Concept for 2050 study to explore how transportation investments might be used to advance quality of life goals, economic development strategies, and sustainable growth. The study coincides with the development of a regional transit master plan by the Tampa Bay Area Regional Transportation Authority, the region's transit agency.

The nature of the scenarios

To guide the investigation, the MPO crafted five different development scenarios that were designed to illustrate different mobility strategies.

**Trend Scenario:** The Trend Scenario concept assumes the implementation of currently adopted transportation plans, which focus on providing transportation capacity primarily through roadway improvement projects. Transit service is limited to increased fixed route and express bus service. New growth in this scenario is placed on vacant lands in accordance with existing comprehensive plans, with no redevelopment or infill.

Three alternative scenarios were then developed and contrasted with the Trend Scenario, each focused on a primary transit technology, with supporting land use and station area assumptions.

**Concept A – The Urban Core:** Concept A focuses on transit oriented land development that concentrates growth and redevelopment in the City of Tampa and provides light rail transit and express bus service connecting Downtown Tampa with USF, Westshore, and the airport.

**Concept B – The Urban Corridors:** Concept B focuses on transit oriented land development as well, but concentrates it along major "spokes" or corridors from New Tampa, Brandon, South Tampa, Westchase to Downtown Tampa. The concept provides light rail transit service along major congested corridors.

**Concept C – The Urban Centers:** Concept C emphasizes transit oriented land development policies that concentrate growth in major centers throughout the County and provides commuter rail transit service connecting major suburban gateways to Downtown Tampa.

Analysis of Concepts A, B, and C led to the creation of a final **Transit Concept for 2050,** consisting of a combination of the concept scenarios. The Concept's transit network integrates three light rail lines, four commuter rail lines, and a premium bus system. The concept's primary transit corridors were selected based upon their potential for hosting future transit-oriented growth, thus creating a transit network that could be optimized by supporting land uses, densities and station area designs.

The evaluation process

The scenarios were constructed using a series of six primary and three special transit station area development prototypes with varying assumptions about land use, percent redevelopment, site design characteristics, population and employment levels, and densities. Land use variations that differ from existing adopted comprehensive plans were limited to station areas; lands outside of station areas were assumed to develop according to existing plans.

| Station Areas | Characteristics | |
|---|---|---|
| CENTRAL BUSINESS DISTRICT | Regional Employment<br>High Density Residential<br>High Intensity Retail | DENSITY - 40 to 60 DUs/Acre, 360 to 400 Jobs/Acre<br>INTENSITY - 8.0 Floor Area Ratio<br>MIX - Residential: 20%, Retail: 20%, Office: 60% |
| URBAN REGIONAL | Office Center<br>High Density Residential<br>High Density Retail | DENSITY - 60 to 80 DUs/Acre, 240 to 260 Jobs/Acre<br>INTENSITY - 4.0 Floor Area Ratio<br>MIX - Residential: 40%, Retail: 10%, Office: 40% |
| URBAN COMMUNITY | Employment Centers<br>Retail<br>High Density Residential | DENSITY - 80 to 100 DUs/Acre, 50 to 70 Jobs/Acre<br>INTENSITY - 2.0 to 4.0 Floor Area Ratio<br>MIX - Residential: 90% , Retail: 5%, Office: 5% |
| URBAN NEIGHBORHOOD | Residential<br>Neighborhood Retail<br>Light Office/Service | DENSITY - 20 to 40 DUs/Acre, 15 to 60 Jobs/Acre<br>INTENSITY - 1.0 to 2.0 Floor Area Ratio<br>MIX - Residential: 90%, Retail: 5%, Office: 5% |
| SUBURBAN REGIONAL | Sub-regional Employment<br>Multi-family Housing<br>Retail | DENSITY - 20 to 40 DUs/Acre, 60 to 80 Jobs/Acre<br>INTENSITY - 2.5 Floor Area Ratio<br>MIX - Residential: 70%, Retail: 10%, Office: 20%, |
| SUBURBAN COMMUNITY | Mix of Residential<br>Sub-regional Employment<br>Retail Commercial | DENSITY - 15 to 25 DUs/Acre, 5 to 15 Jobs/Acre<br>INTENSITY – 1.0 to 2.5 Floor Area Ratio<br>MIX - Residential: 95%, Retail: 2 %, Office: 3% |
| SUBURBAN NEIGHBORHOOD | Mixed Residential<br>Neighborhood Retail<br>Light Office/Service | DENSITY - 6 to 12 DUs/Acre, 10-20 Jobs/Acre<br>INTENSITY - 0.5 to 1.0 Floor Area Ratio<br>MIX - Residential: 98%, Retail: 1%, Office: 1% |
| SPECIAL A | Light Industrial<br>Office/Service<br>Commercial Retail | DENSITY - 0 DUs/Acre, 20-40 Jobs/Acre<br>INTENSITY - 1.0 Floor Area Ratio<br>MIX - Residential: 0%, Retail: 10%, Office: 90% |
| SPECIAL B | Airport | DENSITY - 0 DUs/Acre, 0 Jobs/Acre<br>INTENSITY - 0 Floor Area Ratio<br>MIX - Residential: 0%, Retail: 0%, Office: 0% |

The CorPlan Land Use Allocation Model was used to assemble the scenario components. To accomplish this, the study was divided into 0.15 acre grid cells, with land uses for each cell designated as vacant, redevelopment (commercial or industrial), or neither (residential or institutional). To generate household and employment estimates, CorPlan translated the intensities, densities, and mix of uses associated the station prototypes into household and employment densities, superimposing them on the generalized land use designations. This resulted in incremental household and employment values being assigned to individual grid cells based on the vacant/redevelopment designation of each cell included in the allocation. The household and employment estimates were then aggregated at various scales, including at the TAZ level, which was required for travel demand modeling.

Travel modeling for the study utilized the West Central Florida Regional Planning Model (WCFRPM). WCFRPLM is a TRANPLAN model utilizing standard four-step modeling processes. The model's Smart Growth features are noted in the following table.

| **Smart Growth Model Feature** | |
|---|---|
| Daily vehicle trip model | X |
| Simple mode choice model (that separates transit and highway trips) | X |
| Transit network & assignment of daily trips to that network | X |
| Supply & demand model equilibration | X |
| Travel time feedback loops between model components | X |
| Modeling multiple modes of access to transit (e.g., ped. vs. park and ride) | X |

Although the model includes a mode choice model that estimates a number of transit and auto modal variations (e.g., park-n-ride and kiss-n-ride), it cannot distinguish between commuter, regional, and light rail modes. This drawback, combined with a limited capacity to assess variability in land use and design features, led the study team to calculate maximum potential transit boarding estimates using sketch planning techniques, in addition to using the WCFRPM model.

Using these modeling approaches, Concepts A, B, and C were evaluated for their ability to support the study's key guiding principles:

- Land Use – how many new jobs and housing could be served by transit?
- Mobility – what is the optimum balance to attract desired travel markets and travel time savings?
- System capacity – how many trips could be accommodated by transit?
- Coverage – which system configuration would provide access to the greatest number of people?
- Environment – what are the benefits for improving quality of life?
- Cost – what corridors are most viable given order of magnitude cost considerations?

This analysis identified the best elements of each concept, which were then combined into a final integrated concept.

Evaluation results

| | Scenario | |
|---|---|---|
| | Trend | Final Concept |
| Dwellings per acre within ¼ mile of stations | 3 | 11 |
| Jobs per acre within ¼ mile of stations | 16 | 38 |
| Transit mode share for home-based work trips | 1.01% | 2.18% |
| Potential average daily transit trips | -- | 80,000 |

Elected official participation/public involvement

The Transit Study began with an exploration phase to identify guiding principles that could inform the analysis and eventually help select a preferred option. These principles emerged from eight public focus group meetings that were designed to discover common themes in community values. Working in small groups, participants were asked to review and prioritize a list of sample value statements. The groups discussed each statement and how it might influence the future growth and development, quality of life, and transportation choices in their community. Some of the value statements included:

- "I want more quality time spent with my family and friends, and less time in traffic."
- "Give me more reliable travel times."
- "I like a growing economy, but if traffic grows with it, will gridlock choke the economy?"
- "Let's grow our small towns and save some open space rather than sprawling everywhere."
- "Traffic cuts through my community. I want to feel safe on my street, and I want my child or elderly parent to be safe, too."
- "I want goods, services, and jobs to be more accessible, especially if I don't or can't drive."

The study team translated the results of these focus group discussions into a set of guiding principles that addressed five key areas: land use, mobility/operations, environment, financial, and system development. There were then used to craft the scenarios used in the rest of the study.

The study was steered by three teams—a Leadership Team, a Citizens Team, and a Technical Team. These teams were engaged at key decision points in the study process to obtain input and build consensus on development of the preferred transit concept. Additionally, the public at-large was informed and solicited for input via study newsletters, public workshops and other outreach and feedback methods throughout the study period.

Resulting actions

In the final report of the study, the Hillsborough MPO recognizes that the study's findings are limited to a "conceptual framework" level. The MPO anticipates, however, that the study will provide a structure for additional planning processes and decisions that will affect both transportation investments and land use patterns. As noted above, the study was designed to be integrated with the regional transit agency's master plan. It also provided part of the framework for the MPO's 2035 long-range transportation plan.

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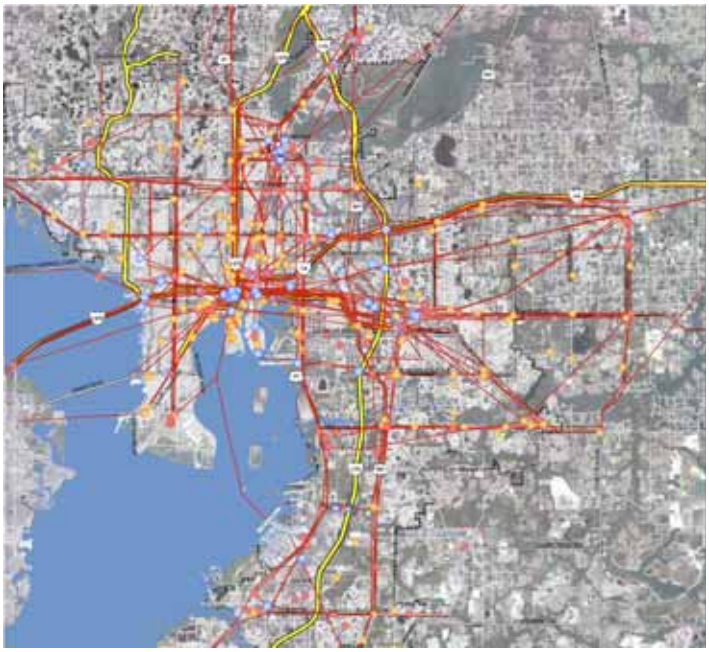


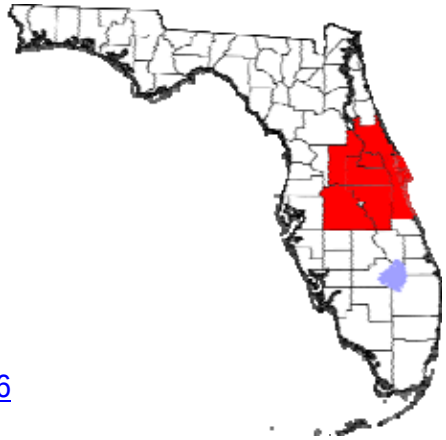
**Project Title:** How Shall We Grow?

**Primary Sponsors:** *myregion.org*
East Central Florida Regional Planning Council
Central Florida Planning Council

**Completion Date:** 2007

**Planning Horizon**: 2050

**Source**: http://www.myregion.org/Default.aspx?tabid=56

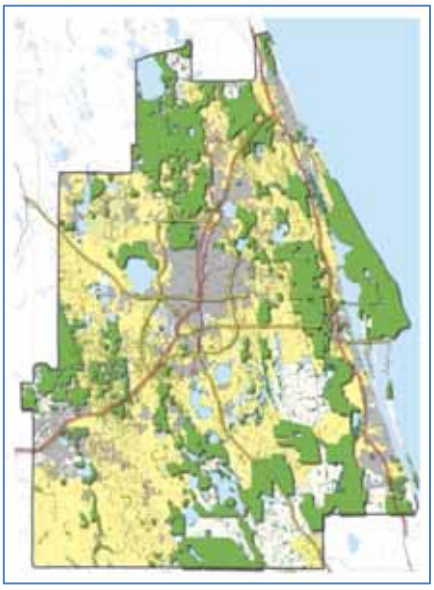


Florida law requires regional planning councils in the state to adopt strategic regional policy plans (SRPPs) and update them every 10 years. In anticipation of a SRPP update in 2008, the East Central Florida Regional Planning Council teamed up with the Central Florida Planning Council, five MPOs in the region, the state departments of transportation and community affairs, and *myregion.org* (a subsidiary of the Orlando Chamber of Commerce). The primary concerns driving the SRPP update process were the impacts posed by the region's continued high rates of growth and land consumption on fragile ecosystems and the functioning of its transportation networks. To address these concerns, the group of agencies, working together, initiated How Shall We Grow?, an 18-month scenario/visioning process designed to articulate a vision for future growth that consumes less land, preserves more environmental resources and natural countryside, creates more distinctive places, and provides more travel choices.

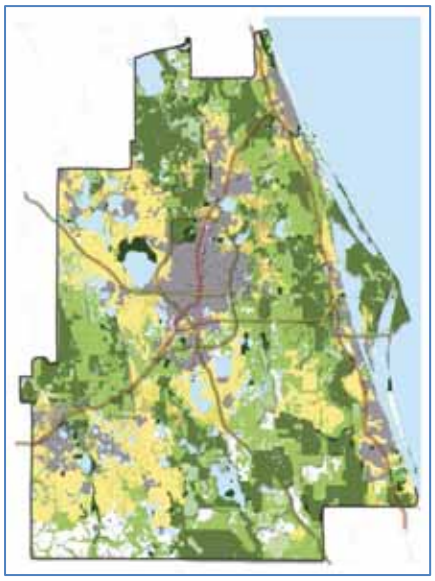
The nature of the scenarios

The study crafted four scenarios to assess ways of achieving these objectives.

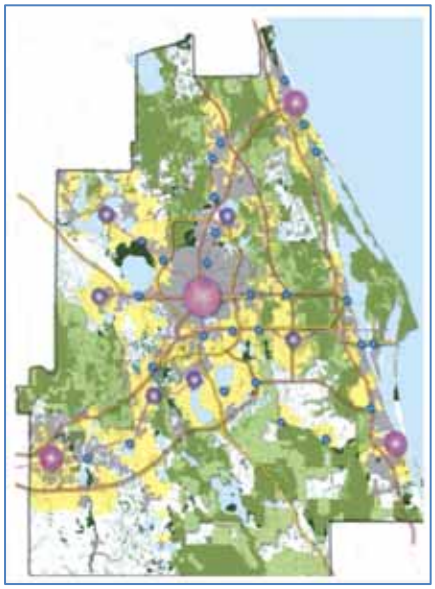
**Trend Scenario:** The Trend Scenario represents the extrapolation of current development patterns and densities to the year 2050, allowing sprawl to continue into critical ecosystem areas.



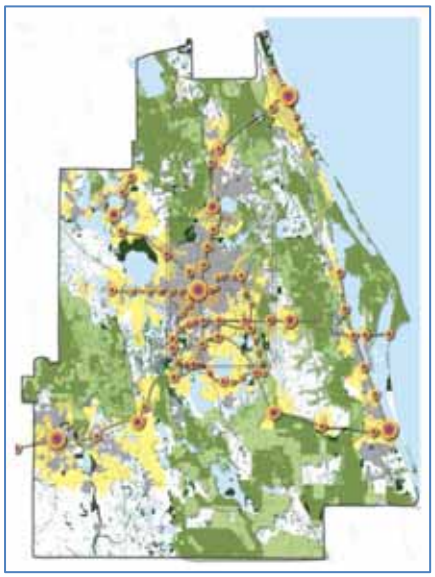
**Green Areas Scenario:** The Green Areas Scenario represents an emphasis on preserving the most sensitive environmental lands, allocating future population outside of those areas, but at basically current development densities. The scenario includes 61 miles of new rail transit, but no new major roads.



**Centers Scenario:** The Centers Scenario emphasizes promoting more future population growth in urban centers, with a secondary emphasis on protecting sensitive environmental lands. The scenario connects the region's centers with 272 miles of rail transit and 370 miles of new expressways.



**Corridors Scenario:** As with the Centers Scenario, the Corridors Scenario represents an emphasis on promoting growth in urban centers, but with higher densities than the Centers Scenario. On the transportation side, the Corridors Scenario focuses exclusively on rail transit (413 miles) with no new roads.



The evaluation process

Agency staff collaborated with researchers at the University of Florida GeoPlan Center, who used a GIS-based Land Use Conflict Identification Strategy (LUCIS) to assist in creating the four scenarios. Researchers first translated the output from the study's public workshops into a single GIS raster representing target density distribution across the region. The researchers then used a conflict raster to determine the suitability or appropriateness for any given GIS cell to be used for each of three land uses: agriculture, conservation, and urban. The scenarios were then built factoring in development assumptions for conservation and redevelopment, population targets, the results of the conflict raster analysis, and the transportation system components.

Each scenario's growth allocation was then allocated to traffic analysis zones, which provided the basis for transportation modeling. The model used for this analysis—the Florida Standard Urban Transportation Modeling System maintained by Florida DOT—included the following Smart Growth features:

| **Smart Growth Model Feature** | |
|---|---|
| Daily vehicle trip model | X |
| Simple mode choice model (that separates transit and highway trips) | X |
| Transit network & assignment of daily trips that that network | X |
| Supply & demand model equilibration | X |
| Modeling multiple modes of access to transit (e.g., ped. vs. park and ride) | X |
| Disaggregate simulation of households | X |

Evaluation results

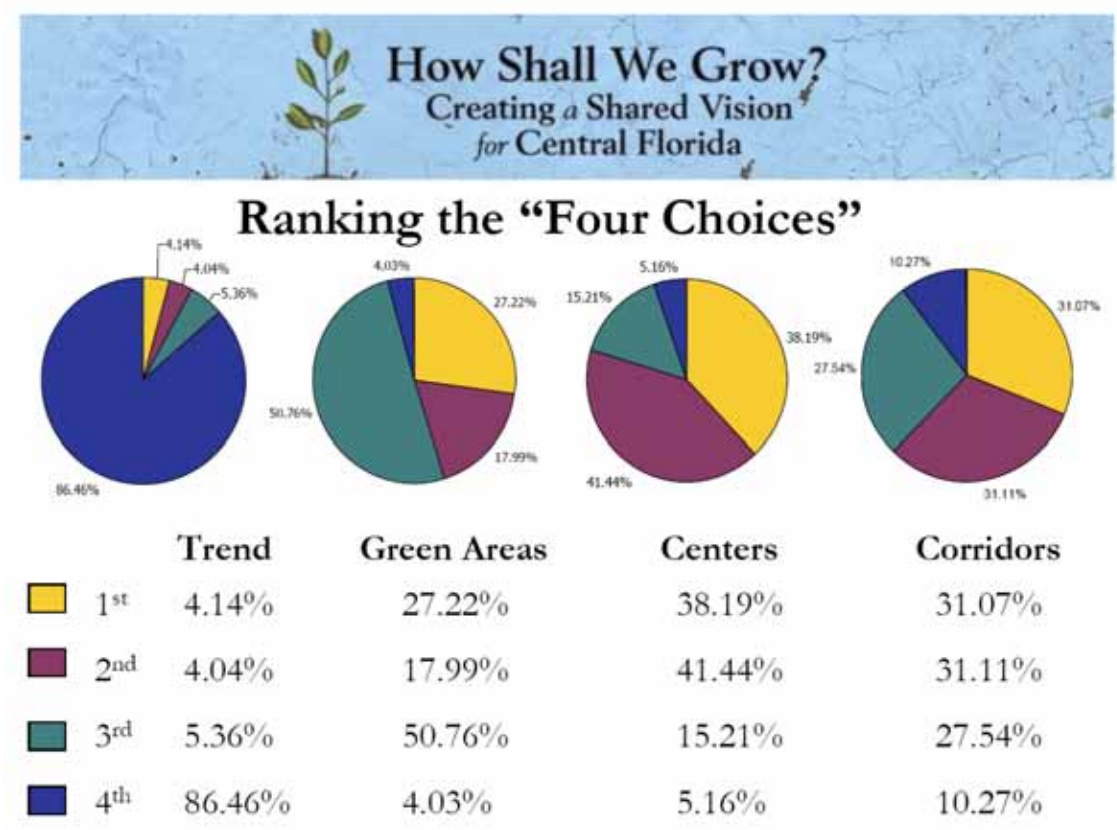
Together, the GIS and transportation models measured each of the scenarios for their impacts on land consumption, habitat destroyed, green areas protected, average commute times and speeds, transportation-based carbon monoxide emissions, water consumption, and vehicle miles of travel.

| | Scenario | | | |
|---|---|---|---|---|
| | **Trend** | **Green Areas** | **Centers** | **Corridors** |
| Miles of rail transit | 43 | 272 | 282 | 413 |
| Acres of developed land | 3,325,141 | 2,262,300 | 2,215,681 | 2,097,843 |
| Average distance from home to store (miles) | 1.8 | .9 | .5 | 1.2 |
| Daily vehicle miles traveled per person | 28.35 | 28.3 | 26.16 | 26.96 |
| Percent land in conservation, agriculture, or undeveloped | 42.3% | 60.8% | 61.6% | 63.6% |
| Gallons of water consumed per day (millions) | 1,700 | 1,570 | 1,560 | 1,550 |
| Kgs. per day of carbon monoxide (000's) | 3,419 | 3,407 | 2,824 | 3,125 |

Elected official participation/public involvement

From March 2006 to August 2007, nearly 20,000 Central Floridians participated in 150 public meetings for the How Shall We Grow study. Thirty of those meetings were workshops in which more than 3,000 attendees participated in a "development dot" exercise indicating their preferences for which lands should be developed at what densities and with what kinds of transportation networks. Interestingly, participants almost universally declined to draw new roads, but were eager to draw future transit routes. They also indicated strong preferences for focusing new growth in centers, promoting multi-modal corridors, and conserving green space. The results of these workshops fed into the GIS model system described above.

In January 2007, after the four scenarios had been crafted and tested, a local public television station devoted one hour during prime time for each of five consecutive evenings to provide information to the public about the How Shall We Grow Study and to invite additional public engagement on the issues. After the final night of television coverage, the audience was asked to visit the study's web site and select their preferred scenario.




The 7,319 people who visited the site indicated a strong rejection of the Trend Scenario, but were more evenly divided among the other three scenarios. Response to a separate indicators survey that was also part of the web site showed that a combination of the Corridors Scenario, with elements from the Centers and Conservation scenarios seemed to provide a "consensus vision" for future growth along these lines:

- Develop the least amount of land (Corridors Scenario)
- Conserve the most natural resources (Green Areas Scenario)
- Attain the best air quality (Centers Scenario)
- Reduce water demand (Corridors Scenario)
- Provide the most transportation choices (Corridors Scenario)
- Have the shortest commute time (Centers Scenario)
- Stimulate the most robust economy (Corridors Scenario)

This led to the concept of a "4 Cs" regional vision focused on **C**onserving the most critical natural resources, promoting growth in walkable mixed-use **C**enters that are connected by multimodal **C**orridors, all of which will help preserve the region's **C**ountryside.

Resulting actions

The 2050 Regional Growth Vision was adopted by the East Central Florida Regional Planning Council, which has now issued a draft Strategic Regional Policy Plan for 2060 that incorporates the vision. In addition, a regional compact was signed by representatives from every city and county in the region, committing each body to the implementation of the vision. For its part, Florida DOT is urging all of the MPOs in the region to include in their 2030 long range transportation plans consideration of both a trend growth forecast and one based on the Regional Growth Vision. MetroPlan Orlando, the Orlando area MPO, has already issued a draft 2030 plan that includes both forecasts and the Lake-Sumter MPO has voted to do the same.

Shortly after the adoption of the regional compact, *myregion.org* assembled a Congress of Regional Leaders to identify and collaborate on regional issues that further the objectives of the Regional Growth Vision. A number of local communities in the region are taking implementation steps, partially as a result of the work of the Congress. The City of Cape Canaveral, for example, recently completed a seven-month, "Envision Cape Canaveral" visioning process, which identified redevelopment opportunities, planned for a downtown core, and determined the city's ideal architectural form. In another example, Seminole County has restructured its entire comprehensive plan to comport with the principles of the Regional Growth Vision and is currently working through a transit-oriented development corridor analysis for the proposed SunRail commuter rail system.

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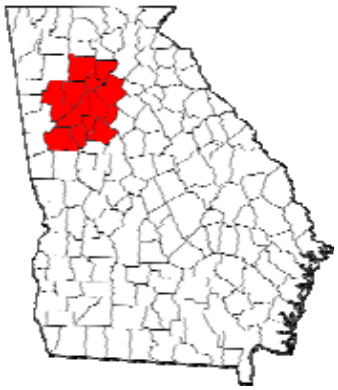
# Georgia



**Project Title:** Envision6: Regional Transportation Plan & Regional Development Plan

**Sponsor:** Atlanta Regional Commission

**Completion Date:** 2007

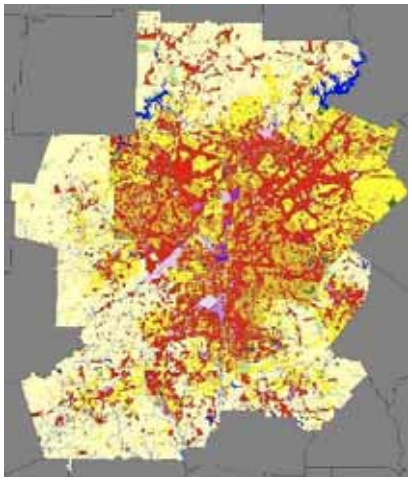
**Planning Horizon**: 2030

**Source**: http://www.atlantaregional.com/

Envision 6 was a broad metropolitan wide planning process to address growth challenges in the Atlanta area. The effort culminated with the adoption of updates to the region's Regional Development Plan (RDP) and Regional Transportation Plan (RTP). The "6" in the title refers to the more than 6 million people expected to live in the metropolitan area by end of the planning horizon, representing an increase of more than 2.3 million over the base year population. Such high levels of growth, both in percent increase and absolute numbers, present challenges to the region's quality of life. Of particular concern to the Atlanta Regional Commission (ARC) – the region's MPO – are threats to the region's supply of affordable housing, levels of traffic congestion, constrained government resources for transportation and other types of infrastructure, water availability, and limited supplies of vacant developable land. ARC developed the Envision6 planning process to better respond to these challenges. The agency's primary approach was to "integrate regional land use, local strategies and transportation planning initiatives."

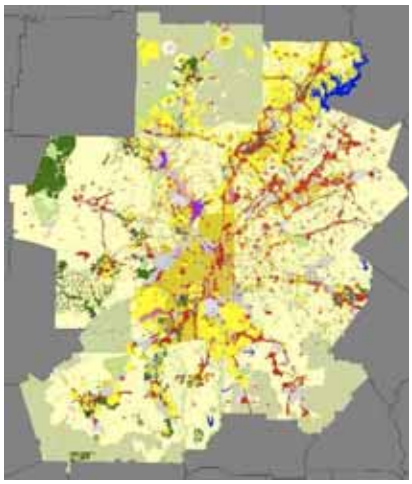
<u>The nature of the scenarios</u>

To help promote this integration, ARC staff developed three different land use scenarios:

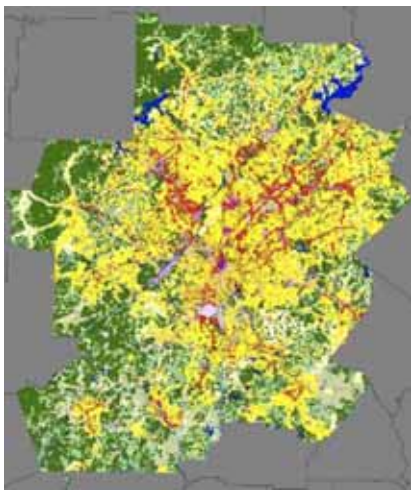


**Mobility 2030:** The Mobility 2030 Scenario is the official forecast used for the previous RTP. Growth in the scenario is distributed based on land availability, trends, and existing policies. The resulting pattern is low in density for both residential and employment growth, leaving only a small percentage of developable land available in 2030.

**Local Land Use Maps:** This scenario is based on the adopted land use maps from the region's local government comprehensive plans. The scenario contains a similar population forecast and allocation as the Mobility 2030 Scenario, but significantly higher levels of employment growth. The scenario allocates most remaining vacant land to low density residential development. This results in a high degree of separation between future jobs and households and, as with the Mobility 2030 Scenario, very little land left in 2030.



**E6/Local Aspirations Plan:** The Local Aspirations Plan Scenario uses local future land use plans, water and sewer plans, and other local policies as its foundation, but significantly departs from these sources in response to input received during the public involvement process for Envision6, as outlined below. The resulting scenario focuses growth in corridors and centers to a much greater degree than the other two scenarios, preserving substantial rural lands through 2030. The scenario also places a much higher percentage of housing in areas accessible to transit.



Each of these scenarios was tested using two different transportation networks:

**Mobility 2030 Network:** This network consists of projects contained in the prior, fiscally constrained long-range plan.

**Aspirations Network:** This network includes all of the projects in the Mobility 2030 network, plus others identified in a variety of state, regional, and local plans. Not all of these additional projects have funding.

The evaluation process

The resulting six scenarios were tested to assess their impacts on a wide range of transportation, land use, and environmental factors. Land use indices included development density, land use mixing, transit adjacency, proximity to parks and open space, impervious surfaces, and remaining forest and agricultural lands. Transportation indices included vehicle miles traveled, vehicle trips, vehicle hours of travel and of delay, and mode split.

ARC used INDEX PlanBuilder to paint the three land use scenarios. The program's "paints" assigned specified population, employment, and impervious surface attributes to a land use grid system. ARC created more than 170 different paints for the process, including land use development types and densities that ranged from representations of current conditions in the Atlanta region to a variety of Smart Growth land use types. The paints facilitated making rough estimates of the scenarios' impacts on social and environmental values. The land uses for each scenario were rectified to the region's traffic analysis zone boundaries and then exported into ARC's travel demand model.

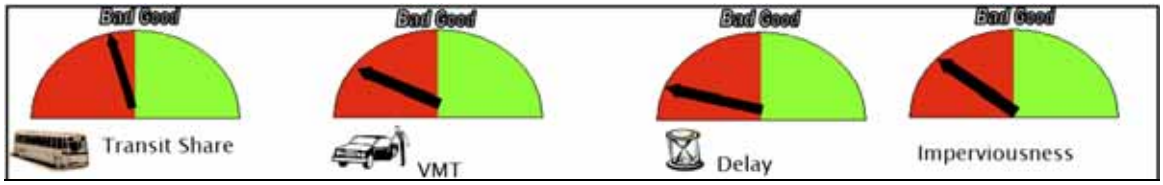
The ARC travel demand model represents one of the nation's higher-end transportation forecasting systems. As illustrated in the following table, the model contains most of the elements recommended for assessing the transportation impacts of land use-based policies. Notably missing from the model, however, are components that would allow calculation of pedestrian and bicycle use—ped and bike networks are not represented in the model and the mode split function does not make estimates of non-vehicle mode percentages.

| **Smart Growth Model Feature** | |
|---|---|
| Daily vehicle trip model | X |
| Modeling peak period as well as daily travel | X |
| Simple mode choice model (that separates transit and highway trips) | X |
| Transit network & assignment of daily trips to that network | X |
| Supply & demand model equilibration | X |
| Income stratification in distribution and mode choice models | X |
| Auto ownership modeling sensitive to land use characteristics | X |
| Travel time feedback loops between model components | X |
| Modeling multiple modes of access to transit (e.g., ped. vs. park and ride) | X |
| Trip distribution sensitive to multi-mode options | X |
| Disaggregate simulation of households | X |
| Activity- and tour-based modeling | X |
| Integrated land use-transportation modeling | X |
| Post-processing of land use ("D") variables | X |

Evaluation results

ARC used "meter" graphics to illustrate each scenario's performance on key measures.

**Mobility 2030 Land Use + Mobility 2030 Network**




**Local Land Use Maps + Mobility 2030 Network**

The performance meters were, naturally, connected to quantitative data generated by both the INDEX and the region travel models. A sample of that quantitative data is contained in the following table.

| | **Scenarios** | | | | | |
|---|---|---|---|---|---|---|
| *Land Use Pattern* | Mobility 2030 | | Local Maps | | Local Aspirations | |
| *Transportation Network* | Mobility 2030 | Aspirations | Mobility 2030 | Aspirations | Mobility 2030 | Aspirations |
| Dwelling units per acre | 0.88 | | 0.83 | | 0.9 | |
| Proportion of mixed use per cell (1 = most mixed) | 0.45 | | 0.44 | | 0.5 | |
| Percent adjacent to transit | | | | | | |
| Housing | 0.8% | n/a | 1.7% | n/a | 3.42% | n/a |
| Employment | 8.5% | n/a | 12.99% | n/a | 12.8% | n/a |
| Daily transit revenue hours | 19,000 | n/a | 19,000 | n/a | 19,000 | n/a |
| Average daily VMT (millions) | 190.5 | 174.5 | 196.3 | 198.1 | 190.6 | 192.9 |
| Percent of home based-work vehicle trips on transit | 5.5% | 8.8% | 4.1% | 4.9% | 5.3% | `6.3% |
| Daily hours of delay (millions) | 2.2 | 1.3 | 3.0 | 2.4 | 2.3 | 1.8 |

Elected Official Participation/Public Involvement

Public and stakeholder involvement for Envision6 began with a series of meetings with officials in all of the region's counties. The meetings provided a forum for discussions of adopted future land use maps, current growth patterns, and local aspirations for directing future growth. Subsequently, ARC hosted two large public workshops with planning professionals and citizens. In addition, the agency received feedback on various land use options through telephone and web-based surveys. The agency convened an additional workshop with real estate developers and market analysts to discuss future growth areas and likely development densities and patterns. The goal of the meetings was to create a regional map reflecting a balanced vision of future land use and public investments. The feedback received at these meetings became the basis for the Local Aspirations Plan land use scenario, described above.

Through these various involvement processes, ARC found:

- There is strong support for growth near existing infrastructure, especially along corridors and in centers;
- Reducing growth in undeveloped areas is important;
- More parks and trails are desired; and
- There appears to be substantial disconnects between local and regional plans.

Resulting actions

Products emerging from the Envision6 process included a Unified Growth Policy Map, an update to the Regional Development Plan Policies, a Regional Transportation Plan, and a Regional Place and Development Matrix. Through these tools, ARC hopes to better integrate land use decisions with transportation, environmental, and other public investment choices.

That integration was further advanced by the Envision6 Implementation Strategy, last updated in November 2007, which contains a wide range of activities designed to "further advance land use change in the Atlanta region to better accommodate the population and job growth that is expected in the coming decades." Included in the Strategy are planning and investment programs such as the Livable Centers Initiative (see page D-53), a Community Choices Program that assists local governments with the development of new zoning and design codes, a funding program aimed at promoting the creation and adoption of county-level transportation plans, and the use of multi-modal corridor studies. In each of these areas, ARC seeks to further promote incorporation of regional policies, particularly those contained in the Regional Development Plan.

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**Envision6 Planning Process**

**Project Title:** 2009 Livable Centers Initiative Indicators and Benefits Study

**Sponsor:** Atlanta Regional Commission

**Completion Date:** 2009

**Planning Horizon**: build out

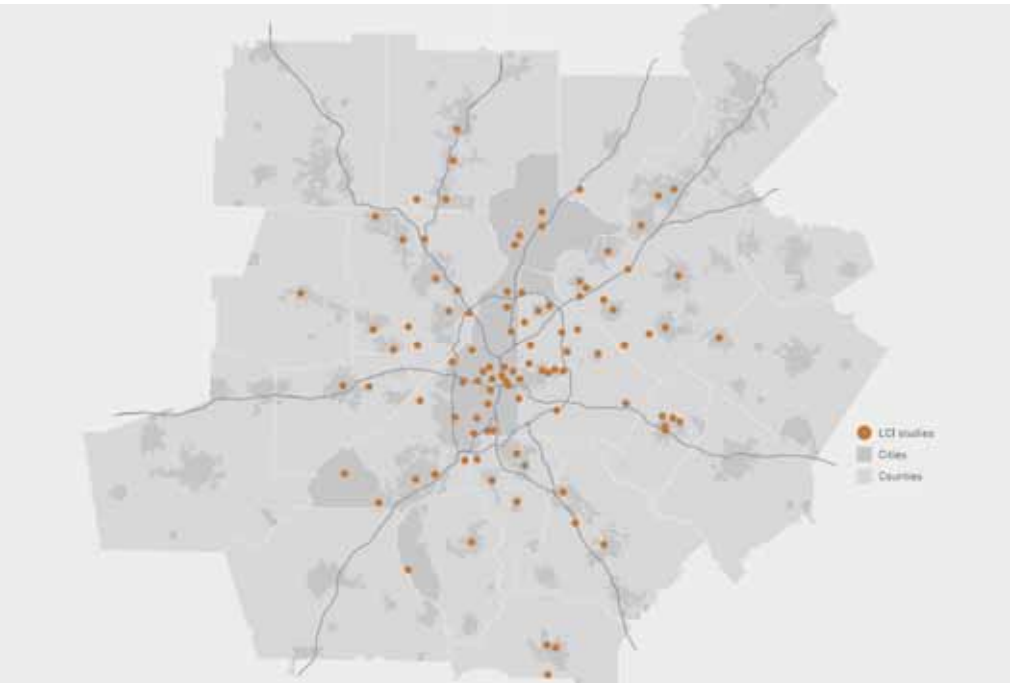
**Source**: http://www.atlantaregional.com/land-use/livable-centers-initiative

The Livable Centers Initiative (LCI) is a planning and community investment program begun by the Atlanta Regional Commission (ARC) in 1999 to help implement Smart Growth-style development policies contained in the agency's Regional Development Plan. The primary goals of that plan are to:

- Encourage a diversity of mixed-income residential neighborhoods, employment, shopping and recreation choices at the center/corridor level;
- Provide access to a range of travel modes including transit, roadways, walking and biking; and
- Develop an outreach process that promotes the involvement of all stakeholders.

Starting with $10 million in federal Surface Transportation Program dollars, the LCI program has funded 86 planning studies for four development types in the Atlanta region: Town Centers, Activity Centers, Corridors, and Emerging Regional Centers. Planning grants are awarded according to an application's consistency with the policies of ARC's Regional Development Plan "to encourage activity and town center development." Transportation projects identified in the planning studies are then eligible for special funding through the region's long-range transportation plan and transportation improvement program.

The LCI Indicators and Benefits study was undertaken to estimate the potential impacts of the LCI program on a variety of indices associated with livability. A key motivator for the assessment was the impact on transportation demand. Because the program is supported by federal transportation funds, ARC felt some obligation to demonstrate the degree of transportation and air quality benefits associated with the program. The following map shows the location of the LCI study sites throughout the region.




The nature of the scenarios

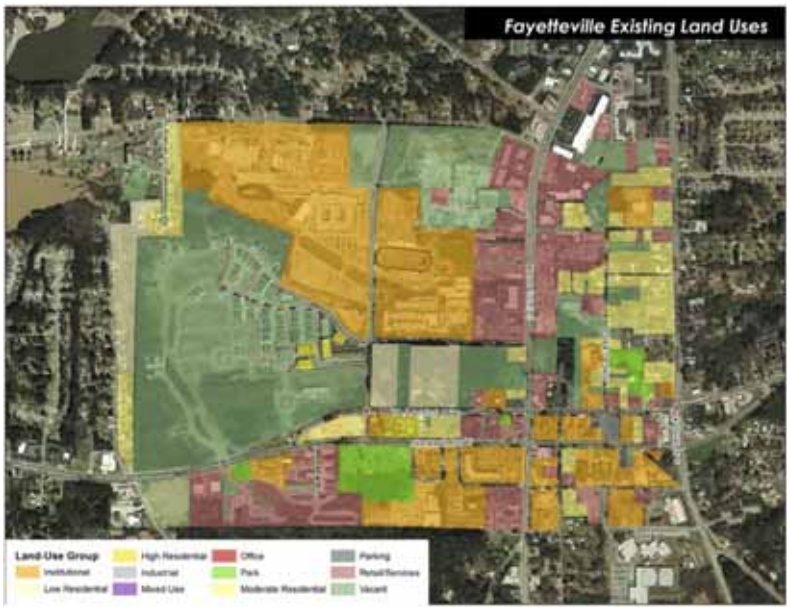
ARC selected 10 LCI areas as the focus for this analysis: Griffin, Fayetteville, Tucker, Hapeville, Bells Ferry, Highway 78, McFarland Stoney Point, North Point, Cumberland, and Brookhaven. The sites were selected to represent a range of locations around the Atlanta region and a variety of development conditions, opportunities, and challenges.

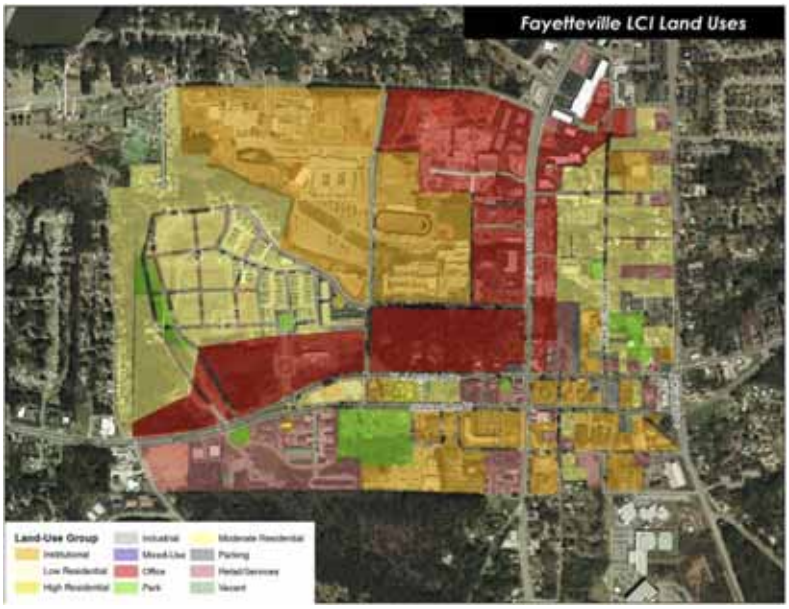
For each study area, the agency assessed two scenarios:

**Existing Scenario:** The Existing Scenario presents a representation of current land use and local street conditions.

**LCI Scenario:** The LCI Scenario, on the other hand, assumes full implementation of the land uses and local street systems contained in the LCI plan for that location.

Below is an illustration of the two scenarios from the Fayetteville LCI study area.



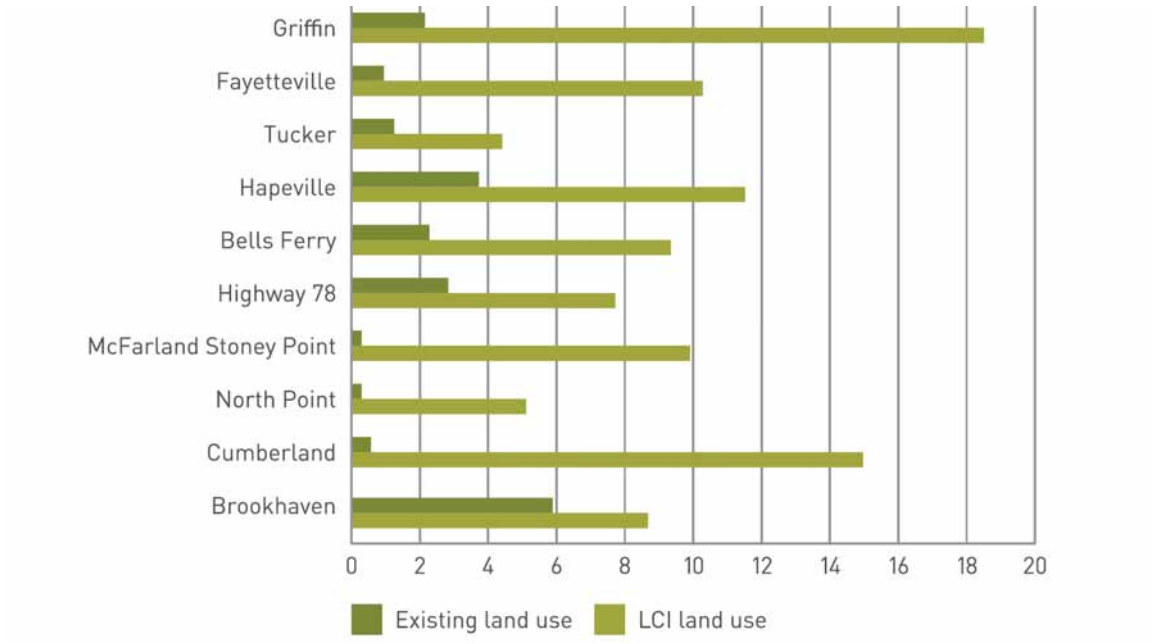
The evaluation process

The scenarios were tested for their relative impacts on jobs-housing balance, population and employment density, dwelling units within ¼ mile of transit stops, internal street connectivity and route directness, use mix and balance, VMT, and vehicle-based CO2 emissions.

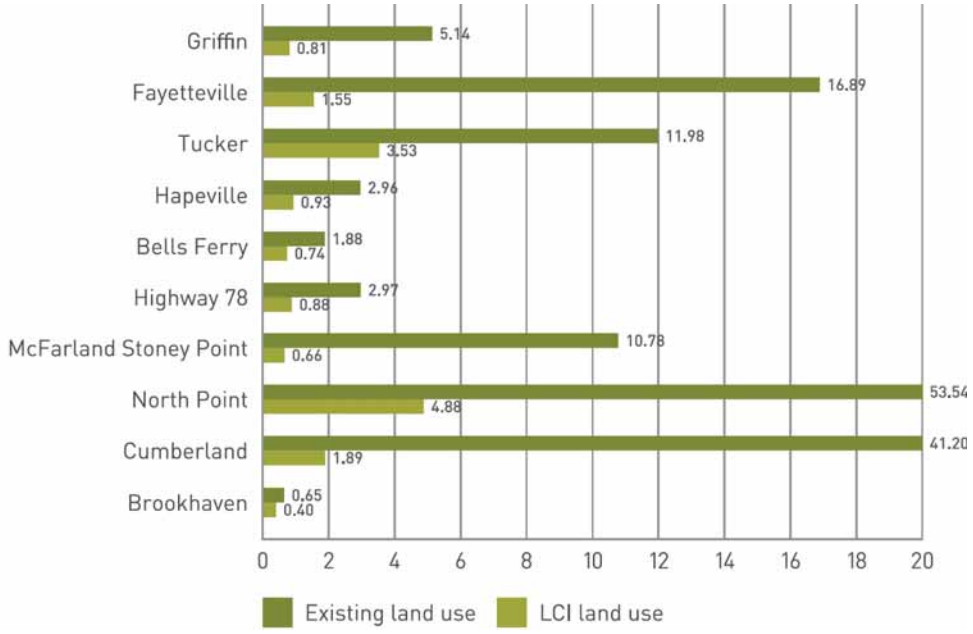
The study used the INDEX spreadsheet modeling system, which employs a GIS platform, facilitating the creation and testing of land use scenarios. The model uses grid-level land uses, transportation network features, and observed travel behaviors to establish a baseline. It then employs elasticities derived from more than 40 national, regional, and neighborhood land use-transportation studies to assess likely transportation impacts of different land use scenarios. The elasticities in the model address the 3 "D" variables of density, diversity, and design by estimating the impacts of population density, jobs/housing balance, street density, sidewalk completeness, and route directness on travel outcomes.

Evaluation results

All of the study areas showed substantial increases in population densities. However, because several of the areas are already so job rich that serious job/housing imbalances are present, only four of the areas show increase employment density under the LCI plans.

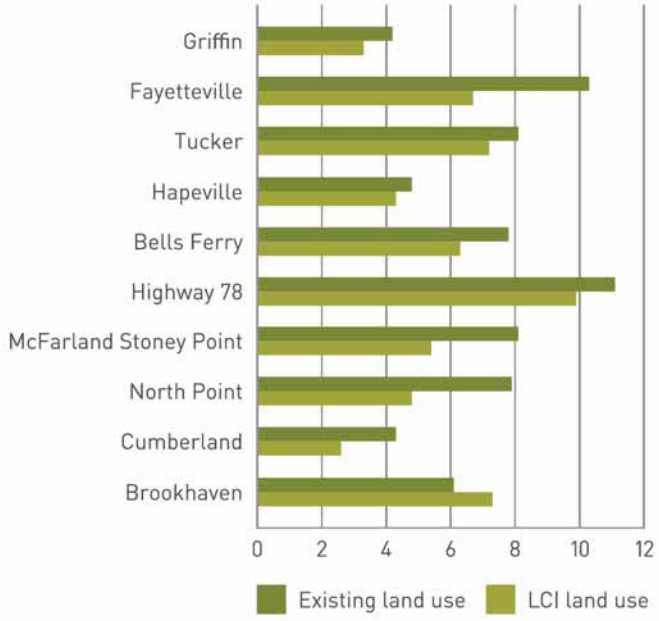



*Population Density (persons/gross acre)*




*Ratio of Jobs to Housing Units*

The study results show the impacts of increased housing densities and improved jobs/housing balance combine to result in significant reductions in VMT per person.




*Home Based VMT per Capita*

The following table provides a sample of the kinds of data provided for each study site.

| | LCI Site: McFarland-Stoney Point | |
|---|---|---|
| | **Existing** | **LCI** |
| % of non-dead end streets | 56% | 79% |
| Dwelling units per acre | 0.12 | 4.29 |
| Proportion of mixed use per grid cell (1= most mixed) | 0.02 | 0.41 |
| Route directness ratio (shortest drivable route vs. straight-line) | 1.77 | 2.64 |
| Daily home-based VMT/person | 8.1 | 5.4 |
| CO2 from light vehicles (lbs./person/year) | 4,789 | 3,185 |

Resulting actions

The planning grant portion of the LCI is a competitive process. Communities are required to demonstrate commitment to implementing the results of the LCI study at the end of the planning process, including making necessary changes to land use planning and zoning documents. Although transportation projects identified in an LCI study can become eligible for regional financial support, funding of these projects hinges on the applicant community's progress in implementing zoning amendments identified in the LCI planning study and the proposed project's role in supporting a mixture of transportation modes. Funding for supplemental planning studies is also available for those communities that show a strong level of commitment to implementation of policies developed through the planning process. To date, more than $500 million has been allocated for the program.

A 2008 survey of LCI recipient communities shows that since the inception of the program, more than 1,140 LCI-related development projects have been built, are planned, or are under construction. These projects represent more than 84,500 new residential units, 19.2 million square feet of commercial space, and nearly 38.4 million square feet of office space. In addition, 92% of the survey respondents reported that they have incorporated the results of their LCI study in their comprehensive plans, 66% have created special LCI zoning districts, and 83% have LCI-based design guidelines.

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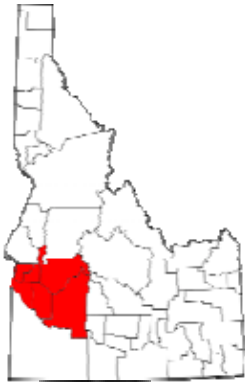
# Idaho



**Project Title:** Communities in Motion

**Sponsor:** Community Planning Association of Southwest Idaho

**Completion Date:** 2006

**Planning Horizon:** 2030

**Source:** http://www.communitiesinmotion.org/plandocuments.html

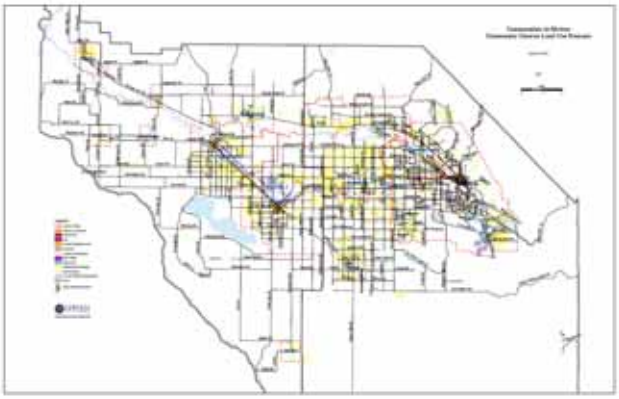
The Boise region is planning for rapid growth over the next twenty-five years. The population of the six-county area was 504,000 in 2000, but will likely grow to 978,000 by 2030—a 94% increase in just 30 years. The location of jobs to support this growing population will be critical. So too will be the challenges of meeting the needs of a future transportation system while preserving quality of life and open spaces. The Community Planning Association of Southwest Idaho (COMPASS)—the region's MPO—developed the Communities in Motion process to assess these land use and transportation challenges and to develop a new regional long-range transportation plan.

The Nature of the Scenarios

Initially, COMPASS staff crafted two sketch-level "bookend" scenarios, portraying standard urban form archetypes. Suburban Residential Explosion assumed an acceleration of residential growth on greenfields at the region's edges. "Changing Tides of Growth," in contrast, assumed a centripetal allocation of growth to the more central existing urban centers. From these sketch scenarios, agency staff crafted two fully formed scenarios for analysis:

**Trend Scenario:** The Trend growth scenario is based on the general growth patterns of the region over the last several decades. This scenario describes a future that continues the current, relatively low density pattern of development throughout the region. Transit service in this scenario was limited to only 490 service hours per day.

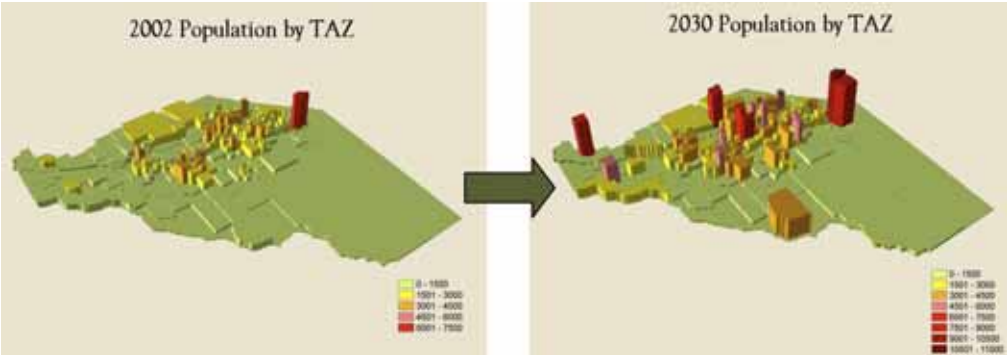
**Community Choices Scenario:**
This scenario focuses growth into "areas of impact," reducing the need to consume farmland and open space. It assumes a greater diversity of housing located near jobs and services. The scenario's compact growth pattern supports increased transit, walking and biking, and includes 4600 hours of daily transit service.



The Evaluation Process

COMPASS' travel demand model uses a standard four-step modeling process. Travel estimates are adjusted to account for roadway capacities, the availability of alternate routes, and changes in travel time due to congestion. When all routes have approximately the same travel time and there are no longer advantages associated with alternative routes, equilibrium is reached. The agency's model is capable of estimating non-motorized mode shares (for pedestrian and bike modes) and multiple modes of transit access (e.g., pedestrian versus park-and-ride). The agency uses a sketch-model post-processing system to estimate the impacts of land use variables (density, diversity, and design) on travel demand.

| **Smart Growth Model Feature** | |
|---|---|
| Daily vehicle trip model | X |
| Modeling peak period as well as daily travel | X |
| Transit network & assignment of daily trips to that network | X |
| Non-motorized modes (ped/bike) estimated in mode choice model | X |
| Modeling multiple modes of access to transit | X |
| Post-processing of land use ("D") variables | X |



Evaluation Results

Assessment of the scenarios indicated the following impacts on land use and transportation measures.

| | Scenario | |
|---|---|---|
| | **Trend** | **Community Choices** |
| Additional acres of development | 125,000 | 42,000 |
| % of development at transit supportive densities | 20% | 52% |
| Households per acre | 1.3 | 2.0 |
| Average daily vehicle miles traveled | 20,778,541 | 19,584,743 |
| Tons per day emissions of | | |
| PM 10 | 131.81 | 117.42 |
| NOx | 3.63 | 3.25 |
| VOC | 4.01 | 3.59 |

Elected Official Participation/Public Involvement

The public involvement strategy for Communities in Motion was tied to thematic phases that built and enhanced public participation throughout the planning process. The project's four phases—Leading, Learning, Communicating; Choice, Awareness, Participation; Expanding, Collecting, Sharing; and Reviewing, Evaluating, Adopting—incorporated multiple involvement tools and strategies, including websites, informal Community Cafés, educational forums, workshops, open houses, and meetings with elected officials, business leaders, residents, and technical staff. The effort was directed by a project steering committee and the COMPASS executive committee.

Resulting Actions

The COMPASS Board of Directors adopted the Communities in Motion plan in August 2006. The plan included a series of land use and development goals and strategies that were based on the Community Choices scenario, as well as a more traditional list of transportation projects. A 2009 annual performance monitoring report reveals that the plan's goals and objectives have been adopted by about half of the local governments in the region. On a set of key implementation indices, the performance report shows improvements in transportation choices and connectivity since adoption of the plan, but

deterioration on the principle land use measures of jobs/housing balance, housing choice, and open space preservation. Agency staff are currently in the process of updating the Communities in Motion plan and expect to have a new version adopted by August 2010.

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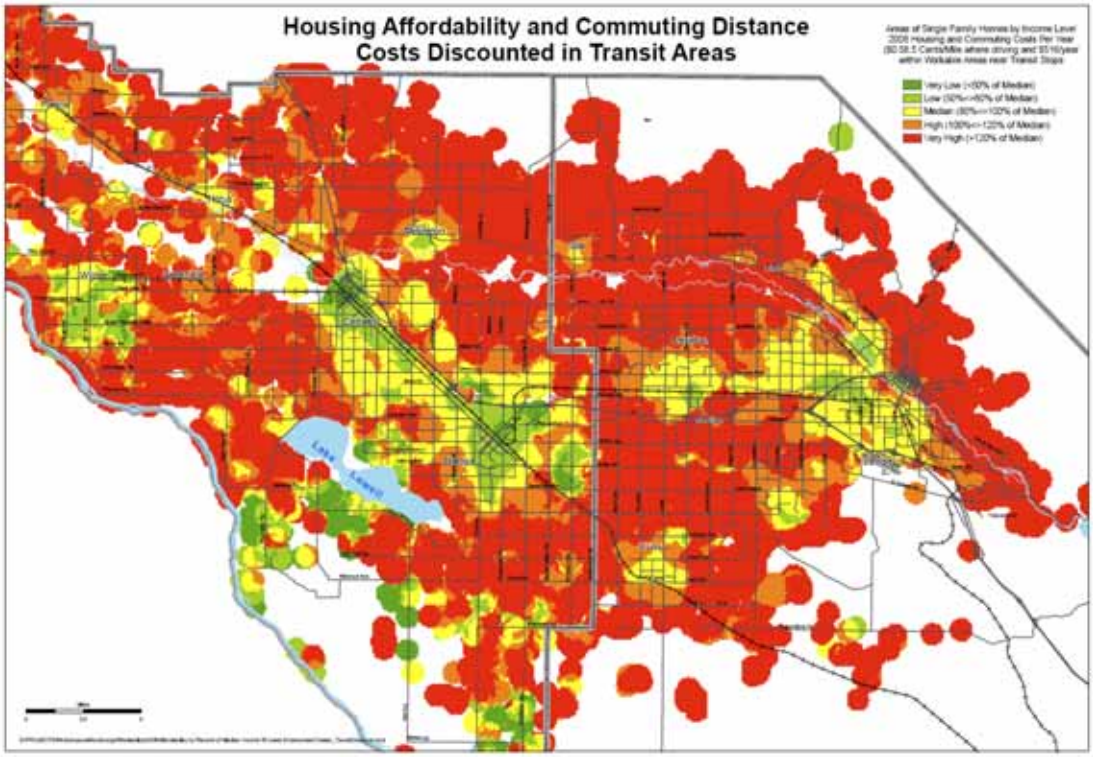


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# Illinois

**Project Title:** *GO TO 2040*

**Sponsor:** Chicago Metropolitan Agency for Planning

**Completion Date:** 2010

**Planning Horizon**: 2040

**Source**: http://www.goto2040.org/

The Chicago Metropolitan Agency for Planning (CMAP) used the centennial of Daniel Burnham's legendary Plan of Chicago in 2009 to engage in a broad examination of issues and challenges facing the Chicago region, including economic growth, transportation system functions, air and water quality, and natural resource consumption in the face of the expected addition of 2.8 million people and 1.8 million jobs by 2040. Of particular concern for the agency were issues relating to economic prosperity and climate change. The goals for the planning process included creating more compact, mixed-use communities, investing in education and workforce development, improving the region's system of parks and open space, creating a multi-modal transportation system to achieve economic growth, environmental protection, and congestion reduction.

The nature of the scenarios

To guide the scenario creation process, CMAP convened five committees of noted experts to address the following areas: economic and community development, natural environment and energy, housing, land use, and transportation. Each committee was tasked with developing the contents of scenarios based on three fundamental themes—preserve, innovate, and reinvest—from the perspective of their areas of expertise. CMAP staff melded the committees' responses into three integrated scenarios, using a matrix of sub-themes to maintain overall scenario coherence.

| Theme | Courses of action in "reinvest" scenario | Courses of action in "preserve" scenario | Courses of action in "innovate" scenario |
|---|---|---|---|
| Economic development | Infrastructure | Human capital | Innovation |
| Energy | Conservation – land use and transportation | Conservation – buildings | Clean energy |
| Environment | Accessibility | Biodiversity | Green development |
| Housing | Transit oriented development | Preservation of affordability | Green housing |
| Land use | Very dense | Moderately dense | Least dense |
| Transportation | Major capital investment | Management and operations | Technology |

**Reference Scenario:** The Reference Scenario assumes the continuation of recent trends in development and transportation investment.

**Reinvest Scenario:** The Reinvest Scenario primarily relies on infill and redevelopment strategies to accommodate future growth, resulting in a much denser development pattern with an emphasis on transit orientation. The scenario also includes significant improvements to transit capital facilities and services and capacity improvements to arterials in high density areas.

**Preserve Scenario:** The focus of the Preserve Scenario is to retain much of the existing building stock, accommodating growth in moderately dense new growth areas. The scenario includes a fairly aggressive transportation demand management component, which assumes effective implementation of transportation management associations at suburban employment centers and increased parking costs. Improvements to transit and pedestrian and bicycle facilities and services were also included.

**Innovate Scenario:** In the Innovate Scenario, growth would continue to occur at the region's fringes, but it would use clean energy and more efficient homes and vehicles to reduce development impacts. Instead of adapting the physical arrangement of growth, the scenario focuses on using improved technology to help reduce resource consumption. The scenario includes a system for charging variable user prices on the region's expressways and at major parking facilities. Also included are technological improvements to the transit system, such as advanced traveler information systems and signal prioritization.

From the three initial scenarios, CMAP crafted a **Preferred Scenario,** which was developed through an extensive public involvement process. The Preferred Scenario blends some of the most effective features of the three non-reference scenarios, and was designed by using compact, mixed-use communities as the basic building block for future growth.

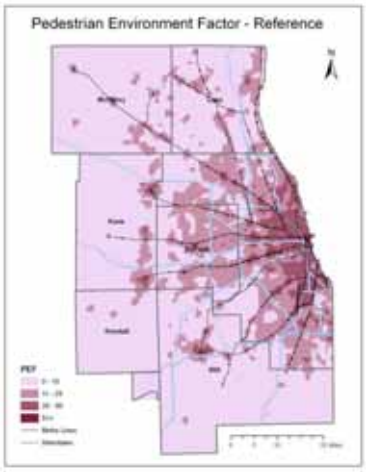
## The evaluation process

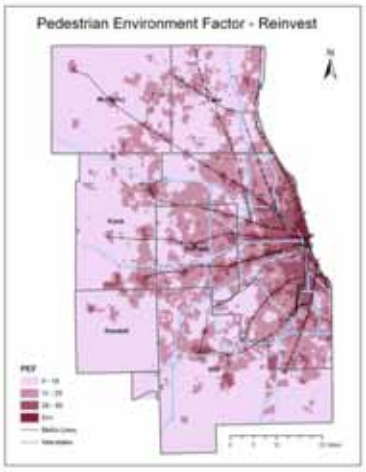
CMAP evaluated the scenarios for their impacts on land consumption, infill development, open space access, imperviousness, water use, greenhouse gas emissions, air quality, traffic congestion, non-auto mode shares, travel times, private housing and transportation costs, jobs accessibility, environmental justice, and infrastructure cost. The CMAP travel demand model includes the following Smart Growth components.

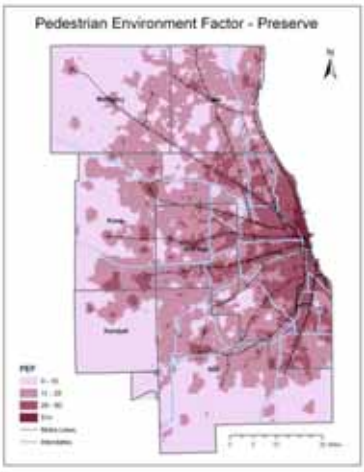
| **Smart Growth Model Feature** | |
|---|---|
| Daily vehicle trip model | X |
| Modeling peak period as well as daily travel | X |
| Simple mode choice model (that separates transit and highway trips) | X |
| Transit network & assignment of daily trips to that network | X |
| Supply & demand model equilibration | X |
| Auto ownership modeling sensitive to land use characteristics | X |
| Travel time feedback loops between model components | X |
| Modeling multiple modes of access to transit (e.g., ped. vs. park and ride) | X |
| Trip distribution sensitive to multi-mode options | X |
| Disaggregate simulation of households | X |
| Post-processing of land use (“D”) variables | X |

## Evaluation results

One of the measures used to both specify and evaluate the scenarios was an index to assess pedestrian friendliness, called the Pedestrian Environmental Factor.



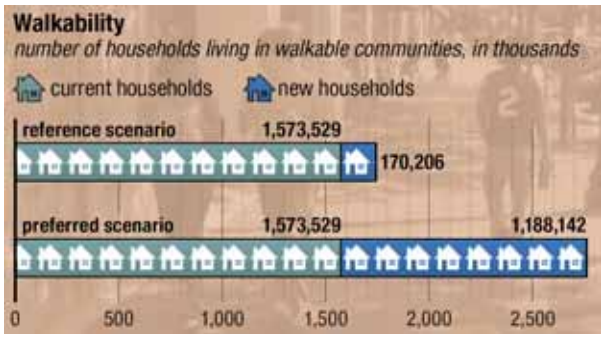



Scenario performance using some of the study's other measures are reported below.

| | Scenarios | | | | |
|---|---|---|---|---|---|
| | **Reference** | **Reinvest** | **Preserve** | **Innovate** | **Preferred** |
| Vehicle Miles Traveled (millions) | 199.8 | 206.7 | 194.5 | 201.4 | - |
| Acres of ag. and environmentally sensitive lands consumed | 644,000 | 471,000 | 491,000 | 592,000 | 378,000 |
| Gallons of water consumed per day (millions) | 1,432.1 | 1,308.1 | 1,221.1 | 1,280.1 | 1,149.9 |
| Jobs accessible by 75 mins. travel on transit | 1,075,144 | 1,424,000 | 1,309,000 | 1,457,000 | 1,445,539 |

The report on the Preferred Regional Scenario includes some additional graphic-based metrics that are keyed to some of the study's other major themes.



In addition to the above measures, a committee comprised of human service experts assessed how each scenario would impact on human service issues, such as accessibility to the disabled.

Elected Official Participation/Public Involvement

The *GO TO 2040* project grew out of earlier regional planning efforts of the Northeastern Illinois Planning Commission (NIPC), one of CMAP's predecessor agencies. NIPC's Regional Framework Plan, itself the result of a scenario planning process, was based on a broad public involvement process dubbed the Common Ground initiative. Common Ground engaged a cross-section of more than 4000 people in the region who participated in 200 local and regional workshops. Using a variety of interactive technologies that allowed for real-time responses to a host of growth-related issues, workshop participants were able to engage in a "conversation" with planners, elected officials, and other stakeholders about the future. A common theme arising through this process was dissatisfaction with the prospects of a trend-based forecast: "The residents

of northeastern Illinois expressed a strong desire to build a region that is far superior to what will happen if we simply allow current trends to continue."

Using the 2040 Regional Framework Plan as a starting point, CMAP worked with stakeholders to draft a Regional Vision for 2040 at a visioning workshop, which was then revised based on public comment received via surveys and public meetings. The CMAP board adopted the Regional Vision in 2008, and then used it as the basis for additional public involvement and technical analysis. The agency created or commissioned more than three dozen in-depth strategy papers on topics ranging from public transit, to waste water disposal, greenhouse gas emissions, school siting, and workforce development. CMAP also has created a series of "snapshot" reports that analyze broad subjects requiring further study including, jobs-housing balance, air quality, the Latino population, and infill development.

The three theme scenarios plus the reference scenario, outlined above, were released for public comment during the summer of 2009. In addition to more than 50 public workshops, members of the public could weigh in on the different scenarios by participating in online surveys (at CMAP kiosks as well as on personal computers) and by using an online sketch scenario building tool called MetroQuest, which allowed users to experiment with different types of transportation investments and development patterns and view the outcomes of these decisions. The Preferred Regional Scenario was crafted based on the input received through these venues.

A key continuing element of the *GO TO 2040* planning process is the development and deployment of benchmark metrics to predict and measure progress of the region in implementing both the Regional Vision and Scenario.

Resulting actions

With the selection of the Preferred Regional Scenario, CMAP is now engaged in the selection of major capital projects that will form the framework for a unified regional plan that the agency is scheduled to adopt in the fall of 2010.

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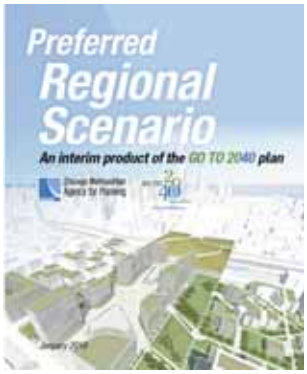


**Project Title:** Long Range Transportation Plan 2025

**Sponsor:** Champaign Urbana Urbanized Area Transportation Study

**Completion Date:** 2004

**Planning Horizon**: 2025

**Source**: http://www.ccrpc.org/planning/transportation/lrtp/lrtp2025.php

The Champaign Urbana Urbanized Area Transportation Study's (CUUATS) Long Range Transportation Plan (LRTP) is a federally mandated document that must be updated every 5 years. Its completion permits agency members of CUUATS to receive federal and state funding for transportation projects and programs.

The LRTP details how the existing transportation system works and how local residents and decision makers would like it to work in the future. The LRTP considers existing conditions, local needs, and anticipated growth to provide the best transportation system possible for all users. The purpose of the LRTP is "to provide a safe, efficient, and economical transportation system that makes the best use of existing infrastructure, optimizes mobility, promotes environmental sensitivity, accessibility, and economic development, and enhances quality of life for all users." To that end, the LRTP seeks to promote:

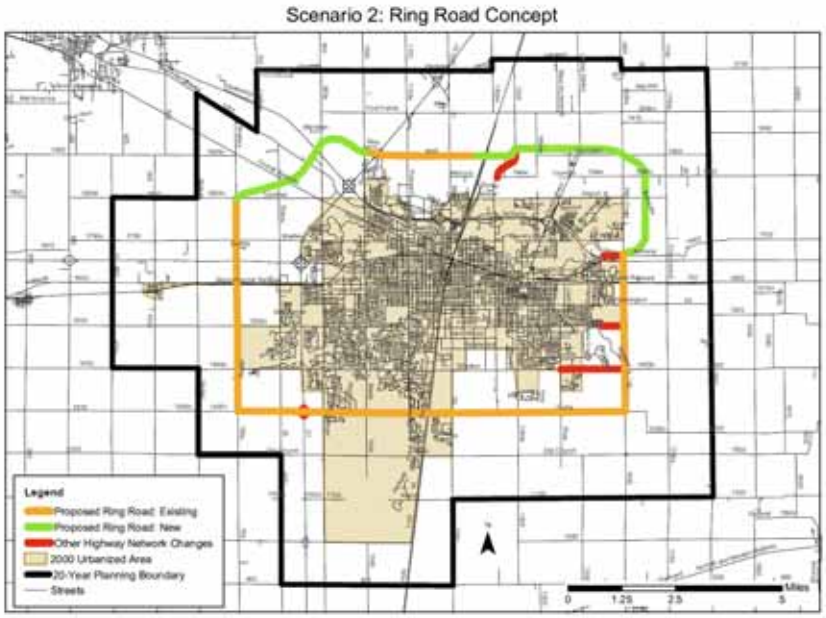
- Less congestion, more mobility
- Less dependence on cars, more use of alternative transportation modes
- Less fringe development, more core development
- Less new construction, more transportation system management

<u>The nature of the scenarios</u>

To better achieve those goals for the 2025 update to the LRTP, CUUATS elected to conduct an elaborate analysis of multiple scenarios utilizing a variety of land use-transportation combinations. Three transportation options were articulated:

**Scenario 1:** Scenario 1 reflects those transportation projects and land use developments that are currently proposed for implementation during the 20-year plan horizon and likely to occur.

**Scenario 2:** Scenario 2 includes everything in Scenario 1, plus a new arterial ring road.




**Scenario 3:** Scenario 3 includes everything from Scenario 1, plus a modified/enhanced version of the new ring road included in Scenario 2.

Each of these transportation options was paired with five different transit/land use alternatives.

**Alternative A:** Current development patterns would continue under Alternative A, with most development dispersed through outlaying areas of the region. These patterns are marked by low residential densities and separated uses. The alternative assumes no improvements to the existing transit system.

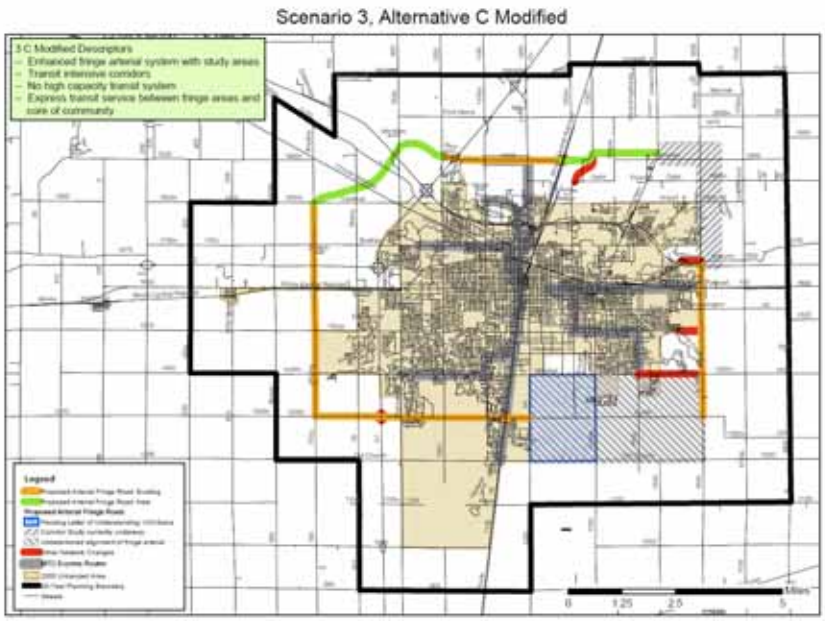
**Alternative B:** Alternative B combines the land use assumptions of Alternative A with a new radial express bus service running from the region's fringes to its core.

**Alternative C:** In Alternative C, land use patterns would become much more compact and transit oriented. New growth would be concentrated in mixed use activity centers along transit corridors. Much of the fringe development that would occur in Alternative A would instead be sited toward the region's core. The alternative adds to the existing transit network a new high-capacity transit system in the University District.

**Alternative B+C:** This alternative adds the radial bus service from Alternative B to the transit-oriented land use patterns and high-capacity transit system from Alternative C.

**Alternative C Modified:** This variant to Alternative C keeps the transit-oriented land use pattern, but swaps the University District high-capacity transit system for the radial express bus network from Alternative B.

Combining the three transportation packages with the five land use/transit options resulted in a total of 15 different land use-transportation scenarios. Below, for example, is a map representing Scenario 3C Modified.




The evaluation process

The transportation impacts of the 15 scenarios were calculated using the CUUATS travel demand model. Inputs for the model include base year population and employment data; existing and future roadway and transit network links and nodes; and population and employment projections for 2025. Agency staff altered and supplemented these base-level inputs to represent the land use and transportation configurations described in the scenarios outlined above. The model components include the four standard elements: trip generation, distribution, mode choice, assignment. The Smart Growth features included in the model are indicated in the following table.

| **Smart Growth Model Feature** | |
|---|---|
| Daily vehicle trip model | X |
| Simple mode choice model (that separates transit and highway trips) | X |
| Supply & demand model equilibration | X |
| Travel time feedback loops between model components | X |

Density levels were estimated using total population divided by the sum of the existing urban area plus the additional agricultural land anticipated to be developed by 2025. Population-employment balance was calculated as a pop : jobs ratio at the TAZ level.

The amount of housing near transit was the sum of the population for all the TAZs located within ¼ mile of transit routes.

Evaluation results

Given the large number of scenarios, evaluation of their relative impacts resulted in a rather large table of data. The table below provides some of the highlights. As illustrated in the table, the variation in VMT seems to be the result of changes in transit and land, with little variation coming from the inclusion of the proposed ring road. The ring road's impact is more observable in the percent of congested roads.

| **Scenario** | Persons per sq. mi. | Pop-jobs ratio | local street mi./person | VMT (millions) | % roads w/ congestion |
|---|---|---|---|---|---|
| **1A:** Trend transportation and land use | 4098 | 10.48:1 | 4.25 | 2.27 | 4.88% |
| **1B:** Trend roads and land use + express bus | 4098 | 10.48:1 | 4.25 | 2.25 | 4.71% |
| **1C:** Trend roads + TOD + high-cap. transit | 4245 | 9.52:1 | 4.01 | 2.1 | 3.02% |
| **1B+C:** Trend roads + TOD + high-cap. transit + express bus | 4245 | 9.52:1 | 4.01 | 2.08 | 2.92% |
| **2A:** Ring road + trend land use and transit | 4098 | 10.48:1 | 4.25 | 2.27 | 3.03% |
| **2C:** Ring road + TOD + high-cap. transit | 4245 | 9.52:1 | 4.01 | 2.1 | 2.11% |
| **2B+C:** Ring road + TOD + high-cap. transit + express bus | 4245 | 9.52:1 | 4.01 | 2.08 | 2.0% |
| **3B+C:** Limited ring road + TOD + high-cap. transit + express bus | 4245 | 9.52:1 | 4.01 | 2.08 | 2.4% |

In addition to these more traditional, quantitative data, the LRTP also presents a detailed narrative of a hypothetical "day in the life" circa 2025 that attempts to address the following questions: Who are the residents of the region? Where are they living and working? What travel options do they have? How will the region's transportation systems function from the perspective of the average resident? Here are some excerpts from the six-page story:

6:30 - 7:30 a.m.
The Champaign-Urbana-Savoy-Bondville-Tolono-Mahomet urbanized area is even more of a major employment center, having increased its number of employees by about 40,000 over the last 20 years. Early morning commuter traffic still enters the community on the same major corridors, but now many come into town using the I-57 interchange at Curtis Road that was built in 2007. Previous I-57 motorists had to exit two miles south at Monticello Road or three miles north at the I-74 interchange. This new entryway into the community provides direct access to the City of Urbana and the University of Illinois via Curtis Road.

* * * * *

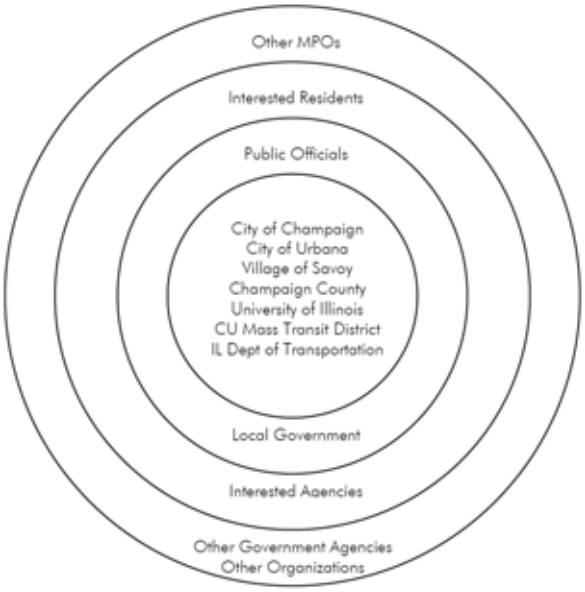
7:30 - 8:30 a.m.
Peak hour traffic in the University District has taken on a different form, as more cars are being left in shuttle lots and parking garages on the fringe of the University and high capacity transit is taking travelers from there into the core of the University. This movement is facilitated by MTD's implementation of a daycare adjacent to the park and ride lots. The MTD hopes to expand the high capacity transit system to areas outside its current extension between downtown Champaign and downtown Urbana. Riders of the improved system note the timeliness of the system and how development seems to be springing up around the transit stops. The center of the community seems livelier as pedestrians walk from their homes to nearby shops and services, or hop on the transit system to reach work downtown without having to search and pay for a parking space.

* * * * *

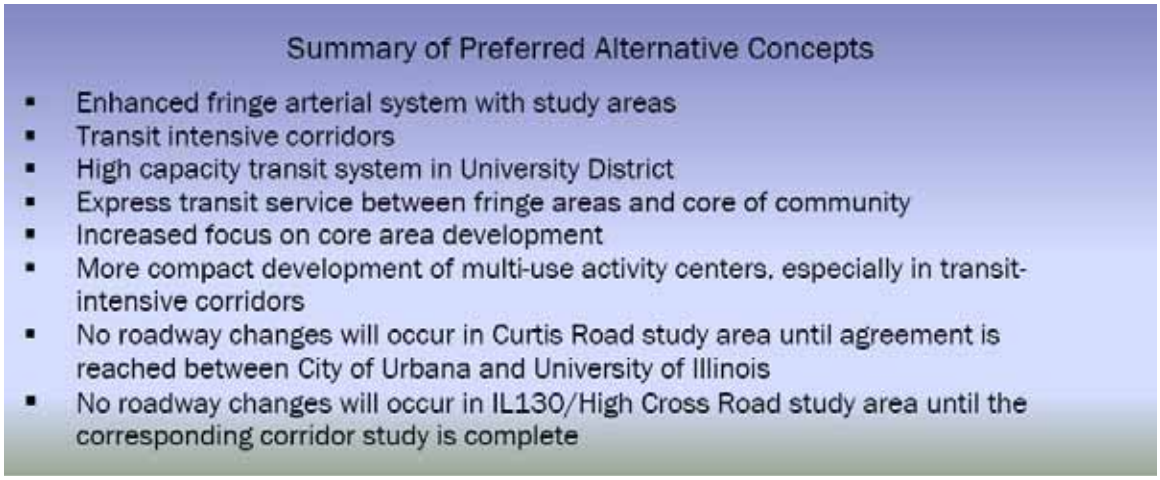
2:30 - 4:30 p.m.
Up at Herff Jones Cap and Gown Division, there is no longer a bottleneck as employees cross Market Street to enter the factory. In accordance with the City of Champaign Beardsley Park Plan, the company negotiated a land trade with the City of Champaign so that the employee parking lot on the west side of Market Street would become a residential area, while the City's Public Works storage facility to the south of the factory would become a parking lot for Cap and Gown employees. Infill development such as the residential area across from the factory has become more common over the last 20 years as local officials make better use of existing infrastructure in the core rather than building exclusively in the fringe areas of the community. This has helped relieve traffic on the major arterials leading into the core, and lowered infrastructure maintenance costs for the city.

Elected official participation/public involvement

The involvement of stakeholders, elected officials, and members of the public in the LRTP planning process was structured according to the agency's concept of "stakeholders," which it analogizes to a series of concentric circles with decisionmakers in the center surrounded by rings of declining influence.




Consistent with this model, the process of identifying a preferred land use-transportation option began with agency staff and the LRTP steering committee crafting an initial set of 6 scenarios: 1A, 1B, 1C, 2A, 2B, and 2C, as outlined above. These scenarios became the focus of a public open house where 60% of participants voted for some version of Alternative C (either in combination with Scenario 1 or 2). In response to other input received at the open house, staff crafted a set of hybrid scenarios—the remaining nine scenarios listed above. Using a mix of public input from the open house and other sources, local knowledge, modeling data, and best planning practices, the steering committee narrowed the number of scenarios down from 15 to four: 3C, 3B+C, 1C, and 1B+C, plus 1A as the baseline. The agency's technical committee then further winnowed the number down to two: 3B+C, plus a slight variation on that scenario, labeled 4B+C. The agency's policy committee then selected 4B+C as the preferred alternative.




Resulting actions

The implementation chapter of the LRTP outlines not only the transportation system elements customarily found in a long-range plan, but also identifies important non-facility related components of the preferred scenario, including:

- Organizing urban development to improve travel conditions
- The relationship between economic growth and transportation capacity
- Shifting travel choices toward non-automobile modes
- Increasing transportation capacity through corridor management
- Making the local area transportation system easier to use

The chapter articulates both the necessity and potential obstacles for achieving each of these components and then targets specific actions for overcoming the obstacles, including steps the agency can take to assist local government partners for actions that fall outside the agency's authority.

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# Michigan

**Project Title:** Regional 2035 Transportation Plan

**Sponsor:** Tri-County Regional Planning Commission

**Completion Date:** 2010

**Planning Horizon**: 2035

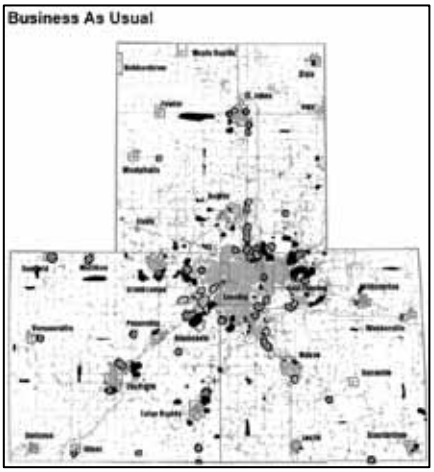
**Source**: http://www.mitcrpc.org/translibrary.htm

The Tri-County Regional Planning Commission (TCRPC) is the designated MPO for the Lansing/East Lansing, Michigan metropolitan area. The TCRPC began a multi-year land use and regional visioning process, known as Regional Growth: Choices for Our Future, in 1997. The projects' objective was to articulate a shared vision of future land use and development patterns throughout the region and to establish an action plan to address urban sprawl in ways that would guide future private and public investment decisions, including those related to transportation facilities and services. Central to the Choices project was a series of four land use-transportation scenarios—Trend, Wise Growth, Build Out, and Wise Growth Build Out—that were studied for their impacts on a range of community livability measures. At the conclusion of the process in 2003, the TCRPC adopted a regional transportation plan for 2025 that included the Wise Growth Scenario as the region's official land use policy map; integrated regional land use and transportation goals, objectives, and investment strategies; a regional land use vision consisting of 29 key principles; and a set of implementation strategies. In 2005, the TCRPC adopted an updated version of the plan for the 2030 planning horizon that continued to advance the land use and transportation approaches of the prior plan. The 2035 plan, described here, is a further continuation of those policies.

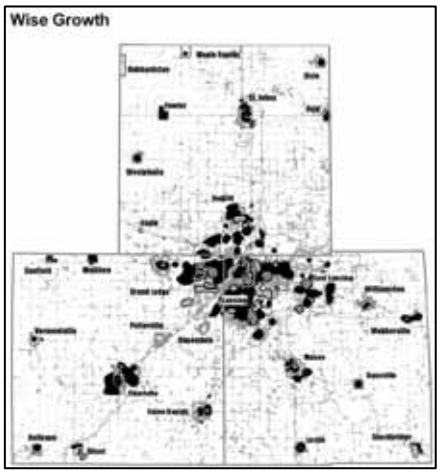
<u>The nature of the scenarios</u>

For the 2035 plan, TCRPC relied on the same four scenario concepts used in the Choices project, updated for the 2035 planning horizon.

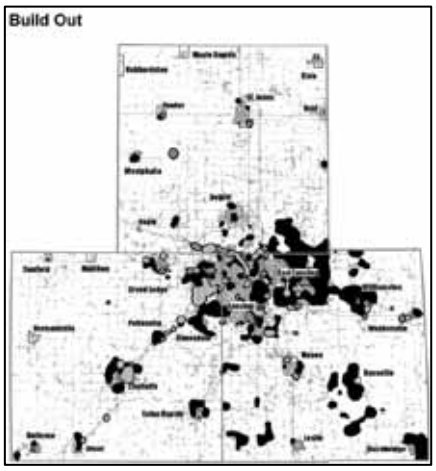
**Trend/Business as Usual:** The Trend Scenario extrapolates existing trends of development and urbanization, extending them through the study period. The scenario illustrates an irregular development pattern that favors access to public utilities and roadways and is attracted to outlying townships, away from the region's core.



**Wise Growth:** The Wise Growth Scenario represents a focus on existing urban areas, merging two previous draft scenarios (titled Compact Development and Environmental Preservation) that were derived from visions and goals developed during a set of town hall forums. The hybrid scenario allocates the same total amount of growth as in the Trend Scenario, but seeks to minimize public infrastructure costs by focusing development in existing urban areas, while avoiding environmentally sensitive and agricultural lands.




**Build Out:** The Build Out Scenario assumes the maximization of building capacity under existing zoning at maximum allowable densities. The scenario considers any area where the zoning capacity exceeds existing land uses as a growth area and assumes growth at the maximum intensity allowed. As with the Trend Scenario, much of the development in the Build Out Scenario occurs away from the core of the region in fringe areas and along major transportation corridors.




**Wise Growth Build Out:** This scenario assumes roughly the same amount of total growth as the Build Out Scenario, but it is allocated using the same policies and principles and development footprint that underlie the Wise Growth Scenario.

<u>The evaluation process</u>

Prior to developing the scenarios for the Choices project, TCRPC prepared two sets of population and employment forecasts: one based on existing development trends and one based on the build out capacity of existing zoning districts in the region. These forecasts, which were specified at the traffic analysis zone (TAZ) level, served as the basis for Trend and Build Out scenarios. The overall regional totals for population and employment growth for the Trend and Build Out scenarios were then reallocated for the Wise Growth and Wise Growth Build Out scenarios according to the policy objectives stated for those scenarios. For the 2035 plan, TCRPC simply updated these scenarios using new demographic growth projections. Despite the additional 10 years in planning horizon (from 2025 to 2035), the projections for the 2035 plan are actually lower than

those used previously, due in part to recent economic conditions and in part to improved demographic data.

The TCRPC land use model is a locally derived, GIS-based system that incorporates such variables as built and vacant lands, developable lands, environmental constraints, local zoning, local comprehensive future land use plan maps, employment location data, and accessibility measures from the travel model. Model outputs are enhanced by a two-stage modified Delphi-style local review process. TCRPC also uses GIS-based tools for assessing scenario impacts on land use-based measures such as amount of developed land, amount of development in existing urban service areas, development proximity to transit and parks, and public service costs.

For analyzing transportation impacts, the agency uses a version of the TransCAD computer software package, which operates using the standard four steps of trip generation, trip distribution, mode choice, and trip assignment. Additional model components include modules that estimate peak period travel and the effect of parking supply on travel to downtown and university areas. A travel time feedback function connected to trip distribution was added for the 2035 Plan process. The Smart Growth components of the modeling system are represented in the following table.

| **Smart Growth Model Feature** | |
|---|---|
| Daily vehicle trip model | X |
| Modeling peak period as well as daily travel | X |
| Simple mode choice model (that separates transit and highway trips) | X |
| Transit network & assignment of daily trips to that network | X |
| Auto ownership modeling sensitive to land use characteristics | X |
| Travel time feedback loops between model components | X |
| Modeling multiple modes of access to transit (e.g., ped. vs. park and ride) | X |

All of the four scenarios were initially modeled assuming the existing and committed regional roadway and transit networks. The Wise Growth Scenario—which is the adopted preferred scenario—was then further analyzed to identify areas of deficiency in system operations. In addition to the more traditional assessment of link and intersection volume to capacity ratios, the deficiency analysis also identified proposed improvements in the region's transit, pedestrian, and bicycle networks. The deficiency analysis led to another series of model runs, using a range of transportation network alternatives, all paired with the Wise Growth Scenario land use allocation (except for Alternative 6B).

The network alternatives included:

**Alternative 1 – High Transit:** Alternative 1 consists of the existing and committed highway network, plus a doubling of existing transit service. The new service includes a reduction of service headways by 50% and the addition of new express bus routes and local line haul services.

**Alternative 2 – Medium Transit:** This option is similar to Alternative 1, except the transit service improvements range from 20 to 50 percent and are more strategically chosen to match with land use features in the Wise Growth development pattern.

**Alternative 3 – Demand Reduction/Improve Operations:** This alternative uses existing and committed highway and transit networks, but also contains a package of demand reduction strategies designed to reduce vehicle trips by 12% in the downtown area and 20-30% at the university.

**Alternative 4 – 2+3:** The features of alternatives 2 and 3 are combined in this alternative.

**Alternative 5 – The Combination Alternative:** This option combines the elements of alternatives 6A, 2 and 3. The TCRPC Long Range Plan Task Force identified this option as its preferred alternative.

**Alternative 6A: Potential Highway Options:** Alternative 6A incorporates highway capacity expansion projects suggested by area transportation agencies, based on the highway deficiency analysis outlined above.

**Alternative 6B: Potential Highway Options:** This alternative is the same as 6A, except that it uses the Trend Scenario growth allocation, instead of the Wise Growth allocation.

**Alternative 7 – Highways Only Options:** This option incorporates all possible highway capacity projects.

**Alternative 8:** This alternative represents the adopted 2035 Plan network. It incorporates a combination of elements taken from alternatives 2 and 3 and the fiscally constrained projects from Alternative 6A, as modified based on public participation results and further refinements by local governments.

Evaluation results

Below are the results of the initial analysis of the four land use options. As mentioned, for this analysis, all of the scenarios assume the same transportation network comprised of existing facilities and services, plus those with committed funding.

| | Scenario | | | |
|---|---|---|---|---|
| | Trend | Wise Growth | Build Out | Wise Build Out |
| Total population | 491,808 | 491,808 | 1,163,761 | 1,076,362 |
| Total employment | 299,644 | 299,647 | 489,944 | 489,837 |
| Residents & employees per net urban acre | 6.58 | 7.5 | 6.53 | 11.26 |
| Percent of population in developed areas | 59% | 64% | 31% | 74% |
| Percent of households ¼ mile from transit | 42% | 48% | 23% | 49% |
| Daily vehicle miles traveled (000's) | 16,548 | 16,087 | 34,530 | 26,536 |
| Daily congested lane miles | 50.6 | 50.9 | 3225.5 | 1583.2 |
| Daily unlinked transit trips | 45,357 | 51,533 | 46,450 | 47,970 |

The following table provides results from the test of the nine alternative transportation networks outlined in the previous section. All of the networks assume the Wise Growth land use pattern, except Alternative 6B, which assumes the Trend pattern. The data for the Wise Growth and Trend scenarios with the existing and committed transportation network—from the table above—are provided for comparison purposes.

| | Lane Miles | Transit Hours | VMT (000's) | VHT | Congested Lane Miles | Transit Trips |
|---|---|---|---|---|---|---|
| Trend | 4,553.3 | 216,881 | 16,548 | 320,673 | 50.6 | 45,357 |
| Wise Growth | 4,553.3 | 216,881 | 16,087 | 314,068 | 50.9 | 51,533 |
| Alt. 1: High Transit | 4553.3 | 554,335 | 15,995 | 311,386 | 45 | 78,299 |
| Alt. 2: Medium Transit | 4,553.3 | 529,687 | 16,033 | 312,531 | 47.4 | 67,457 |
| Alt. 3: Demand Reduction* | 4,553.3 | 216,881 | 14,765 | 284,226 | 30.6 | 53,995 |
| Alt. 4: 2+3* | 4,553.3 | 529,687 | 14,718 | 282,978 | 29.9 | 71,218 |
| Alt. 5: Combo (2+3+6A)* | 4,544.8 | 529,687 | 14,709 | 282,025 | 29.8 | 71,214 |
| Alt. 6A: Highway Options | 4,544.8 | 216,881 | 16,092 | 313,377 | 49 | 50,839 |
| Alt. 6B: Highway Options | 4,544.8 | 216,881 | 16,544 | 319,790 | 46.4 | 44,696 |
| Alt. 7: Highways Only | 4,580.4 | 216,881 | 16,144 | 312,744 | 29.2 | 50,695 |
| Alt. 8: 2035 Plan* | 4,534.8 | 529,687 | 14,709 | 282,012 | 30.5 | 71,222 |

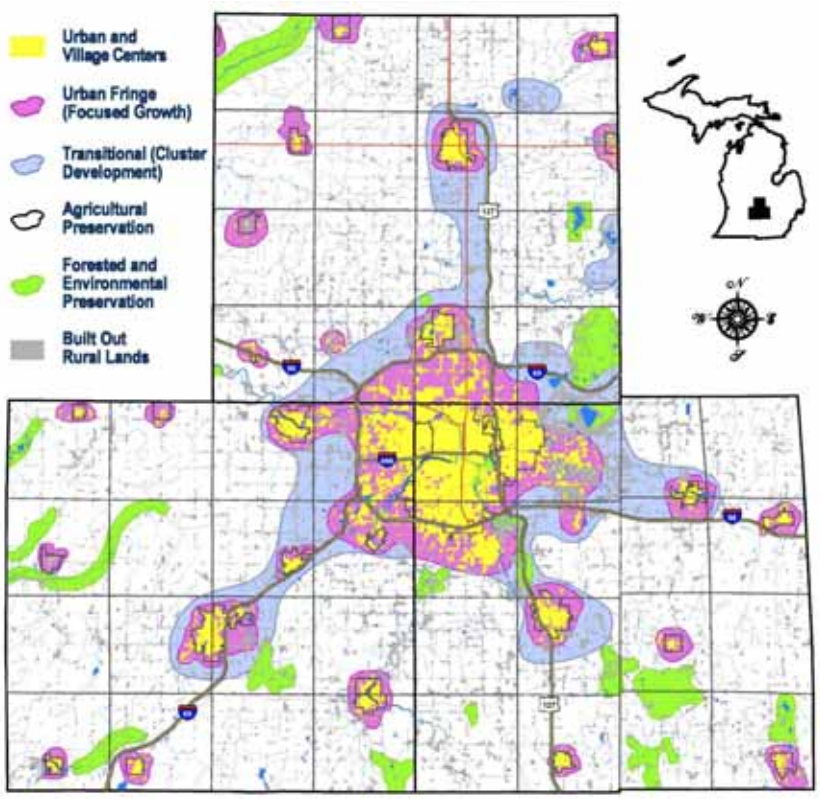
* Includes strategies designed to reduce vehicle trips by 12% in the downtown area and 20-30% in the university district.

Elected Official Participation/Public Involvement

As explained above, the 2035 Plan is based on the earlier Regional Growth: Choices for Our Future study. That study was built on an extensive public involvement process that began with a stakeholders Land Use Forum in 1997, which was followed by a series of facilitated town hall forums attended by more than 700 people. A Stakeholders Committee representing 90 different public and private organizations provided unique perspectives on growth-related issues throughout the study process. Additional involvement techniques included random-sampled citizen opinion surveys, leadership surveys, targeted interviews, a proactive media involvement program, a project website, and more traditional newsletters, brochures, and fact sheets. In crafting the 2035 plan, TCRPC utilized the input received from these earlier efforts, updating that input with additional town hall forums and information meetings around the region and a new round of surveys of social service agencies, freight users, and local governments.

Resulting actions

The 2035 plan updates the analyses, land use and transportation goals, objectives, investment strategies, principles, and implementation measures adopted in the 2025 Plan at the conclusion of the Choices project.




The 2035 Plan also re-adopts the regional land use vision, depicted above, that was developed as part of the Choices project. That vision has been endorsed by 43 local

governments in the region responsible for local land use decision-making. In most of the resolutions endorsing the vision, local elected bodies have directed their planning staffs to conform general plans and ordinances to be consistent with the vision.

The project selection portion of the 2035 Plan utilizes a qualitative evaluation of proposed projects and programs for their potential to advance the plan's goals in areas such as accessibility, mobility, safety, system efficiency, climate change and energy, environment, land use, finance, economic development, public involvement, transit, parking, community impact, non-motorized travel, management systems, and intelligent transportation systems.

To assist in implementation of the 2035 Plan in areas other than transportation facilities and services the region makes use of an Implementation Steering Committee, which in turn has created four task forces to address regional growth, development, and quality of life; public involvement and education; natural resources, parks, and recreation; and funding. Each task force is charged with implementing a series of goals and objectives. The Regional Growth, Development, and Quality of Life Task Force, for example, has a goal to "give top priority to encouraging development, preservation and use of existing structures to promote urban revitalization as a primary means of accommodating economic growth." The objectives for achieving this goal include:

- Create brownfield redevelopment policies and programs.
- Promote quality of life through walkability and downtown revitalization.
- Establish urban service boundaries to enhance redevelopment of existing downtowns.
- Conduct fair and equitable development approval processes.

Like previous plans for 2025 and 2030, the 2035 plan includes a monitoring process and methodology designed to gauge progress toward achievement of the plan's overall aims. The monitoring system is based on a series of proposed regional indicators, including:

- Percentage of residential units in urbanized areas built at densities greater than or equal to 3.5 units per acre.
- Percentage of non-residential development in urbanized areas built at greater than or equal to 0.25 Floor Area Ratio (FAR).
- Percentage of residential development concentrated in areas where residential uses are at least 25 percent of land area.
- At least three-fourths of new residential development should occur within the first three rings of urban development.

- Employment growth (number of jobs) in and around high-density employment centers.
- Jobs/housing balance per census tract.
- Number of mixed-use developments constructed annually.
- Percentage of residential development with densities of one dwelling unit per acre or higher that occurs in areas planned for sewer and water.
- Acres of land preserved in perpetual open space.
- Acres of environmentally sensitive lands in large contiguous sections acquired or preserved by easement.
- Percentage of prime agricultural lands still in active agricultural production.

By periodically assessing progress on each of these indicators, the region hopes to benchmark its achievements and target areas requiring additional institutional support. The process could also be used to identify issues requiring new or additional policy development. As stated in the plan, "what gets measured gets done."

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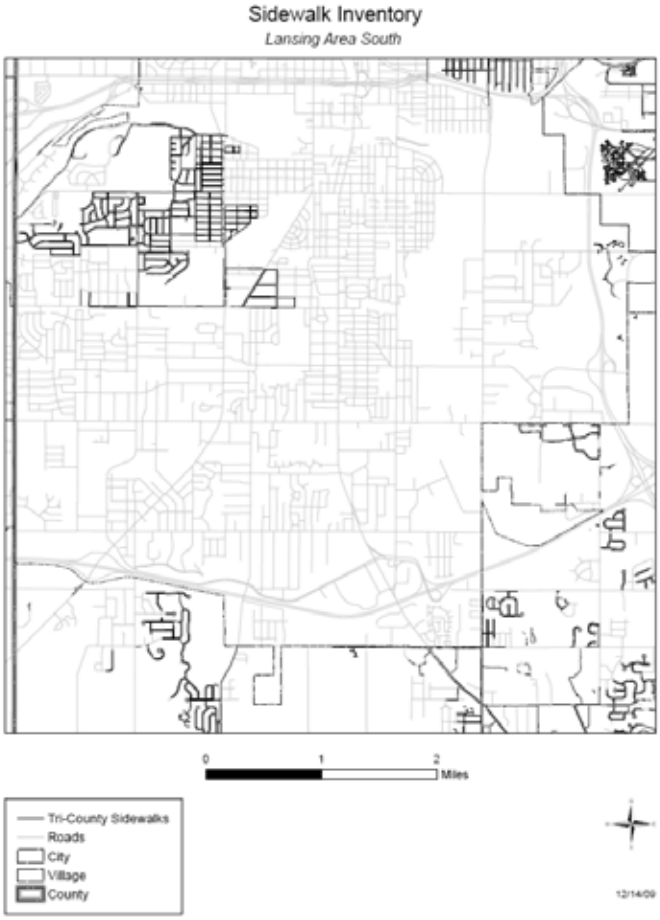


# Montana

**Project Title:** Envision Missoula

**Sponsor:** Missoula Office of Planning and Grants

**Completion Date:** 2008

**Planning Horizon**: 2035

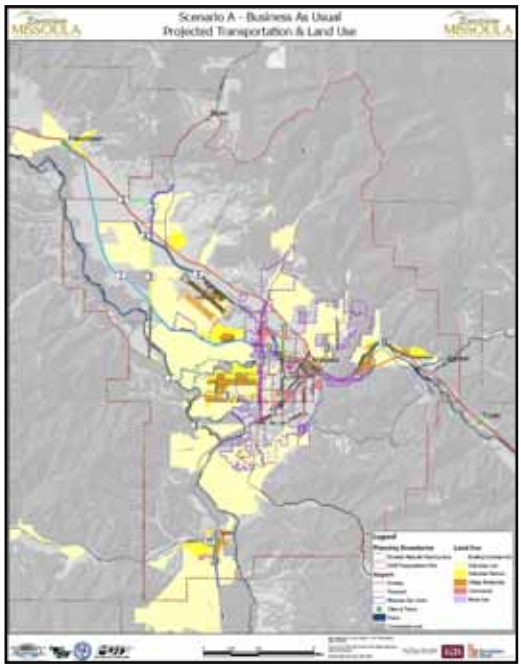
**Source**: Envision Missoula Report

Envision Missoula is the name of a planning process used by the Missoula Office of Planning and Grants, the region's MPO, to update its long-range transportation plan. Through this process, the agency sought to conduct research and engage the public in a visioning exercise and a system analysis leading to the development of a preferred long term "mobility architecture" for the Missoula region.

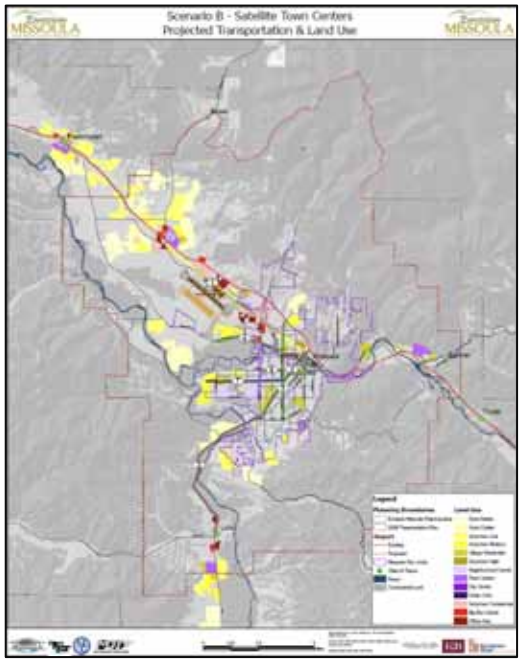
<u>The nature of the scenarios</u>

To accomplish this task, the agency considered three unique development scenarios.

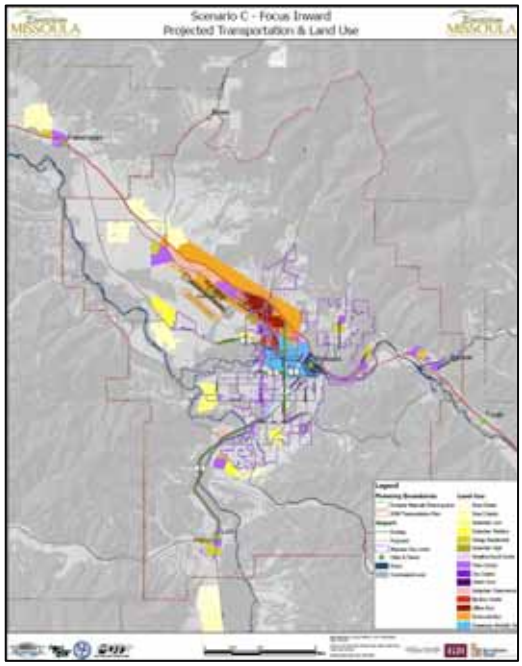
**Business as Usual Scenario:** The Business as Usual Scenario assumes that land and transportation infrastructure are developed in a manner consistent with trends over the last 20 years, with an emphasis on increased roadway capacity improvements supporting the development of additional land in currently undeveloped areas. The scenario favors roadway expansion and the availability of new land over multi-modalism and higher density development. While currently committed transit improvements are assumed in this scenario, the purpose of the scenario is to explore the requirements a focus on roadway expansion and lower density development may place on Missoula's transportation system.



**Suburban Satellites:** This scenario would integrate additional multi-modal transit facilities into Missoula's existing urban pattern, allowing for efficient transition points between various modes, as people park cars and bikes and walk before taking advantage of transit. Transportation investments would be channeled and selected to account for the demands and requirements associated with a denser mix of shoppers, workers, and residents utilizing these corridors. While committed roadway improvements are assumed in this scenario, the purpose of the scenario is to explore the potential of concerted land and infrastructure development along higher density corridors oriented towards transit. This future seeks to manage travel demand by concentrating activities in town centers in different areas of the region. The town centers are connected by multi-modal corridors, which often follow existing rail lines.

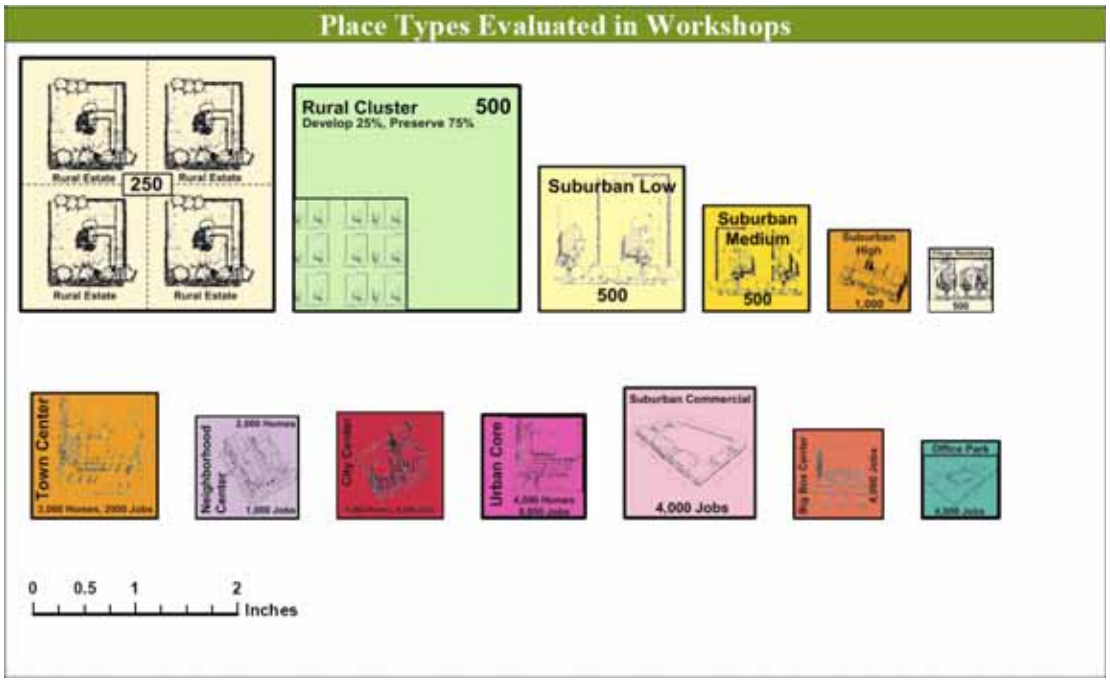



**Focus Inward:** The Focus Inward scenario seeks to manage travel demand by bringing activities together into one highly concentrated downtown area. Unlike the Suburban Satellites scenario, the Focus Inward scenario does not assume the development of town centers throughout the region. Instead, the scenario considers only one corridor from Lolo to the Montana Rail Link Apex in downtown Missoula, concentrating the remainder of investment into a densely developed In-town Mobility District.




<u>The evaluation process</u>

The Business as Usual scenario was crafted based on the judgments of professionals and other citizens familiar with existing trends in land use and transportation in the region. The other two scenarios were constructed based on the output from public visioning workshops where participants used a "growth chip game" to allocate future development and transportation facilities. The growth chips used for this process are depicted below.




All three scenarios were assessed for their performance on traditional transportation planning indices, including vehicle miles traveled and vehicle hours traveled. These were generated using the Montana Department of Transportation's travel demand model, which includes the following Smart Growth model components:

| Smart Growth Model Feature | |
|---|---|
| Daily vehicle trip model | X |
| Modeling peak period as well as daily travel | X |
| Simple mode choice model (that separates transit and highway trips) | X |
| Income stratification in distribution and mode choice models | X |
| Auto ownership modeling sensitive to land use characteristics | X |

Instead of gearing the analysis toward any particular planning horizon date (like 2035), the agency used the "next 100,000 residents of Missoula"—essentially, a doubling of the region's current population—as the study's frame of reference. This was done to avoid possible irreversible decisions that might fall from a study using an artificially narrow time frame—decisions that could be regretted further into the future. For example, the study report uses the hypothetical of railroad corridors being sold for development because the region during the planning horizon (20 years, for example) might not be mature enough for passenger rail, but could be 10 or 15 years after that timeframe, well after the corridors had been sold off.

Evaluation results

Quantitative information from the analysis shows the following:

| | Scenario | | |
|---|---|---|---|
| | **BAU** | **Satellites** | **Focus** |
| Square miles consumed by new development | 58.9 | 12.3 | 0.3 |
| Percent development in mixed use areas | | | |
| Housing | 0.4% | 48% | 74.3% |
| Employment | 10.1% | 27.3% | 59.2% |
| New lane miles of roads | 143 | 42 | 42 |
| Miles of bus rapid transit | 0 | 23 | 19 |
| Average daily vehicle miles of travel (thousands) | 10,046 | 10,125 | 8,496 |
| Average daily vehicle hours of travel | 712,523 | 965,596 | 364,444 |
| Congested lane miles | 970 | 963 | 959 |

The data indicate a notable decrease in vehicle miles traveled associated with the Focus Inward scenario (−15.4% compared to the BAU scenario). Even more striking is the scenario's drop in vehicle hours traveled (−48.9%). Study authors attribute these results primarily to the Focus Inward scenario's near complete reliance on infill and redevelopment to accommodate new growth and its emphasis on mixed-use development patterns: "By bringing origins and destinations closer together, the Focus Inward future is likely to reduce the length of trips in Missoula, effectively reducing vehicle miles and hours of travel more effectively than any other future considered in this Envision Missoula Report."

In addition to the quantitative information, a qualitative assessment of scenario strengths, trade-offs, and potential obstacles was also used to compare scenario performance.

| | Key Strategies | Unique Features | Trade Offs | Potential Obstacles |
|---|---|---|---|---|
| **Business as Usual** | • Invest in roadway expansion<br>• Target known high-growth areas<br>• Do not depend on growth management | • The most dependent on costly right-of-way and new infrastructure<br>• Significantly increased roadway capacity<br>• Independent of local planning and zoning<br>• Makes more land available for new development than other scenarios | • Expanded roadways over modal balance and choice<br>• Expansion over modernization and preservation | • Heavily dependent on costly roadway expansion<br>• May not be financially feasible<br>• Fewer modal alternatives, potential air quality conformity problems |
| **Suburban Satellites** | • Invest in selected corridors<br>• Concentrate on<br>○ Preservation<br>○ Modernization<br>○ Operations<br>○ Multi-Modal Improvements<br>• Limit System Expansion<br>• Rely on local planning and zoning. | • Four distinct Multi-Modal Corridors<br>• The most investment in Transit<br>• The most geographic balance | • Key corridors over downtown<br>• Preservation, modernization and Multi-Modal over roadway expansion.<br>• Town centers over downtown or new low-density development. | • Highly dependent on local planning and zoning<br>• Dependent on non-roadway funding<br>○ Local funds<br>○ Federal Enhancements funding<br>○ Other non-roadway programs |
| **Focus Inward** | • Invest Heavily in Downtown<br>• Select One Multi-Modal Corridor<br>○ Missoula to Lolo<br>• Limit System Expansion<br>• Rely on local planning and zoning<br>• Possible linkage to current rail feasibility study (Missoula to Lolo) | • In-town Mobility District<br>• The shortest trips<br>• The highest density of development<br>• The most pedestrian- and bicycle-friendly<br>• Possible linkage to downtown streets plan and downtown Master Plan | • Downtown over geographic balance<br>• Preservation, modernization and Multi-Modal over roadway expansion | • Highly dependent on local planning and zoning<br>• Dependent on non-roadway funding<br>○ Local funds<br>○ Federal Enhancements funding<br>○ Other non-roadway programs |

Elected official participation/public involvement

The project's first round of public involvement consisted of three public visioning workshops, where more than 280 participants were given the chance to identify possible ways to accommodate future growth. In addition to providing the grist for the three scenarios outlined above, the output of the workshops indicated significant public support for using land use policies to manage travel demand. Participants also signaled support for expanded transit services and a pedestrian-friendly downtown.

Analysis of the three scenarios was presented at a Missoula Transportation Planning Summit, where participants used real-time keypad polling to register their reactions to the scenarios. Participants indicated a marked preference (approximately 67%) for the Focus Inward scenario. Consistent with that result, they also showed

- A strong desire for the development of town centers;
- Support for inward growth;
- A desire for development and infrastructure to focus on existing neighborhoods;
- A preference for a denser and larger downtown in Missoula;
- A desire for a greater incidence of attached and multi-unit homes; and
- A desire for policies to encourage development near public transportation

Resulting actions

This feedback, in conjunction with the results of a telephone survey and input from public agency officials, provided the basis for selecting the Focus Inward scenario as the basis for a preferred regional vision, leading to a series of demand management and transportation investment strategies, which together comprise the region's Mobility Architecture. These elements were then incorporated into the region's long-range plan, which was adopted at the end of 2008.

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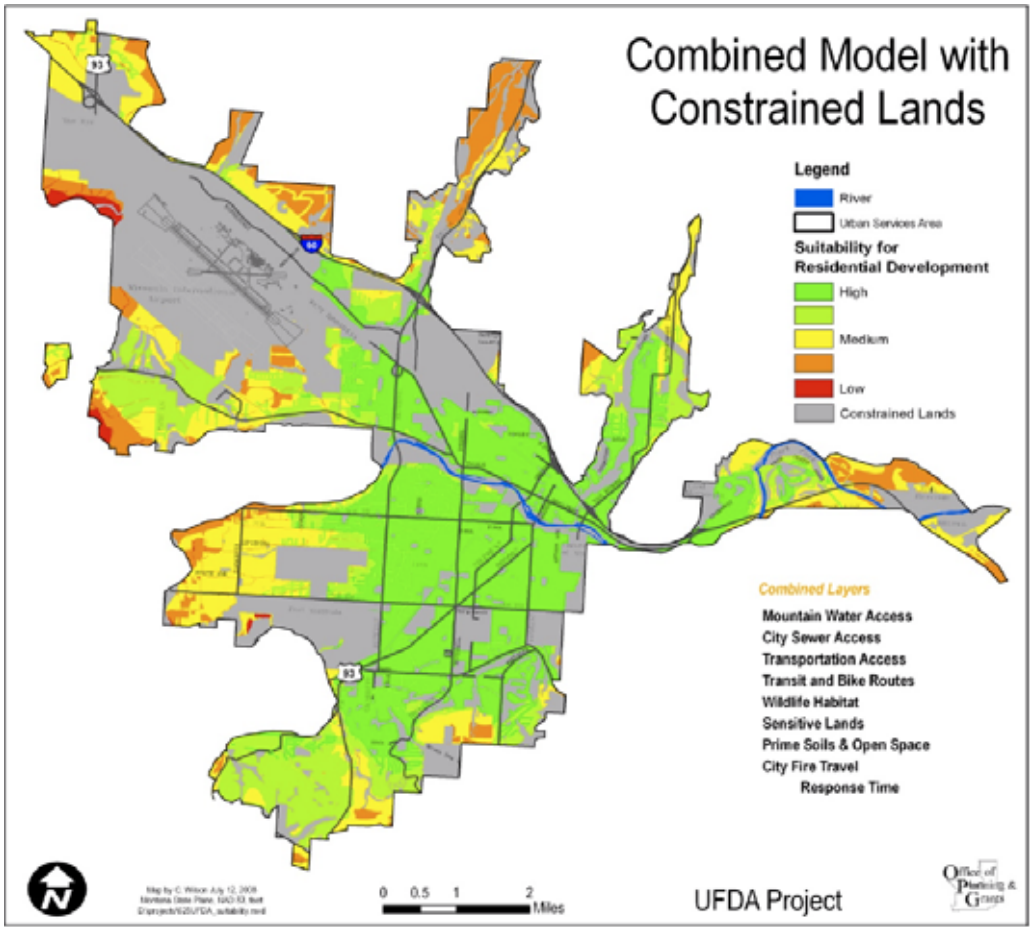
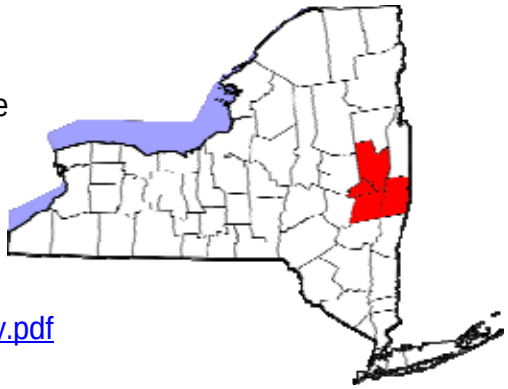


# New York



**Project Title:** New Visions 2030

**Sponsor:** Capital District Transportation Committee

**Completion Date:** 2007

**Planning Horizon**: 2030

**Source**: http://www.cdtcmpo.org/rtp2030/summary.pdf

The Capital District Transportation Committee (CDTC) is the MPO for the Albany-Troy-Schenectady region. Since the mid-1990s, CDTC has used some form of land use-transportation scenario analysis to guide updates to the region's long-range transportation plan. This practice has stemmed from a long-standing interest among stakeholders and citizens to address development patterns as part of the transportation planning process. A particular concern driving the New Visions planning process is the phenomenon the Brookings Institution calls "Sprawl without Growth: The Update Paradox"—high rates of land consumption but low rates of population growth. According to Brookings, the whole upstate New York area grew by 30% in developed area between 1982 and 1997, while its population grew only 2.6%, effectively reducing the density of the built environment by 21%. The CDTC launched the New Visions planning process in 1993 to address the land/population growth mismatch and the negative impacts the mismatch was having on land availability, transportation demand, and environmental values.

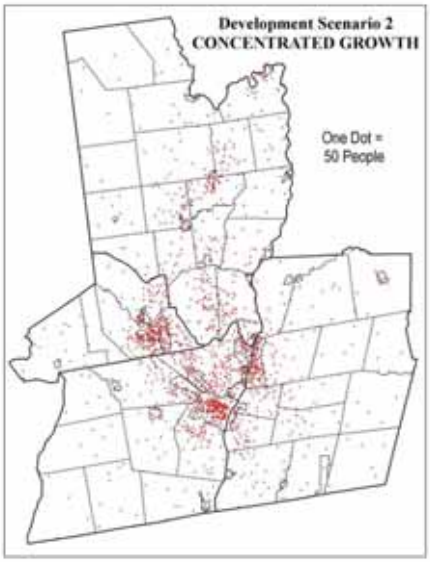
The initial New Visions process, completed in 1997, focused on 2015 as the planning horizon. The most recent update, finished in 2007, uses 2030 as its horizon.

<u>The nature of the scenarios</u>

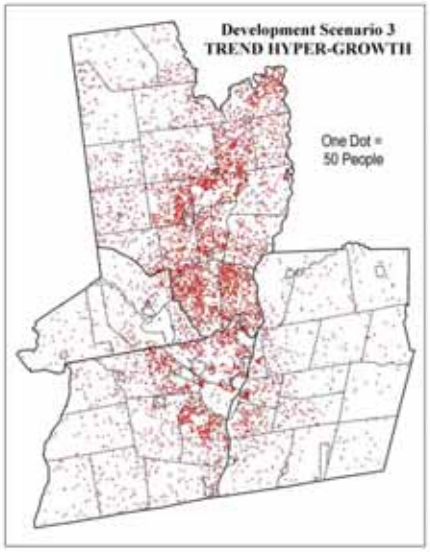
The scenarios developed for this revision of the New Visions plan tested two variations in growth rates, with two different spatial distributions for each growth assumption.

**Status Quo Trend:** This is the baseline forecast (9% growth in population, 15% growth in households by 2030, current development patterns continuing), which is distributed by extending recent past development trends. This is the official forecast, and can be considered the most likely based on past trends.

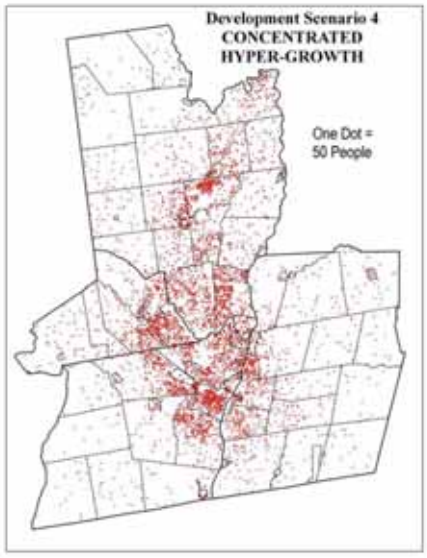
**Concentrated Growth:** The Concentrated Growth Scenario assumes the baseline growth rate from the Status Quo Trend Scenario, but the growth is applied to each traffic analysis zone (TAZ) in proportion to the existing population. This effectively constrains the outward spread of growth and concentrates development in existing urbanized areas.




**Trend Hyper-Growth:** This scenario examines the regional growth patterns that could result if the region grew at the same rate of growth as projected for the United Stated as a whole from 2000 to 2040 (29% population growth and 35% household growth by 2030). The scenario distributes the growth within each county based on the proportional share of growth each county is projected to receive under baseline projections. The spatial distribution is also constrained by density caps and environmental limitations. The general effect of this scenario is an extensive spread of growth into currently undeveloped areas and minimal growth in older urban areas.




**Concentrated Hyper-Growth:** This scenario explores the regional growth patterns that could result if the region grew at the same rate of growth as projected for the United Stated as a whole from 2000 to 2040. However, instead of distributing the growth within each county proportionate to baseline projections, the growth in each TAZ would be scaled in proportion to the overall regional rates of projected growth. The distribution of growth is constrained by environmental factors; however, no density caps are applied. The general effect of this scenario is a large amount of the regional growth is concentrated, at higher densities, in the already developed and the newly developed areas within the region.




Apart from the factors explicitly used to craft the scenarios, the agency staff acknowledges that there are many other forces that could influence growth amounts and distribution: “There are a number of trends taking shape in the U.S., which may be considered potential harbingers of future conditions

that will affect land use patterns. These trends may already be taking place in some parts of the country and may eventually see more widespread manifestation in the Capital District. There are also several global trends that have the potential to greatly shape land use patterns in the future." Among these trends, the factor identified as having the greatest potential impact is peak oil.

The evaluation process

CDTC began the scenario drafting process by projecting forward recent development trends, creating the Status Quo Trend Scenario. This was accomplished using a two-stage population projection model that first uses log-linear regression projections of historic census data and census bureau growth estimates, and then adjusts the projections using a series of qualitative judgments of the likelihood and extent of future population change within particular jurisdictions. The resulting projections were then allocated to the region's 925 TAZs using historic TAZ distributions within each municipality. The growth allocations for the three alternative scenarios were then constructed, using the assumptions listing the scenario descriptions above.

The calculation of the scenario's transportation impacts were derived from the CDTC's Systematic Traffic Evaluation and Planning Model (STEP model). Using VISUM software, the regional model directly generated p.m. peak hour VMT and speed data representative of existing land use, traffic, and highway network conditions. The Smart Growth components of the model are represented in the following table:

| **Smart Growth Model Feature** | |
|---|---|
| Daily vehicle trip model | X |
| Modeling peak period as well as daily travel | X |
| Travel time feedback loops between model components | X |

Evaluation results

By definition, the Status Quo Trend and Trend Hyper-Growth scenarios would continue the highly dispersed suburban growth pattern of recent decades—in the Status Quo Trend Scenario, only 10% of future growth would occur within existing cities and villages. Under the Concentrated Growth and Concentrated Hyper-Growth scenarios, substantially higher percentages of population growth would locate in historic centers, much of it reoccupying grey- and brown-field sites. However, even with these levels of concentrated growth, population of the region's traditional central cities would not still not equal their historic, mid-twentieth century levels. The Concentrated Growth/Hyper-Growth scenarios would conserve approximately 20,375 acres, compared to the Status Quo Trend. In addition to protecting potentially sensitive lands and farmland, this would reduce the need for costly infrastructure improvements.

| | Scenario | | | |
|---|---|---|---|---|
| | **Status Quo Trend** | **Concentrated Growth** | **Trend Hyper** | **Concentrated Hyper** |
| Total 2030 population | 867,000 | 867,000 | 1,023,634 | 1,023,633 |
| Total developed acres | 154,549 | 140,898 | 260,855 | 191,657 |
| Daily vehicle miles (millions) | 2.03 | 1.89 | 2.39 | 2.16 |
| Daily vehicle hours | 65,195 | 57,958 | 85,303 | 74,954 |
| Daily hours of delay | 9,065 | 6,531 | 16,722 | 13,649 |

In addition to these quantitative assessments, the project report provides a qualitative analysis of the possible impacts of peak oil:

> If oil and gas remain widely available and relatively inexpensive, this would also support the likelihood of [the Status Quo Trend and Trend Hyper-Growth] scenarios. However, if oil becomes scarce, and its price subsequently skyrockets, then we will have no choice but to significantly alter the manner in which we build and travel. Non-motor travel, such as walking and biking, will become more common. We will need to live close to where we work, while the kind of work we do will likely change dramatically. We will need to assemble our entire built environment much closer together, at higher densities, to try and eliminate long distance travel for everyday tasks. We will also be forced to localize our economy, including producing much of our food from within the local region. Under these conditions, "Growth Scenario 2 – Concentrated Growth" would likely be closest to representing the kind of land development pattern that would result.

Elected Official Participation/Public Involvement

Public engagement for the 2030 New Visions plan was organized and carried out via a series of task forces, committees, and programs. This multi-faceted approach made use of a joint task force in conjunction with the Capital District Regional Planning Commission; a roundtable with local government leaders, corporate CEOs, and university presidents; a region-wide coalition of faith, neighborhood, and labor-based organizations; a technical planning committee from local, state, and federal agencies; a variety of task forces assigned to specific issues with membership drawn from a wide range of interests; and a unique Community and Transportation Planning Linkage Program that funds small-scale citizen-based studies throughout the region. These activities were in addition to the more customary slate of public meetings, presentations, mailings, surveys, and newsletters.

Resulting actions

The central finding of the 2030 New Visions update confirms earlier versions of the plan: "the positive benefits of concentrated development patterns are significant for the transportation system and for regional quality of life." The plan, hence, prioritizes transportation investments that support urban reinvestment and work to achieve a set of specified regional goals:

- Encourage sustainable economic growth with good-paying jobs;
- Revitalize urban areas;
- Help build community structure in growing suburbs;
- Preserve open space and agricultural land;
- Make communities more walkable and livable;
- Provide meaningful transit options;
- Connect all residents with job opportunities;
- Mitigate growing congestion and maintain reasonable mobility on the highway system; and,
- Encourage land use and transportation planning.

The 2030 version of New Visions carries forward the 25 New Visions Principles from the earlier versions of the plan. These principles cluster around six basic themes: system preservation first, demand management, jurisdiction blind investments, transportation investment as a tool, link land use and transportation, and plan and build for all modes. To these principles, the 2030 update adds six new principles addressing safety, security, consideration of roundabouts, community context, capacity management, and environmental stewardship.

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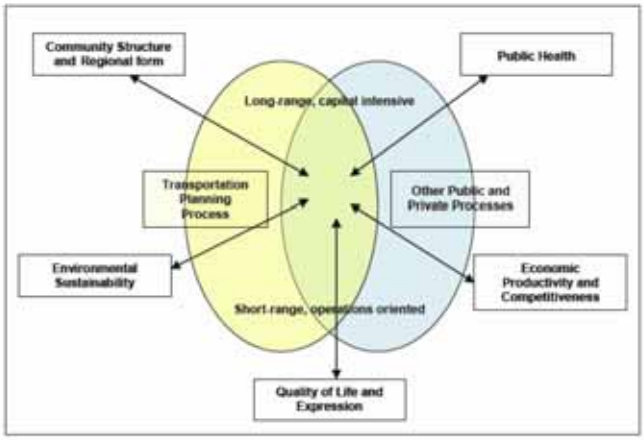
A Holistic View of Transportation Planning



**Project Title:** Transportation Tomorrow: 2030 Placemaking for Prosperity

**Sponsor:** Binghamton Metropolitan Transportation Study

**Completion Date:** 2005

**Planning Horizon**: 2030

**Source**: http://bmtsonline.com/files/bmts/pdfs/TransportationTomorrow2030.pdf

Since the mid-1980s, the population of the Binghamton metro area has been slowly declining. The region has, nevertheless, seen continued suburban growth in both housing and commercial development. This has created what might be called a 'hollowing of the core'. The City of Binghamton, for example, has seen its population decline from 53,008 in 1990 to 47,380 in 2000, while the suburban Town of Vestal stayed essentially flat for the same period. Similarly, while Binghamton lost over 800 housing units during that decade, the suburban towns showed a slight growth. Similarly, shopping centers in the core communities have lost most major tenants while new retail centers have been developed in the suburban towns. Taken together, these trends mean that the property tax base in the core municipalities is shrinking. The population that remains in these areas, however, is getting older faster than the overall region. The implication is that if these trends were to continue, there will be an ever greater demand for public services in the urban core communities, and a declining ability to finance those services. Total employment in the region shows declines commensurate to those in population.

The nature of the scenarios

Given these contexts, the Binghamton Metropolitan Transportation Study (BMTS) engaged in a scenario-based community visioning process that sought to "create a successful region without growth." This led to the idea of "placemaking for prosperity" in which transportation investments "contribute to a quality of life that will create a successful community." To more fully explore these themes, BMTS used two primary variables as the basis for scenario construction: the amount of growth (some growth vs. no growth) and the location of development in the region (inward vs. outward).

Under **No Growth** conditions, population loss continues, similar to recent trends, over the first five years of the study period. This would be followed by a leveling off to a zero growth rate for the remainder of the study horizon.

The **Growth** assumptions, on the other hand, begin with a flat population level for the first five years, followed by some degree of population growth through the rest of the planning period. The level of that growth was an issue for study participants, with forecasts indicating a possible growth range of 10,000 to 50,000 people. BTMS ultimately selected the bottom end of this range for the study.

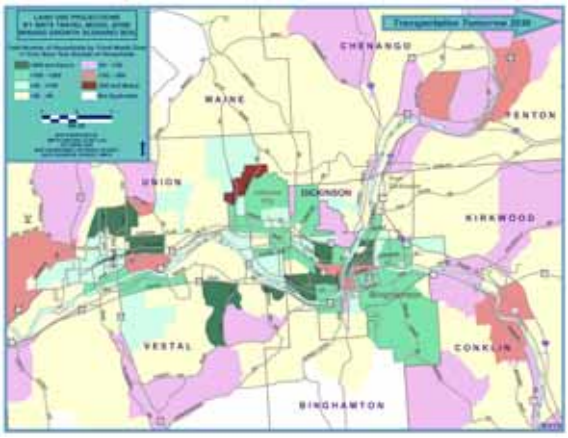
The location of growth under **Moving Outward** conditions reflects a continuation of recent suburban development trends. The expectations are that commercial and retail development would continue to happen almost exclusively in suburban locations, while core communities would continue to lose population and economic activity.

The **Moving Inward** assumption, on the other hand, would reverse these trends with a certain level of development and redevelopment occurring in central communities. While it is not expected that interest in suburban development would stop entirely, these conditions assume that properly targeted investment of public resources would effectively redirect industrial and commercial development toward core locations.

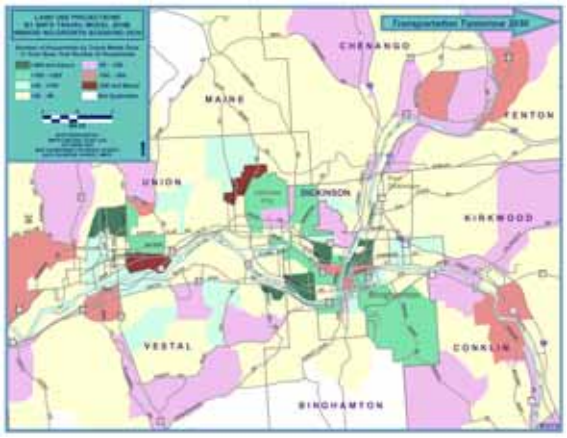
Using these four sets of assumptions in a 2 x 2 matrix, BMTS created four scenarios that paired up the two levels of growth with each of the two location variables.

| | ←INWARD--URBAN FORM – OUTWARD → | |
|---|---|---|
| ↕ NO GROWTH POPULATION FORECAST GROWTH | INWARD NO-GROWTH | OUTWARD NO-GROWTH |
| | INWARD GROWTH | OUTWARD GROWTH |

Household Location




Inward Growth Scenario




Inward No-Growth Scenario

The evaluation process

Study consultants used the land use model CorPlan to estimate the development patterns and land use impacts of the scenarios versions of the urban form variable (inward and outward) with the different levels of population growth.

| SCENARIO EVALUATION CRITERIA | MOVING OUTWARD | | MOVING INWARD | |
|---|---|---|---|---|
| | POPULATION NO-GROWTH | POPULATION GROWTH | POPULATION NO-GROWTH | POPULATION GROWTH |
| % regional employment in CBDs | 63 | 53 | 72 | 78 |
| % housing in CBDs, enhanced neighborhoods | 53 | 52 | 65 | 69 |
| Diversity of housing types (%SFDU/%MFDU) | 61/39 | 57/43 | 38/62 | 50/50 |
| % population withing 5 minute walk of existing schools | 27 | 25 | 32 | 31 |
| Acres of greenfield developed | 500 | 3000 | 125 | 175 |
| Acres of brownfield developed | 0 | 85 | 0 | 130 |

The model estimates, presented in the table above, provided the basis for a consensus among study participants to move forward with the Inward-based scenarios, which were then translated into usable form for travel demand modeling. The BMTS Regional Traffic Model is built on a VISUM™ software platform and utilizes 7 trip types. Trip distribution uses a gravity-based sub-model with differing parameters for each trip type, reflecting the variance in average trip length for each trip type. The model uses PM peak-hour skims with congested travel times (and to a much lesser extent, trip length) as the impedance component for travel demand cost modeling and route choice during the trip assignment step. Assignment travel times are fed back to the distribution phase. No mode choice model is currently used.

| **Smart Growth Model Feature** | |
|---|---|
| Modeling peak period as well as daily travel | X |
| Supply & demand model equilibration | X |
| Auto ownership modeling sensitive to land use characteristics | X |
| Travel time feedback loops between model components | X |

BMTS modeled each of the Inward scenarios (both growth and no-growth versions) with each of two transportation networks: a “no-build” network including only current facilities and a “build” network consisting of current facilities plus those from the proposed plan that are likely to be constructed during the planning horizon.

Evaluation results

| | Scenario | | | |
|---|---|---|---|---|
| | **No-Growth/ No-Build** | **No-Growth/ Build** | **Growth/ No-Build** | **Growth/ Build** |
| 2030 population | 187,721 | 187,721 | 197,700 | 197,700 |
| 2030 employment | 96,360 | 96,360 | 102,260 | 102,206 |
| Roadway miles | 340.77 | 342.07 | 340.77 | 342.07 |
| Dwelling units per acre | 2.69 | 2.69 | 2.84 | 2.84 |
| Percent within ½ mile of transit | | | | |
| Dwelling units | 71.8% | 71.8% | 72.9% | 72.9% |
| Employment | 77.5% | 77.5% | 79.2% | 79.2 |
| Daily VMT | 5,504,103 | 5,493,435 | 5,980,907 | 5,992,215 |

Elected official participation/public involvement

The process used to develop the Transportation Tomorrow plan included a series of monthly public workshops that were publicized by the local news media, the use of the BMTS web site to disseminate information and collect feedback at each stage of the plan's development, and numerous mailings to the agency's public involvement mailing list. In addition, elected officials were involved throughout the process, as were other organizations like the Broome County Environmental Management Council and the Broome County Planning and Economic Development Advisory Board. Others, like the Greater Binghamton Coalition, which represents the region's business community, were represented directly on the Community Vision Team that was created to guide the Plan.

Resulting actions

The BMTS Policy Committee adopted the Transportation Tomorrow plan at the end of the study process in 2005. The plan includes numerous implementation steps, including transportation investments, economic development strategies, and the proposed creation of a Land Use Partnership with local governments in the region.

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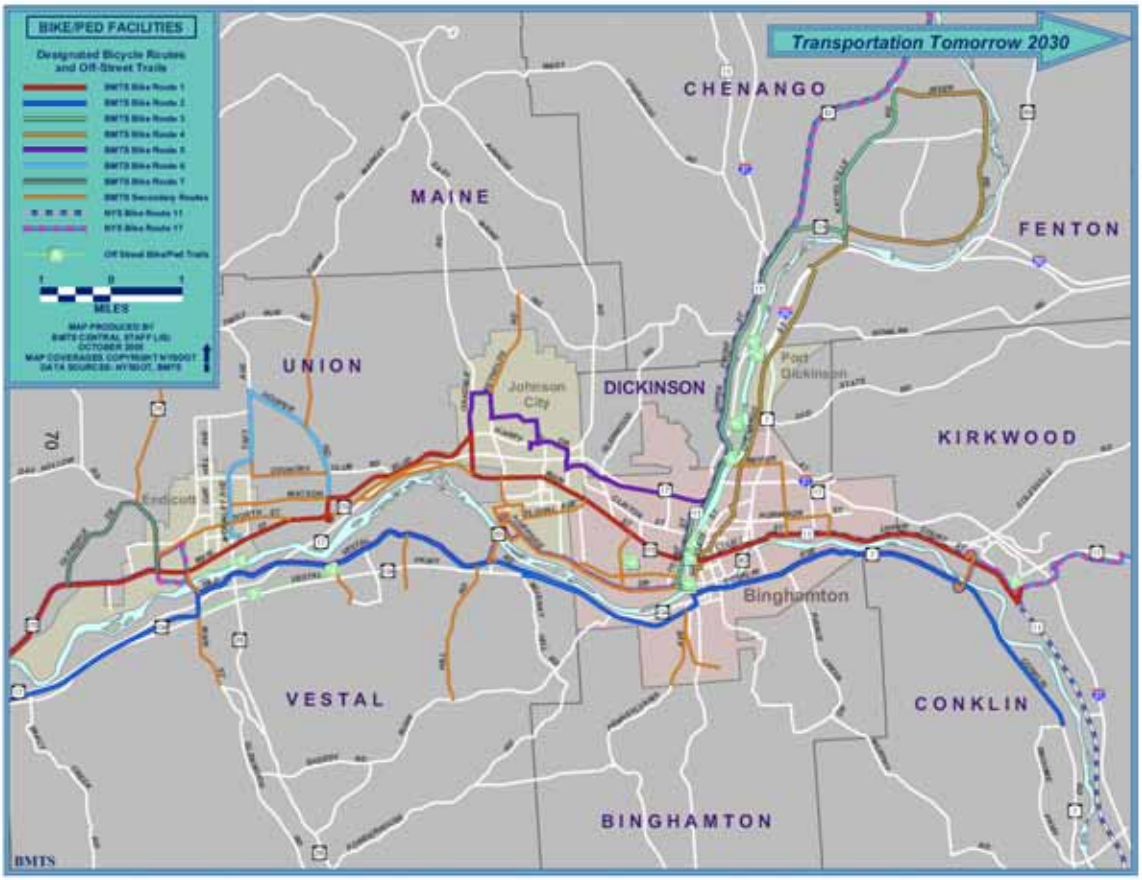
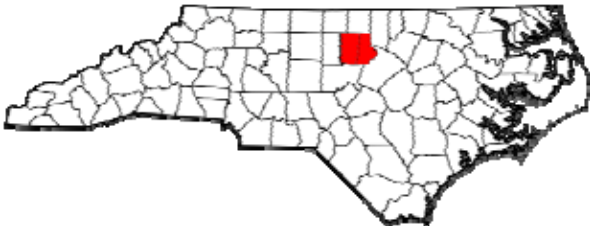


# North Carolina



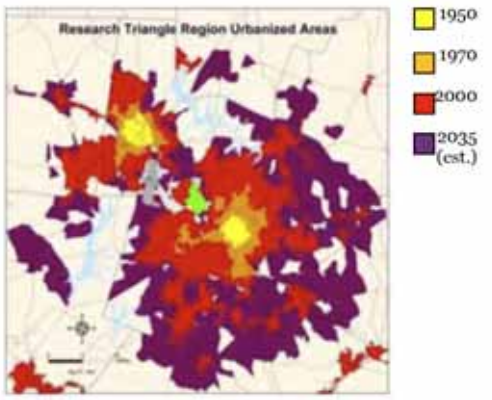
**Project Title:** 2035 Long Range Transportation Plan Alternatives Analysis Report

**Sponsor:** Durham-Chapel Hill-Carrboro Metropolitan Planning Organization

**Completion Date:** 2009

**Planning Horizon**: 2035

**Source**: http://www.dchcmpo.org/index.php?option=com_content&task=view&id=66&Itemid=35




The Research Triangle Area of North Carolina is one of the nation's most sprawling regions. Current forecasts project both continued outward growth and infill development in selected locations, most notably in the central parts of Raleigh, Durham and Chapel Hill. A key challenge for the region is to match its vision for how the communities should grow with the transportation investments needed to support this growth. This challenge is set against significant demographic changes expected to occur in coming decades: the population is aging, more households will be composed of single person and two-person households without children, the number of households without cars is increasing, and more people are interested in living in more compact neighborhoods with a mix of activities. The 2035 Long Range Transportation Plan is, hence, driven by the need to create a wider range of mobility choices for the region's changing needs. The plan is the result of the combined efforts of two MPOs—the Durham-Chapel Hill-Carrboro MPO (DCHC) and the Capital Area MPO (CAMPO). This summary focuses on the scenario analysis conducted by the DCHC in support of the broader plan eventually crafted and adopted by the two MPOs.

<u>The nature of the scenarios</u>

Each scenario considered in the analysis was comprised of a set of transportation system components and one of several land use growth allocations. To create these scenarios, DCHC staff first established a "palate" of six transportation system packages and five land use allocation patterns. The transportation system packages included:

**Adopted 2030 LRTP:** This package assumes regional transportation systems with the projects from the current adopted long range plan. Those projects include 518 additional highway and arterial lane miles, HOV/HOT on I-40, light rail between Durham and Raleigh, fixed guideway transit from Durham to Chapel Hill, and major bus expansion and improvements.

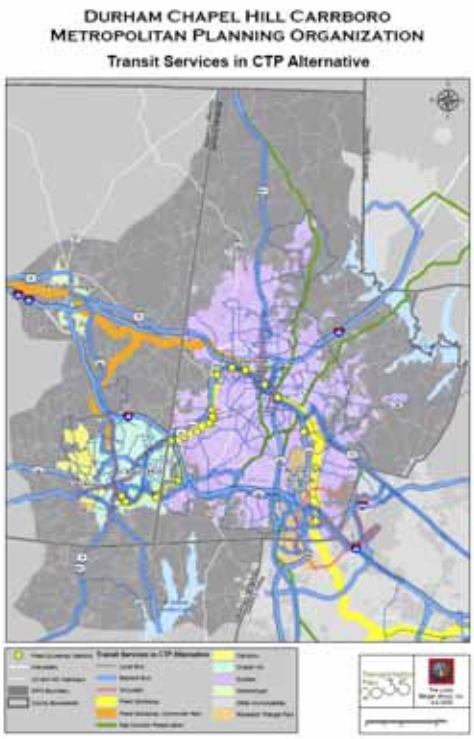
**Comprehensive Transportation Plan:** This package is comprised of the non-fiscally constrained transportation plan required by state law. It includes 703 additional highway lane miles, expanded HOV/HOT lanes (compared to the 2030 plan), the same light rail and fixed guideway transit as the 2030 plan, and more frequent bus service than the 2030 plan.

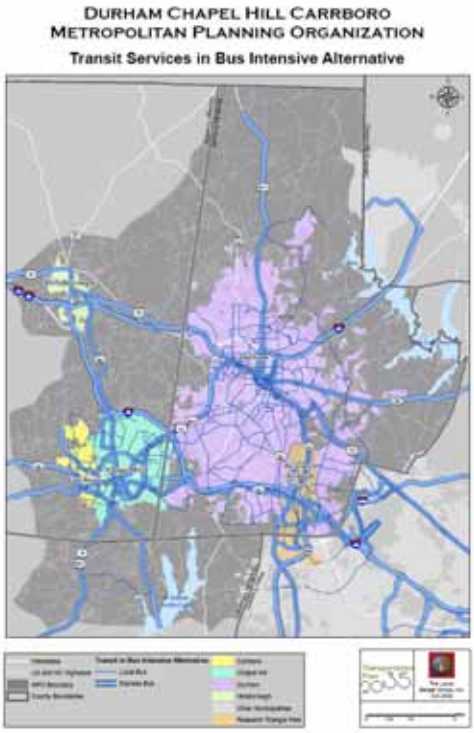
**Intensive Highway:** This package includes 665 additional highway lane miles, some HOV/HOT lanes, no rail/fixed guideway transit, and less bus service than the 2030 plan.

**Intensive Fixed Guideway:** In this package, there are 276 additional highway lane miles, no HOV/HOT, and the rail/fixed guideway and many of the bus elements from the Comprehensive Plan package.

**Intensive Bus Transit:** The Intensive Bus Transit package includes 324 additional highway lane miles, limited HOV/HOT, and most of the bus improvements from the Comprehensive Plan package, but no rail/fixed guideway facilities.

**Moderate Multimodal:** This package includes 285 additional lane miles, no HOV/HOT, commuter rail from Burlington to Raleigh and from Selma to Durham, and less bus service than in the 2030 plan.



The alternative land use allocations included the following:

**Baseline:** The Baseline allocation assumes that land is developed through 2035 in a manner consistent with the adopted land use plans, policies, and official actions of MPO jurisdictions.

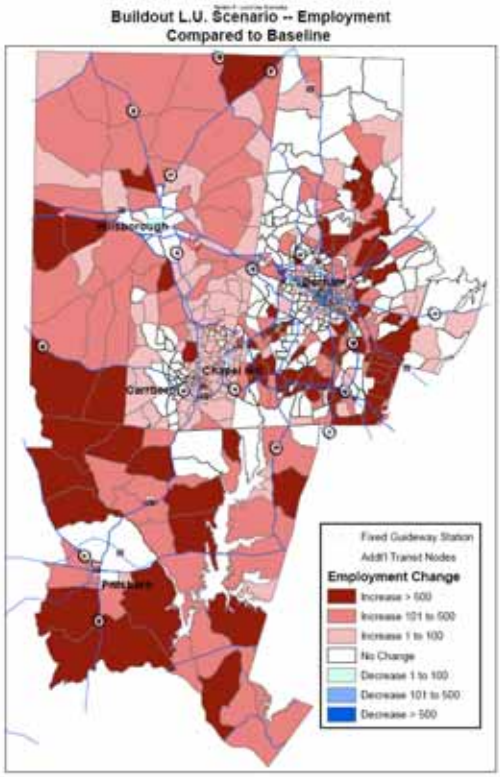
**Build-out:** The Build-out allocation uses the same basic assumptions as the Baseline allocation, but fully develops areas to their current planning and zoning capacities. It is assumed that this would occur well beyond the 2035 timeframe.

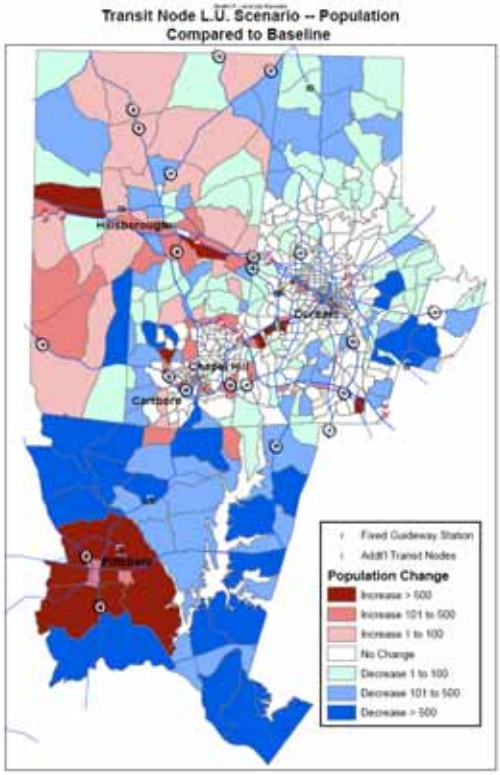
**Constrained Growth:** This allocation assumes that long range land use plans and development regulations would be changed to scale down the amount of new development allowed each year.

**Travel Corridors:** In this allocation, the same amount of growth is assumed as in the Baseline option, but is focused along major arterials.

**Transit Nodes:** Like the travel corridors option, this allocation assumes the same amount of growth as the baseline option, but focuses it into transit-oriented compact neighborhoods.

After the articulation of these transportation and land use components, agency staff mixed and matched the elements to create 15 different integrated land use-transportation scenarios.



## The evaluation process

DCHC staff measured the scenarios for their relative and absolute impacts on mobility, travel time, congestion, mode choice, air quality, fiscal viability, and environmental justice. The primary tool used in making these measurements was the region's travel demand model, TransCAD v4-2008, which is described by the agency as "an advanced four-step model." The Smart Growth components in the model include:

| **Smart Growth Model Feature** | |
|---|---|
| Daily vehicle trip model | X |
| Modeling peak period as well as daily travel | X |
| Simple mode choice model (that separates transit and highway trips) | X |
| Transit network & assignment of daily trips to that network | X |
| Supply & demand model equilibration | X |
| Income stratification in distribution and mode choice models | X |
| Travel time feedback loops between model components | X |
| Modeling multiple modes of access to transit (e.g., ped. vs. park and ride) | X |
| Trip distribution sensitive to multi-mode options | X |
| Disaggregate simulation of households | X |

## Evaluation results

| Scenario | Lane Miles | Density (pop/sq. mi.) | Vehicle Miles (000's) | Hours of Delay |
|---|---|---|---|---|
| Comprehensive Plan | | | | |
| with Baseline | 703 | 2,631 | 17,204 | 54,365 |
| with Build-out | | 4,754 | 25,987 | 228,383 |
| Intensive Highway | | | | |
| with Baseline | 665 | 2,631 | 17,703 | 58,666 |
| with Constrained Growth | | 2,561 | 16,185 | 43,854 |
| with Travel Corridors | | 2,925 | 17,533 | 58,308 |
| Intensive Fixed Guideway | | | | |
| with Baseline | 276 | 2,631 | 17,334 | 81,929 |
| with Travel Corridors | | 2,925 | 17,188 | 81,070 |
| with Transit Nodes | | 2,759 | 17, 302 | 84,689 |
| Intensive Bus | | | | |
| with Baseline | 324 | 2,631 | 17,366 | 82,216 |
| with Travel Corridors | | 2,925 | 17,254 | 82,189 |
| with Transit Nodes | | 2,759 | 17,364 | 86,015 |
| Moderate Multimodal | | | | |
| with Baseline | 285 | 2,631 | 17,264 | 79,980 |
| with Travel Corridors | | 2,925 | 17,323 | 78,604 |
| with Transit Nodes | | 2,759 | 17,103 | 79,018 |

In addition to the quantitative data in the table above, analysis of the scenarios included graphic representations of congestion levels on the region's highway systems. The congestion maps, like the one illustrated to the left, depict varying levels of volume to capacity (V/C) ratios, with yellow indicating V/C levels approaching 1.0 (some delay), purple indicating V/C over 1.0 (frequent delays; level of service E), and red depicting V/C greater than 1.1, which are described in the 2035 LRTP as unacceptable levels of delay. The LRTP places particular emphasis on the map for the Existing and Committed transportation network (those projects either on the ground or with secured funding), paired with the Baseline land use allocation. The importance of this map is that it helps to answer the question: "When we make our next transportation investment decision, where do we need to focus our investment?"

Elected official participation/public involvement

Extensive input and coordination activities were used to develop the 2035 LRTP. These activities included both regional coordination efforts between DCHC and its companion MPO, the Capital Area MPO (CAMPO), and involvement of the public and local elected officials by each MPO. The breadth of these activities is summarized in the table to the right, where each category of activity is classified either by the date of completion for each MPO, a check mark to indicate the completion of a series of tasks, or a dashed line, signifying the activity was not included in the public involvement plan.

| | Activity | | | | |
|---|---|---|---|---|---|
| Decision | TAC Approval | Public Hearing | Public Work-shops | Draft Available for Public | Media Notification |
| **Goals and Objectives** | | | | | |
| CAMPO | 05/21/08 | 04/16/08 | 02/07/08 | 03/19/08 | ✓ |
| DCHC | 10/10/07 | 09/12/07 | Aug/Sep | 08/01/07 | ✓ |
| **Socio-economic Forecasts** | | | | | |
| CAMPO | 08/15/07 | 08/15/07 | -- | 06/22/07 | ✓ |
| DCHC | 09/12/07 | 03/14/07 | Feb/Mar | 01/31/07 | ✓ |
| **Model Adoption** | (version TCV4-2008) | | | | |
| CAMPO | -- | -- | -- | -- | -- |
| DCHC | 08/13/08 | -- | -- | -- | -- |
| **Deficiency Analysis** | | | | | |
| CAMPO | -- | -- | -- | -- | -- |
| DCHC | 03/12/08 | -- | -- | -- | -- |
| **Performance Measures** | | | | | |
| CAMPO | -- | -- | -- | -- | -- |
| DCHC | 02/13/08 | -- | -- | -- | -- |
| **Alternatives Evaluation** | | | | | |
| CAMPO | -- | -- | -- | 08/20/08 | -- |
| DCHC | -- | 09/10/08 | Aug/Sep | 08/20/08 | ✓ |
| **Draft 2035 LRTP** | | | | | |
| CAMPO | 02/18/09 | 01/28/09 | Dec/Jan | 10/15/08 | ✓ |
| DCHC | 02/11/09 | 11/12/08 | Oct/Dec | 10/22/08 | ✓ |
| **2035 LRTP and AQ Conformity Report** | | | | | |
| CAMPO | 05/20/09? | 04/15/09? | -- | 03/18/09? | ✓ |
| DCHC | 05/13/09? | 04/08/09? | -- | 03/25/09? | ✓ |

Resulting actions

The transportation elements of the 2035 LRTP will be implemented through the MPOs' Transportation Improvement Programs (TIPs), which designate project planning and construction funding for seven years into the future. The land use plans of some Triangle municipalities already accommodate higher density, mixed-use development around future transit stations. Others, including Durham and Chapel Hill, are in the process of making similar amendments to their planning and zoning documents.

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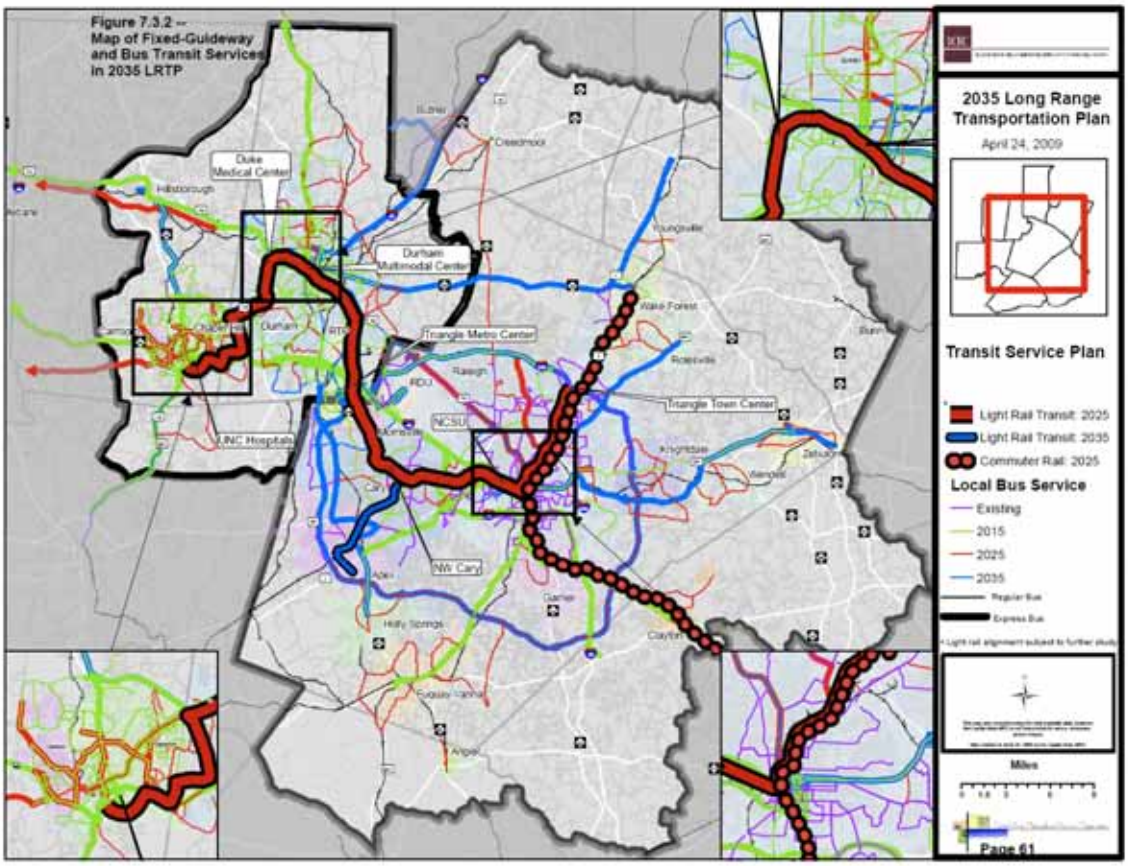
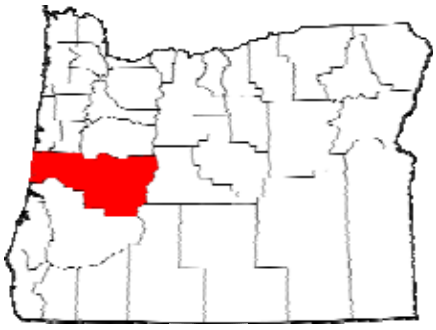


# Oregon



**Project Title:** Region 2050

**Sponsor:** Lane Council of Governments

**Completion Date:** 2006

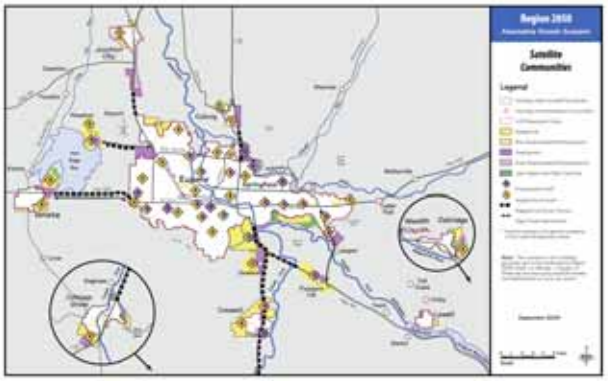
**Planning Horizon**: 2050

**Source**: http://www.region2050.org/

Region 2050 was initiated in 1999 to respond to rapid growth in the Eugene-Springfield metropolitan area in the southern Willamette Valley area of western Oregon. A major impetus for the project was the City of Eugene's adoption of a growth management strategy that focused new growth in the existing developed portions of the city, rather than expanding the region's urban growth boundary (UGB). This decision increased concern by other municipalities in the region that this could result in the "shedding" of future growth from Eugene to the other cities in the region, some of which had already seen fast growth rates in recent years. The fear was that Eugene's decision could result in increasing sprawl in the smaller towns. The Lane Council of Governments (LCOG) designed Region 2050 to address these possible growth allocation issues in ways that would preserve and enhance quality of life for the whole region.

The nature of the scenarios

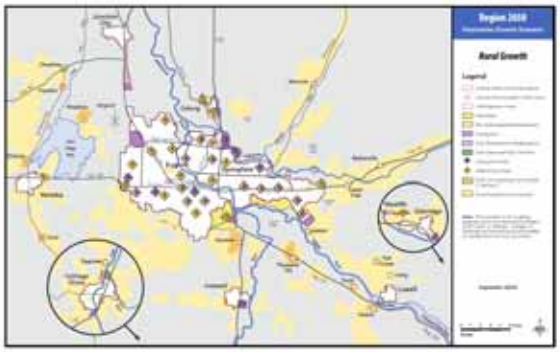
To start the scenario building process, the Lane Council of Governments (LCOG) sketched out two broad archetypal scenarios: a **Yesterday Scenario,** which projected development and growth patterns based on historic trends, and a **Today Scenario**, which projected development and growth patterns with higher densities, more mixed uses, and other changes. Three more detailed scenarios were then created to represent the "Tomorrow Scenarios":

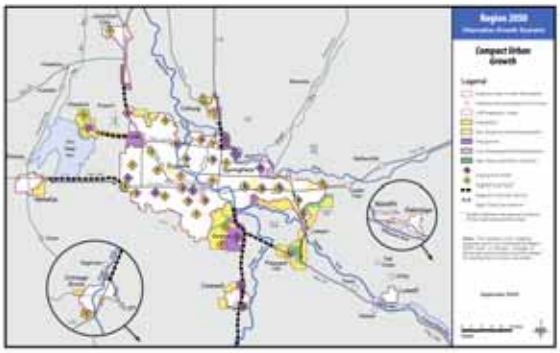


**Compact Urban Growth Scenario**. In the Compact Urban Growth Scenario, the region would develop at the highest concentration practical, given anticipated market forces. The regional distribution of growth is similar to today, with most of the growth occurring in the metro cities. Development is more compact than is planned for today and is mostly concentrated at higher housing and

employment densities in Eugene and Springfield. The rural communities of Goshen, Pleasant Hill, and Alvadore become part of the metro UGB in this scenario and the rest of the rural area stays pretty much the same as it is today.

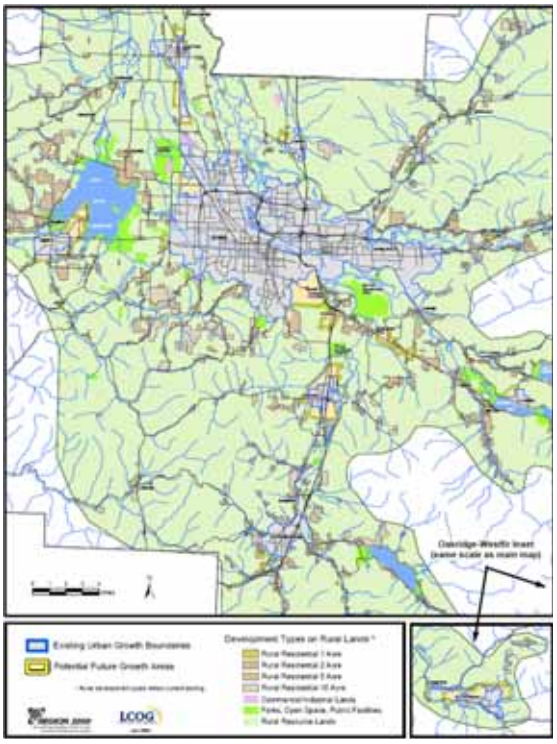
**Satellite Communities Growth Scenario**. In the Satellite Communities Scenario, a much greater share of the housing and employment growth is distributed among the small cities. Similar to today, the small cities develop at small-town housing and employment densities which are lower than Eugene and Springfield. The three rural communities in closest proximity to the metropolitan area—Alvadore, Goshen, and Pleasant Hill—become "growth centers" because they grow to a size and have housing densities similar to small cities.





**Rural Growth Scenario**. In the Rural Growth Scenario, growth is distributed throughout the region on rural residential lands inside rural communities on one-acre lots, and outside rural communities on two-acre lots. Houses are also built on two acre lots on farm and forest lands that are of lower quality and/or less suitable for farm or forest use. The population of the rural area more than doubles in this scenario. There are also more jobs in the rural area and in the metro cities where these rural residents will access goods, services, and work.

**Region Growth Concept.** The Region Growth Concept evolved out of the public process surrounding the review of the three archetypal scenarios. Its primary content was a series of goals and policies, but it had a physical planning representation as well that most closely matched the Compact Urban Growth Scenario.



With respect to transportation system networks, each scenario has a slight variation in roadway lane miles and transit service hours to match the respective differences in the development patterns in each scenario.

The evaluation process

LCOG evaluated the Compact Growth, Satellite Communities, and Rural Growth scenarios for their relative impacts on seven primary indices: land use, housing, economy, environment, public facilities and services, transportation, and education. The subjects of these indices tie directly to the issue areas used in the process to create the scenarios (see below).

To facilitate scenario construction, LCOG created a land capacity model. The model calculated the development capacities of the urban growth and potential future growth areas, estimated the amount of buildable land by type and density, and allocated the projected study area population to each of the urban growth and potential future growth areas. To estimate transportation impacts, LCOG used a standard four-step travel demand model, which incorporated the following Smart Growth modeling components:

| **Smart Growth Model Feature** | |
|---|---|
| Daily vehicle trip model | X |
| Supply & demand model equilibration | X |
| Travel time feedback loops between model components | X |
| Disaggregate simulation of households | X |
| Integrated land use-transportation modeling | X |

Evaluation results

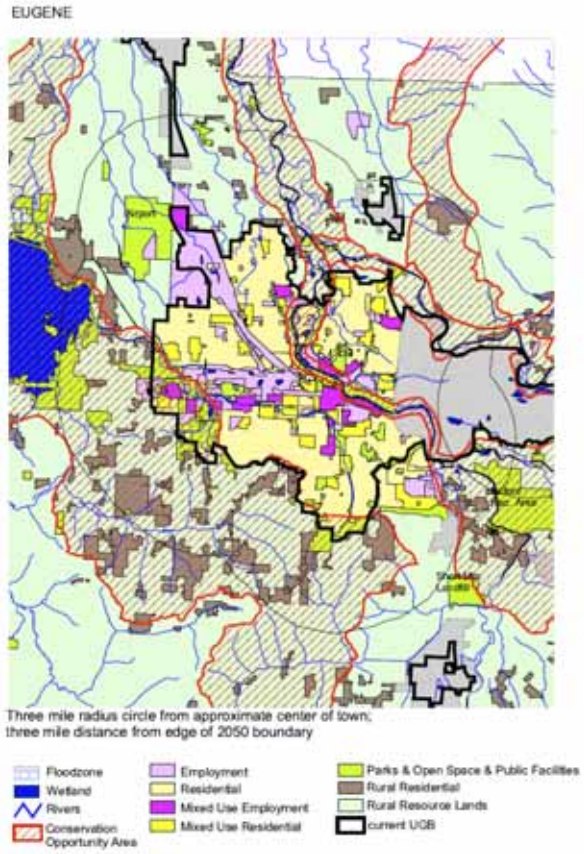
| | **Scenario** | | |
|---|---|---|---|
| | **Compact** | **Satellite** | **Rural** |
| Transit service miles (annual) | 500,566 | 526,664 | 555,069 |
| Housing density (units/acre) | 5.33 | 3.08 | 1.74 |
| Total developed acres | 112,248 | 111,307 | 175,907 |
| Vehicle miles (000s) | 11,651 | 11,402 | 12,370 |
| Vehicle trips (000s) | 1,576 | 1,569 | 1,566 |
| Hours of delay (000s) | 2,224 | 2,215 | 2,210 |

Elected Official Participation/Public Involvement

The Region 2050 project began with the creation of the two archetypal scenarios (Yesterday and Today) outlined above. This provided a foil for discussion of growth related issues in a series of public workshops. Using feedback from these workshops, a group of experts working in small groups next devised a series of seven "regional vision maps," each one reflecting the group's respective area of expertise: land use, housing, the economy, transportation, natural resources, community facilities and services, and education. LCOG staff synthesized the vision maps into the three alternative growth scenarios—Compact Urban Growth, Satellite Communities Growth, and Rural Growth—in a way to highlight and accentuate broad choices in urban form. Agency staff then used these scenarios for a "Design Your Future" public involvement process where, as with the earlier set of meetings, the scenarios were used to stimulate discussion about growth issues and values. More than 1100 citizens participated in these meetings. Input from the meetings helped shape a series of regional goals and objectives that formed the basis for a draft Regional Growth Concept.

Resulting actions

LCOG staff promoted adoption of the Regional Growth Concept among local governments in the region, achieving only partial success. Of the 22 steps identified by an implementation matrix developed by the agency, only 2 were adopted by all jurisdictions, and these were both tied to state mandates. Three municipalities adopted most of the implementation actions. These, however, were three of the smallest jurisdictions in the study area. The second largest jurisdiction, Springfield, withdrew from participating in the project before its conclusion.

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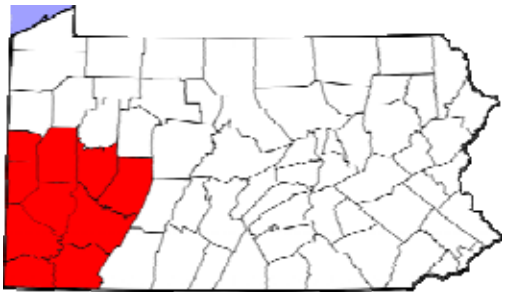
# Pennsylvania



**Project Title:** 2035 Transportation and Development Plan for Southwestern Pennsylvania

**Sponsor:** Southwestern Pennsylvania Commission

**Completion Date:** 2007 (updated 2008)

**Planning Horizon**: 2035

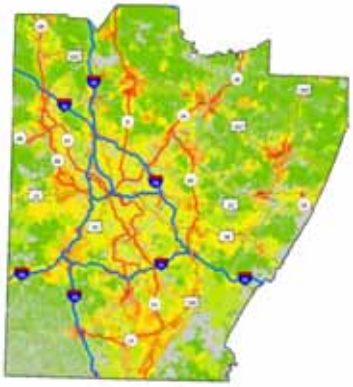
**Source**: http://www.spcregion.org/proj/

The Southwestern Pennsylvania Commission's (SPC) 2035 Transportation and Development Plan for Southwestern Pennsylvania is an integrated transportation and economic development plan for the 7112 square mile region surrounding Pittsburgh. Long the home of steel manufacturing and other heavy industries, the region's economy has been undergoing substantial change since the 1970s, and that process continues. The sharp contraction of the steel industry led to steep declines in the region's population: the percentage of urban dwellers in the region in 2000 equaled levels not seen since the 1930s. Between 1990 and 2005, the region's population declined nearly 2%. Major challenges in the region that serve as the basis for the 2035 plan include economic development, job creation, and transportation infrastructure maintenance and renovation.

The nature of the scenarios

SPC work groups began the scenario process by articulating six sketch-level scenarios, based on their understanding of best planning practices. The sketch scenarios included Dispersed/Fringe, Infill/Redevelopment, Corridor, Transit Oriented, Center/Cluster, and Compact. Each sketch scenario contained information on development location, density, and mix; identified key transportation system elements; and outlined additional policy elements. A Regional Partners group then refined the sketch scenarios into four, distinct draft scenarios that could serve as the basis for further public input.

Trend Scenario



**Trend Scenario:** The Trend Scenario depicts a continuation of the current development pattern with investment taking place scattered throughout the region with no strong tie between population growth and employment growth. Development tends to be medium to low density.

**Dispersed/Fringe Scenario**: The Dispersed Fringe scenario has a lower density development pattern with development occurring mainly outside of the urban cores. Transportation is highway oriented with transit and transit accessibility playing little to no role. Implicitly, the scenario includes the expansion of infrastructure, including water and sewer utilities, to previously unserved areas. Economically, the scenario places a priority on diverse development by type and location and preserves, promotes, and develops tourism and hospitality through historic, cultural, recreational, and ecological assets.

Dispersed/Fringe Scenario

**The Compact/Infill/Transit Oriented Scenario:** This scenario focuses high-density development with a mix of uses and development within or adjacent to core communities. The scenario takes advantage of opportunities for infill development, reinvestment in existing business districts and brownfield rehabilitation. Open space preservation is key in rural areas. The scenario is pedestrian oriented and is strongly reliant on public transportation. There would be minimal expansion of existing utilities to accommodate new growth.

Compact/Infill/Transit Oriented Scenario

**The Corridor/Cluster Scenario:** This scenario locates medium to high density development in centers, clusters, and transportation corridors with a strong multimodal focus including highways, transit, railways and waterways. The scenario has excellent access to the urban core with improved transportation operations. The scenario will require some expansion of water and sewer infrastructure at the corridor level.

Corridor/Cluster Scenario

**Regional Vision Scenario:** A hybrid of the Compact and Corridor scenarios, the Regional Vision Scenario is characterized by high to medium density mixed-use development in centers and clusters. Infrastructure improvements in the scenario target these centers and clusters of development and the corridors that connect them. The scenario emphasizes infill development and reinvestment in existing business districts and brownfield sites. Open space preservation and support for agriculture are also included. The scenario contains a strong multimodal focus including highways, transit, railways and waterways with an increasing emphasis on connecting centers, clusters, and the urban core. The scenario

emphasizes upgrading existing water and sewer, with limited expansion primarily to historically underserved communities.

The evaluation process

Future growth projections are first estimated for the region as a whole using a REMI model. These projections are sub-allocated to municipal and traffic analysis zone (TAZ) levels using the SPC's MERLAM model (Mature Economic Region Land Allocation Model), which uses relative tax rates, accessibility to transportation facilities, proximity to jobs, existing development density, and other factors that measure each area's relative capacity to attract and retain people and jobs. By varying the attractiveness measures and by altering the values of the model's policy variables, MERLAM is able to estimate the impact of various regional land use and development scenarios. The INDEX GIS model was also used to assess impacts.

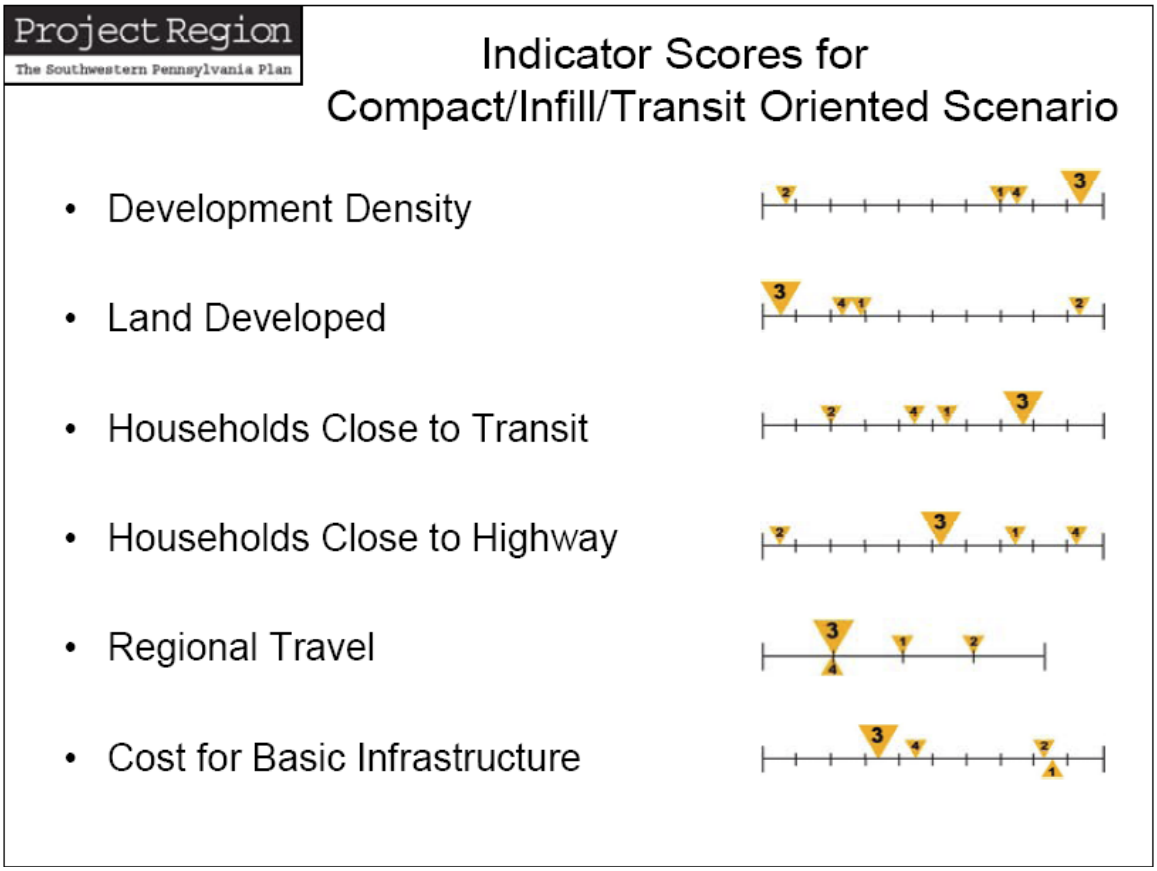
The indices chosen by the Regional Partners group for measuring the scenarios where selected to address the following questions:

- Where would land development take place?
- Where would people live and work?
- How dense is the population?
- How many people would have access to transit?
- How many would use automobiles?

As a sketch-based model, INDEX uses elasticities drawn from many studies in many regions to estimate the impacts of different scenarios. The analysis is, hence, more generalized and not based on the usual locally-based travel demand model. In this study, use of that model was limited to assessing the impacts of the final Regional Vision Scenario.

Evaluation results

Because of the more general nature of the INDEX results, SPC staff elected to display the results using qualitative-style graphics, indicating the estimated direction of change relative to the other scenarios and a rough order of magnitude. The following example shows the results for the Compact/Infill/Transit Oriented Scenario. Because that scenario is the third in the series of scenarios, its results are indicated on the continua with the large number 3's; the other, smaller numbers represent the results from the other scenarios.




Elected official participation/public involvement

The public engagement process for the 2035 plan, which had its own brand ("Project Region"), was based on three principles derived from research on best involvement practices:

1. Talk to people like a neighbor, not a planner. Keep it clear and simple—try to relate planning information to aspects of everyday life and use examples from local communities to help people understand. Ask meaningful questions and use deductive analysis.

2. Make it interesting. Use different kinds of information, such as maps and pictures, and take advantage of new technology.

3. Make it easy and convenient to participate. Provide different types of participation opportunities and let people choose their own level of involvement. Respect people's time.

The SPC's Public Participation Panels applied these three principles for a series of public involvement actions that were deemed "aggressive, inclusive, and expansive." Activities included open houses, workshops, conferences, surveys, oral and written testimony and

comments, brainstorming sessions, and voting. Assisting in these activities were new technologies that included interactive kiosks, web surveys, interactive live polling software, and web enhanced meeting hard- and software. Collectively, the different approaches succeeded in involving more than 1500 people.

The Regional Partners Group, referenced above, was comprised of representatives from hundreds of diverse public, private, governments, and nonprofit agencies and organizations across the region. The Group played a key role in the creation of the scenarios, as outline above, and in communicating the scenarios to a wider public.

The final four scenarios were presented in a "regional town meeting" that was held simultaneously in eleven different locations and broadcast live on the web. Presentation of the scenario results and the responses from the hundreds of participants, including those logged on through their own web connections at home, were discussed at each separate meeting and also collectively. A poll was conducted using these web connections and real-time meeting technologies, allowing participants to identify which scenario best performed on a list of indices derived from the central evaluation questions identified by the Partners Group.

| Participant Preferences Survey - Totals by Percentage | | | | |
|---|---|---|---|---|
| Scenario Indicators | Trend | Dispersed | Compact | Corridor |
| Development Density | 1.5% | 7.0% | 38.2% | 53.3% |
| Amount of Land Developed | 2.8% | 4.5% | 48.1% | 44.6% |
| Households Close to Transit | 4.4% | 3.7% | 56.7% | 35.2% |
| Households Close to Highway Interchanges | 3.1% | 4.2% | 40.8% | 51.9% |
| Regional Travel | 4.2% | 8.1% | 37.5% | 50.2% |
| Basic Infrastructure Cost | 0.6% | 3.5% | 54.5% | 41.3% |

In light of the strong plurality for the Compact and Corridor scenarios, the SPC Commission determined that a hybrid of the two scenarios provided a strong basis for the creation of a preferred regional scenario.

Resulting actions

The Southwestern Pennsylvania Commission is both the MPO and the Economic Development District for the region, as designated by the U.S. Appalachian Regional

Commission. Consequently, the 2035 Plan acts both as the long-range transportation plan required by SAFETEA-LU and the Comprehensive Economic Development Strategy recognized by the federal Economic Development Administration. Direct implementation of the 2035 Plan, hence, will occur through transportation improvement programs and various development district programs, including those related to business finance assistance, government procurement assistance, and export assistance. The concluding section of the plan outlines a structure for an ongoing monitoring system to assess attainment of the plan's goals and policies.

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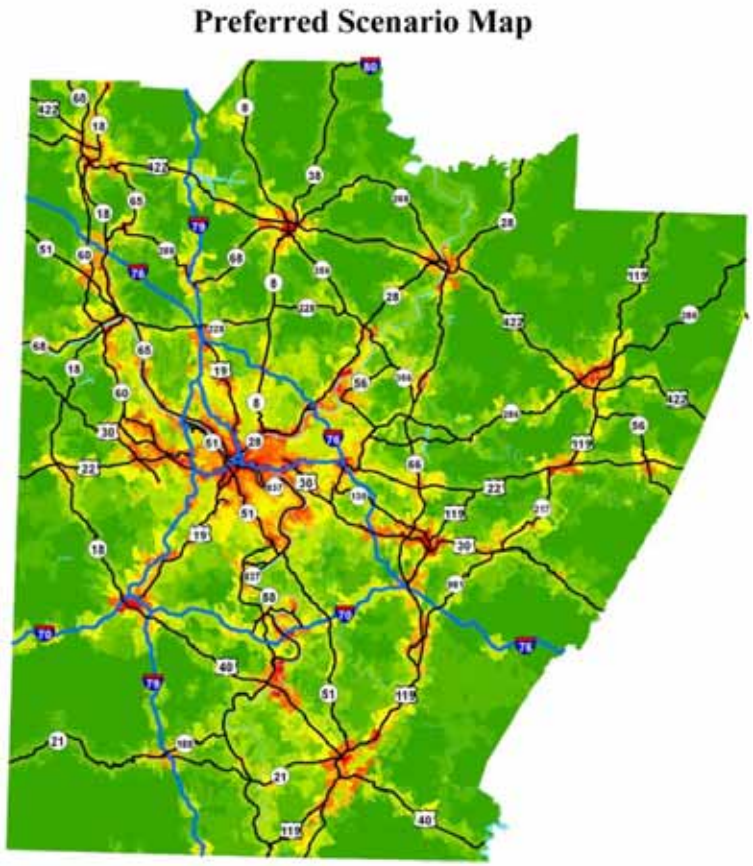


**Project Title:** Brownsville Metropolitan Planning Organization Transportation and Land Use Study

**Sponsor:** Brownsville MPO

**Completion Date:** 2009

**Planning Horizon**: 2035

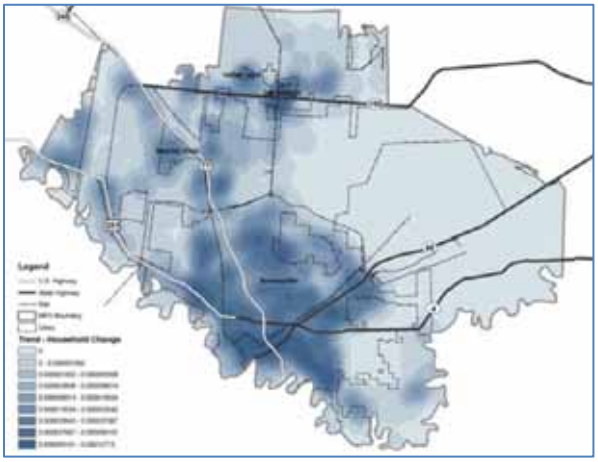
**Source**: http://www.cob.us/index.asp?conID=164

The population of the Brownsville urbanized area is expected to increase by 175,000 by 2035, an approximate doubling of the region's 1999 population. Many of the new residents will be attracted to the region by job opportunities, a comparatively low cost of living, the subtropical climate, and recreational opportunities. The region's economy is rooted in foreign trade, manufacturing, and tourism, all of which are expected to grow substantially in the future. Given these trends, many regional stakeholders have expressed concern about maintaining high transportation performance standards in the face of the growing and changing demands. Additional concerns include the potential impacts of sprawl development, particularly on issues related to environmental preservation. The Transportation and Land Use Study was designed to address these concerns.

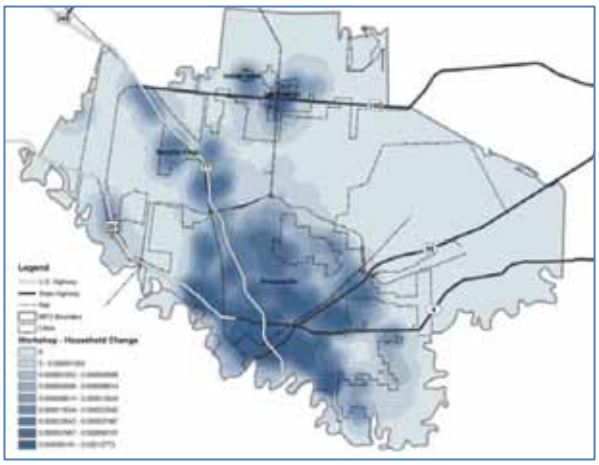
The nature of the scenarios

The study developed three scenarios designed to illustrate and address the key regional issues.

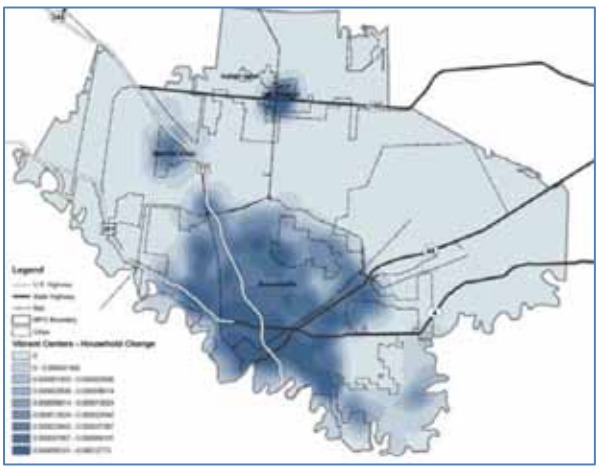
**Scenario A:** Scenario A is the trend scenario, representing the continuation of an emerging suburban development pattern prevalent in the study area. New construction follows established patterns of isolated, single-use developments surrounded by low density rural residential home sites.



**Scenario B:** Scenario B consists of a large mix of housing types, including townhomes, multifamily, single family subdivisions, and rural residential. These developments are clustered near jobs and infrastructure. Mixed-use developments serve as centers for small business and entrepreneurs. Rural clustered development is designed to preserve farmland.



**Scenario C:** Scenario C is the densest scenario, representing the most dramatic change in terms of altering current land use policies. The scenario assumes the construction of many new multi-unit buildings and townhomes within walking distance of jobs and commercial areas. Sewer, water infrastructure, and road improvements are focused in central cities, while rural areas receive relatively less infrastructure funding.



The evaluation process

The scenarios were assessed for their impacts on "critical community indicators," including traffic congestion, municipal costs, land development costs, job growth, and a broad range of environmental indices. To accomplish these assessments, the study team used the CommunityViz GIS software package, plus the region's travel demand model. Outputs from the two computer models were reported as "measures of effectiveness (MOEs)," indicating the significance of the scenarios' reorganized land use patterns and development densities. The following table describes the travel model's capacity to model Smart Growth:

| **Smart Growth Model Feature** | |
|---|---|
| Daily vehicle trip model | X |
| Modeling peak period as well as daily travel | X |
| Income stratification in distribution and mode choice models | X |
| Travel time feedback loops between model components | X |
| Disaggregate simulation of households | X |

Evaluation results

The summary conclusion from the analysis is that the current development standards and transportation policies, as represent in Scenario A, "will not attract, enhance, or manage growth properly." By contrast, more compact, mixed-use development patterns, as contained in scenarios B and C, can reduce travel distance between complementary land uses and reliance on the automobile for day-to-day activities. This leads to less travel and congestion compared to the sprawling development pattern in Scenario A. The more compact scenarios also reduce the footprint of the built environment, decrease the emissions of air pollutants, and reduce the expenditures needed for public infrastructure.

| | **Scenario** | | |
|---|---|---|---|
| | **A** | **B** | **C** |
| Daily vehicle miles traveled | 4,430,000 | 4,400,000 | 4,390,000 |
| *per capita* | *10.7* | *10.6* | *10.5* |
| Daily vehicle hours traveled | 146,000 | 152,000 | 144,000 |
| *per capita (mins)* | *21.1* | *21.9* | *20.7* |
| Daily vehicle hours of delay | 28,000 | 34,000 | 26,000 |
| *per capita (mins)* | *4* | *4.9* | *3.7* |
| Value of time lost (per year) | $198,000,000 | $240,000,000 | $184,000,000 |
| Gallons of fuel wasted annually | 6,130,000 | 7,450,000 | 5,690,000 |
| NOx emissions (tons per year) | 2,674 | 2,655 | 2,649 |
| CO2 emissions (tons per year) | 646,780 | 642,400 | 640,940 |
| VOC emissions (tons per year) | 3,208 | 3,187 | 3,179 |

Elected official participation/public involvement

The primary objective of the study process was to develop a preferred scenario to guide future growth in the region. Elected officials, the study's consultant team, local professionals, and a broad spectrum of citizens, property owners, and developers worked together in a series of workshops to craft that scenario. Key to the early stages of the scenario development process was the use of the "growth chip" game, where study participants, working together in small groups, geographically allocated the region's anticipated future growth using different colored chips, each one representing a development archetype and growth increment. Each group was tasked with allocating

the entire amount of projected growth in a manner that would optimize for the region's livability. The outcome of these exercises were coalesced into the two alternative scenarios (A & B), outlined above.

Resulting actions

Based on the performance of the modeling and community and stakeholder input, Scenario B was selected as the preferred development scenario. Recognizing the limited authority of the MPO—particularly on land use issues—the agency staff crafted a Call to Action, which contains a series of strategies regarding agency coordination, sustainable development practices, Complete Streets, and multimodal planning. These steps are presented as a necessary bridge between current development patterns and the preferred development pattern found in Scenario B:

| AGENCY | ACTION | BMPO ACTION |
|---|---|---|
| City of Brownsville | Adopt Imagine Brownsville | Endorse Imagine Brownsville's land use policies |
| Texas Dept of Transp | Update travel demand model with demographics provided by BMPO | Update MTP based on results from the scenario planning exercise |
| Cameron County Regional Mobility Authority (CCRMA) | Coordinate with TxDOT for new traffic forecasts | Assist CCRMA with modeling and economic forecasts |
| Cameron County | Endorse scenario B demographics | Provide planning assistance to County |
| Brownsville ISD | Perform a Safe Routes to School Study | Assist the ISD with study |
| Brownsville Navigation District | Port area development study | Assist port study |
| Town of Rancho Viejo | Work with MPO to locate a sustainable development site | Perform a sustainable development case study |
| City of Los Fresnos | Work with MPO to locate a sustainable development site | Perform a sustainable development case study |
| Brownsville Utility Board | Examine the findings and implications of the MPO Study | Share study findings and methodologies |
| UT Brownsville | Examine the findings and implications of the MPO Study | Share study findings and methodologies |

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**Project Title:** Future Land Use Study for McLennan County

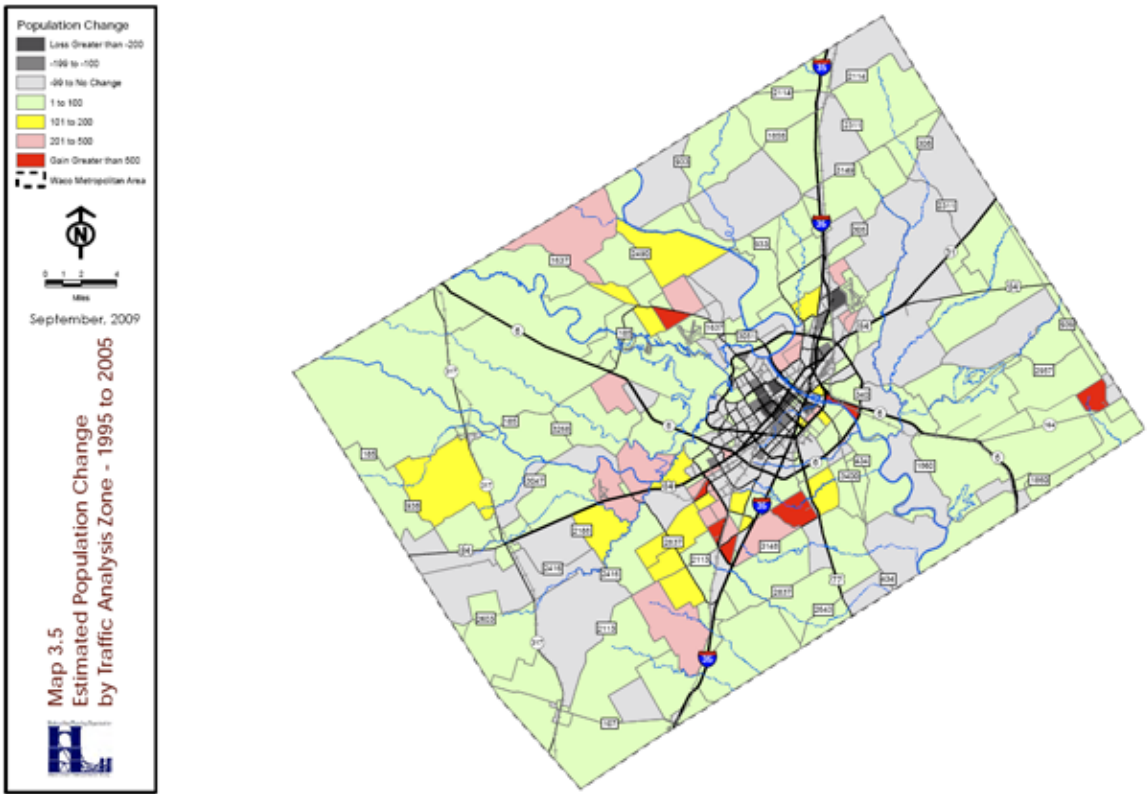
**Sponsor:** Waco Metropolitan Planning Organization

**Completion Date:** 2007

**Planning Horizon**: 2030

**Source**: Future Land Use Study for McLennan County: Final Report

The existing long-range transportation plan for the Waco region assumes that future growth will continue along the lines of recent trends—predominantly low-density in nature and located on greenfield sites within the rural, unincorporated portions of the region. Between 1995 and 2005, developed land in the region increased by 21.6%, nearly double the population increase for the same period. The average amount of developed land per person in the Waco region is higher than that for Atlanta, Georgia, often considered to be the most sprawled region in the country.




The prospect of this type of development pattern continuing and expanding has raised a number of concerns among regional leaders, including the prospect of exaggerated imbalances between jobs and housing, leading to an over-reliance on additional highway capacity in suburban and rural areas. With insufficient funds to provide the transportation capacity necessary to accommodate sprawl-like growth, the Waco MPO

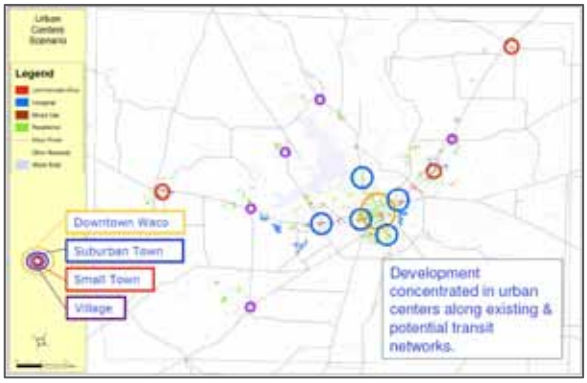
sought alternative ways to simultaneously maintain mobility and guide growth. Recognizing the synergistic relationships between expanded highway capacity and sprawl development, the MPO initiated the Future Land Use Study to address growth and mobility issues by assessing and promoting a better land use development pattern.

The nature of the scenarios

Agency staff used theme-based scenarios developed in a series of public workshops (see below) to craft three, integrated regional scenarios.

**Trend Scenario:** The Trend Scenario continues the past trend of low-density, widely dispersed, sprawl like development outside city centers.

**Suburban Centers Scenario:** The Suburban Centers Scenario uses the "ideal community" elements generated at a stakeholders workshop (see below), drawing all new development closer to downtown Waco, with a substantial amount of growth distributed among the smaller cities and emerging suburban towns surrounding Waco.




**Urban Centers Scenario:** The Urban Centers Scenario uses the ideal community elements to focus all new development within downtown Waco and an array of nearby smaller cities and suburban communities, forming a pattern that could support a future priority transit system such as bus rapid transit or rail.

The evaluation process

Land use data from a CorPlan GIS model provided information on elements such as the number of acres consumed, the percentage of households and jobs with proximity to transit, and other indicators selected to reflect the community values established at the onset of the study.

| Values, Priorities & Indicators | Land Consumption | Vehicle Miles Traveled | Vehicle Hours Traveled | Travel Speed | Gallons of Gas Consumed | Congestion | Roadway Project Costs | Housing Choice | Infill and Redevelopment | Walkable Communities | Proximity to Schools | Proximity to Transit |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Vibrant Economy** | | | | | | | | | | | | |
| High-quality manufacturing, high-tech & health care jobs | | | | | | | | | ✓ | ✓ | | |
| Popular arts & recreational attractions | | | | | | | | | ✓ | ✓ | | |
| Strong "Town-Gown" connections | | | | | | | | ✓ | | ✓ | ✓ | ✓ |
| Vital urban centers | ✓ | | | | | | | ✓ | ✓ | | ✓ | ✓ |
| Affordable, high quality housing | | | | | | | | ✓ | ✓ | | ✓ | ✓ |
| **Transportation For All** | | | | | | | | | | | | |
| Convenient public transit for commuters & visitors | | | | | | | | | ✓ | ✓ | | ✓ |
| Effective transit & bike/walk options for those who can't drive | | | | | | | | | ✓ | ✓ | ✓ | ✓ |
| Safe, attractive pedestrian connections | | | | | | | | | ✓ | ✓ | ✓ | |
| Efficient roadway networks | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | ✓ | ✓ | ✓ |
| Effective freight systems | | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | |
| **Thriving Natural Environment** | | | | | | | | | | | | |
| Active ranches & farms | ✓ | | | | | | | | ✓ | | | |
| Sensitive river corridor & Lake Waco developme | ✓ | | | | | | | | ✓ | | | |
| Abundant open spaces & parks | ✓ | | | | | | | | ✓ | ✓ | | |
| Clean air and water | ✓ | | | | ✓ | ✓ | | | | | | |

The scenarios were also tested using the regional travel demand model. The model's Smart Growth features included the following:

| Smart Growth Model Feature | |
|---|---|
| Daily vehicle trip model | X |
| Supply & demand model equilibration | X |
| Disaggregate simulation of households | X |

To facilitate the analysis, the GIS land use grid data was aggregated to provide population and employment allocations for each traffic analysis zone (TAZ) in the MPO study area, plus several external zones. The TAZ forecasts for each scenario were then tested using several alternative future transportation networks.

**No-build:** This network includes only the existing transportation system, and includes no new highway capacity.

**Committed:** This network includes the existing transportation system, plus all transportation projects programmed in the 2006 Transportation Improvement Program.

**Planned Funded:** This network includes the current and committed network above, plus all the funded transportation projects in the region's 2004 long-range plan.

**Planned Unfunded:** This network includes the current, committed, and funded network above, plus all the unfunded transportation projects in the 2004 plan.

**Alternative:** This network contains carefully selected projects from the Planned Unfunded network (7 of 9 committed projects; 10 of 27 planned funded projects; 7 of 57 planned, unfunded projects), plus a set of 15 alternative projects.

Evaluation results

| Performance Measure | Trend | Suburban Centers | Urban Centers |
|---|---|---|---|
| **Land Use** | | | |
| Acres consumed for development | 9,977 | 6,913 | 6,672 |
| **Daily Vehicle Miles of Travel (thousands)** | | | |
| No-Build Network | 10,119 | 9,923 | 9,937 |
| Committed Projects Network | 10,105 | 9,925 | 9,936 |
| Planned Funded Projects Network | 10,114 | 9,929 | 9,946 |
| Planned Unfunded Projects Network | 10,122 | 9,929 | 9,956 |
| Alternative Projects Network | 10,181 | 9,981 | 10,009 |
| **Daily Vehicle Hours of Travel (thousands)** | | | |
| No-Build Network | 275 | 261 | 265 |
| Committed Projects Network | 265 | 251 | 255 |
| Planned Funded Projects Network | 244 | 232 | 233 |
| Planned Unfunded Projects Network | 235 | 224 | 224 |
| Alternative Projects Network | 211 | 211 | 207 |
| **Average Travel Speed (mph)** | | | |
| No-Build Network | 36.8 | 38.0 | 37.5 |
| Committed Projects Network | 38.1 | 39.5 | 39.0 |
| Planned Funded Projects Network | 41.5 | 42.8 | 42.7 |
| Planned Unfunded Projects Network | 43.1 | 44.3 | 44.4 |
| Alternative Projects Network | 48.3 | 47.3 | 48.4 |
| **Gallons of Gas Consumed (thousands)** | | | |
| No-Build Network | 405 | 397 | 397 |
| Committed Projects Network | 404 | 397 | 397 |
| Planned Funded Projects Network | 405 | 397 | 398 |
| Planned Unfunded Projects Network | 405 | 397 | 398 |
| Alternative Projects Network | 407 | 399 | 400 |
| **Pct of Road Miles Congested** | | | |
| No-Build Network | 11.9% | 13.1% | 11.7% |
| Committed Projects Network | 11.9% | 11.6% | 11.1% |
| Planned Funded Projects Network | 8.1% | 7.8% | 7.5% |
| Planned Unfunded Projects Network | 6.8% | 5.7% | 6.5% |
| Alternative Projects Network | 5.9% | 5.8% | 6.7% |

The Suburban and Urban Centers scenarios compared quite favorably to the Trend Scenario, regardless of which transportation network was assumed. The most striking difference between scenarios is the amount of land consumed, with the Suburban and Urban Centers scenarios up to 2/3 less land than the Trend Scenario. In addition, the analysis shows that the alternative transportation improvement package provides better mobility overall, at a much lower cost than the other transportation packages. In sum, the scenario analysis found that a pattern of compact development patterns (arranged according to either the Suburban Centers Scenario or the Urban Centers Scenario) supported by a revised set of transportation improvements (that could largely be made within the MPO's fiscal constraints) could provide significant improvements in network performance as well as many quality of life measures important to the residents of the region.

Elected official participation/public involvement

The Project Team conducted workshops with various stakeholders throughout the county including representatives from the Heart of Texas Council of Governments, the Waco Chamber of Commerce, various independent school districts, as well as homebuilders, realtors, residents, and bankers. Participants were invited to identify "treasured places" in the region and discuss why these places were important to the community. They were also asked to indicate values and priorities important to them. The three dominant values that emerged from this process were a vibrant economy, transportation for all persons in the community, and maintaining a thriving natural environment. With each value, participants identified more specific attributes that represented or embodied the broader values. Working together in small groups, participants next used the values and attributes as the basis for re-designing each of 21 distinct community archetypes found in the region, ranging from rural villages to urban commercial districts. These re-designed archetypes provided the building blocks for constructing regional scenarios. Each group selected one of the three value themes—vibrant economy, transportation for all, and thriving natural environment—as the basis and emphasis for their group's scenario.

The results of the scenario analysis were presented to the community during two more workshops at which participants were asked to help shape a preferred growth scenario and identify issues related to achieving it. At both sessions, participants were invited to critique the suburban centers and urban centers scenarios and craft a vision for a preferred scenario, which could combine elements of both as well as new ideas. In addition, participants were asked to brainstorm issues and strategies related to achieving the preferred scenario. Many participants expressed equal support for both scenarios, stating a desire to simultaneously pursue infill of the core city of Waco as well as improved suburban development patterns.

Resulting actions

The final chapter of the study report lists a series of recommendation actions to implement a preferred scenario. Included on the list are additional outreach/educational activities to a reach broader range of citizens, updates to local government plans and zoning ordinances, and the development of targeted infrastructure improvements. It is not clear to what degree these actions have been pursued or completed.

The MPO's draft 2035 Regional Transportation Plan—which went out to public hearing in January 2010—includes a short description of the Future Land Use Study, and incorporates a goal/objective (number 5-4) that seems to reflect themes from the study: "Waco's transportation system should be developed in such a way to encourage most future development to occur within existing nodes of development and provide walking access between new residential development and most basic municipal and commercial services." The MPO staff, however, selected to use the Trend Scenario as the socio-economic projection for the plan, suggesting a lack of consensus concerning the alternative scenarios. The stated reason for using the Trend was to "represent[] the 'worst case' scenario in terms of automobile travel demand. . . . . Project recommendations . . . are intended to use the limited transportation resources projected to be regionally available to encourage a more efficient land use pattern." Nevertheless, the MPO's Policy Board is said to have recognized the benefits of the alternative scenarios, including in the final adopted plan many of the transportation elements from those scenarios, including increased funds for transit, intelligent transportation systems, and bicycle and pedestrian facilities. According to staff, "beyond 2020, there are virtually no highway mobility projects identified within the plan with nearly all projected mobility funds being spent on expanding other modes."

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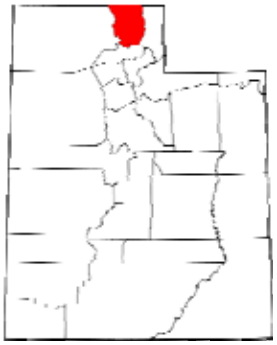


**Project Title:** Envision Cache Valley

**Sponsor:** Cache Valley Regional Council

**Completion Date:** 2010

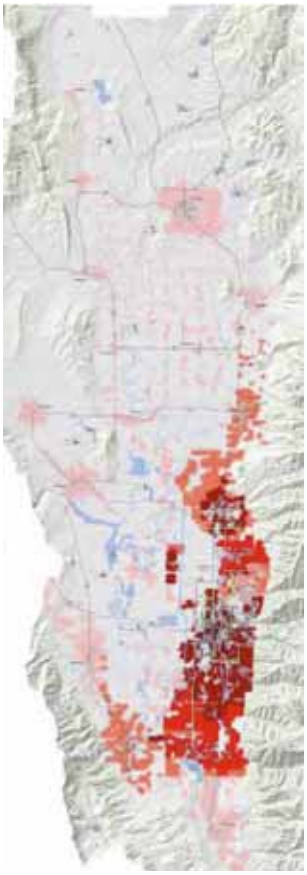
**Planning Horizon**: 2040

**Source**: http://www.envisioncachevalley.com/

The Cache Valley of Utah surrounds the town of Logan and is home to Utah State University. It is a high elevation valley that contains some of Utah's most productive farmland. It has recently been the focus of relatively high rates of population and employment growth, with the current population of 125,000 expected to double by 2040. If that growth follows recent development trends, it will consume approximately 50 square miles—an area three times the current development footprint of Logan. This could imperil the valley's agricultural economic base, exacerbate its already poor winter-time air quality, and threaten its valued small-town character.

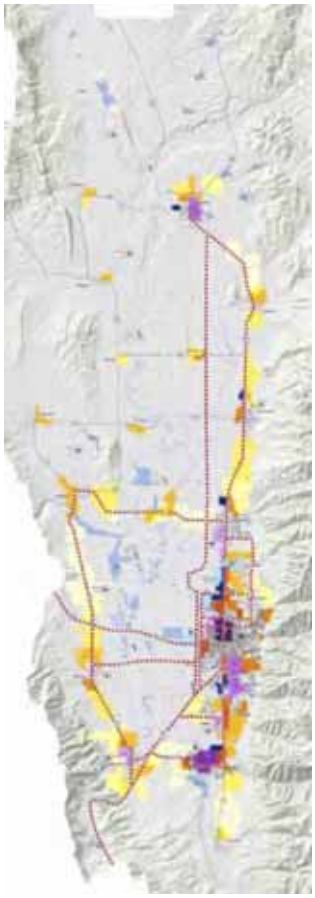
The nature of the scenarios

To address these issues, project staff used input received at public workshops to craft four contrasting scenarios.

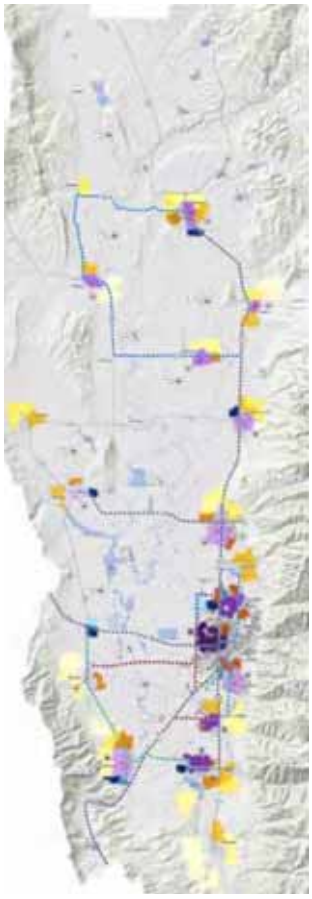


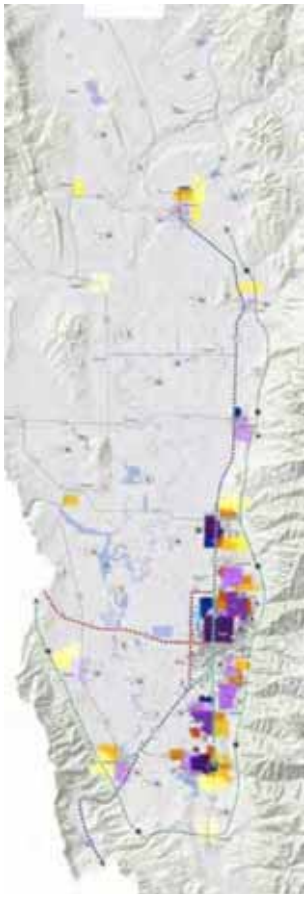
**Scenario A – Baseline:** Scenario A is a picture of what the valley may look like if it continues to grow both where and how it has been growing in recent years, effectively projecting the pattern of the past ten years forward into the future. New growth in this scenario occurs primarily along the edges of the valley, especially near major transportation corridors. Many lots are typical in size compared to recent development trends, and many have large back yards. Land uses tend to be separated, though some communities create new neighborhood or town centers that integrate shopping, employment, and housing. Roads are the transportation priority in this scenario, with almost all trips being made by automobile. Local road systems tend to include more cul-de-sacs and fewer street grids. Buses continue to run on the existing fixed route system. Because housing tends to be further from shopping and employment, few trips are made by walking or biking. Over time, working farms are impacted by the extent of the scenario's growth and most communities grow into one another.

**Scenario B – Eastside/Westside Benches:** As with Scenario A, Scenario B focuses new growth primarily along the valley benches, especially near major transportation corridors. Again, many lots are typical in size compared to recent development trends, and many have large back yards. Though land uses tend to be separated, some communities create new neighborhood or town centers that integrate shopping, employment, and housing. The road network is still a priority, with a new bypass extending from Preston in the north to a point southwest of Logan along Highway 89/91. Buses operate about as frequently as they do today. Some trips are made on foot or by bike, though housing tends to be further from goods, services, and employment. Farming is also impacted in this scenario by the extent of growth and increased fragmentation. Water quality is largely protected, with growth happening away from most water bodies, wetlands, and floodplains.



**Scenario C – Town Centers/Clustering:** In Scenario C, communities across the valley grow into traditional towns and small cities. Most feature neighborhood or town centers that provide for day-to-day needs and some employment. The centers have a range of housing choices, including living spaces above retail and commercial businesses. Overall, houses tend to be closer together. The road network includes a partial bypass road west of the Logan area as well as enhanced east-west connections. Enhanced public transportation loops serve most communities. New service may include peak hour vanpools, more bus routes, and more frequent bus service. Bike commute routes follow the public transportation loops. Open lands keep most communities distinct and separate from one another. Working farms are impacted by growth at the edges of existing towns, though they remain largely intact in the valley's center. Water quality is protected, as most water bodies, wetlands and floodplains on the valley floor are conserved.





**Scenario D – Urban Centers/Rural Edge:** In Scenario D, existing eastside communities assume a compact pattern and absorb most of the population growth. Distinct city and town centers emerge. Most growth occurs within city limits by filling in vacant developable lands and through redevelopment, particularly in commercial areas. Westside/central communities experience some growth, perhaps in the form of small neighborhood centers providing for day-to-day needs and more housing choices. This growth pattern places a mix of jobs, shopping, townhouses and condos at the center of larger cities and towns with single-family housing nearby. Major streets are designed for a range of transportation choices: walking, biking, public transportation, as well as auto use. A dedicated public transportation corridor is envisioned as part of an existing road right-of-way, extending from Preston through Sardine Canyon, linking compact centers along the valley's east side to the Wasatch Front. The corridor may accommodate a street car or bus rapid transit. Many trips are made on foot or by bike, since most people live near services, shopping and workplaces. Open lands separate most communities, and most working farms remain. Water quality is protected, as water bodies, wetlands and floodplains on the valley floor are conserved. The edge between urban use to the east and rural functions to the west is distinct.

After analysis of the four scenarios, study participants and project staff worked to create a fifth scenario to serve as the project's final **Vision Scenario**. The result is essentially a blend of elements from scenarios C and D.

<u>The evaluation process</u>

The scenario construction process began with local residents participating in a "growth chip" game visioning process at a series of public workshops. This charrette-style of public engagement asks participants, working in small groups, to allocate a set amount and mix of expected growth to a large-scale map of the relevant study area. To make the allocation, participants use a set of different-colored and sized chips that represent a specified increment and type of development. Group members place these chips on the map in the general locations where they believe that

amount/type of growth should go. They also use different colored tapes to indicate preferred transportation links.

After the workshops, project staff, local planners, and the project steering committee reviewed the public input carefully to identify common themes emerging from the 53 maps created at the workshops. Of particular concern were the ways in which workshop participants treated conservation, housing, employment, and transportation issues. The similarities and differences between the maps provided the basis for crafting the three non-trend scenarios (B, C, and D).

Travel demand modeling for the project was accomplished using the modeling system maintained by the Cache Valley MPO. That system contains the following Smart Growth modeling elements:

| **Smart Growth Model Feature** | |
|---|---|
| Daily vehicle trip model | X |
| Modeling peak period as well as daily travel | X |
| Simple mode choice model (that separates transit and highway trips) | X |
| Transit network & assignment of daily trips to that network | X |
| Supply & demand model equilibration | X |
| Income stratification in distribution and mode choice models | X |
| Auto ownership modeling sensitive to land use characteristics | X |
| Travel time feedback loops between model components | X |
| Non-motorized modes (ped/bike) estimated in mode choice model | X |
| Modeling multiple modes of access to transit (e.g., ped. vs. park and ride) | X |
| Disaggregate simulation of households | X |

Evaluation results

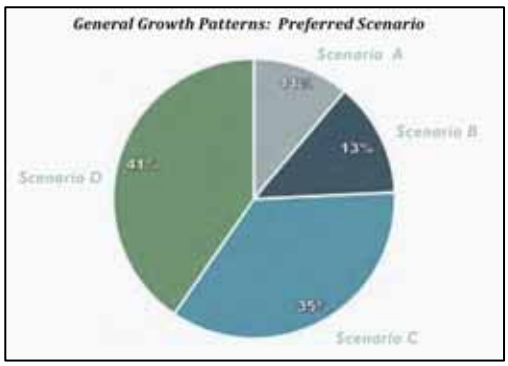
| | **Scenario** | | | | |
|---|---|---|---|---|---|
| | **A** | **B** | **C** | **D** | **Vision** |
| Highway lane miles | 6,670 | 6,935 | 6,518 | 6,459 | 6,665 |
| Dwelling units per acre | 1.4 | 1.7 | 2.3 | 3.3 | 1.7 |
| Newly developed land (square miles) | 52 | 45 | 32 | 23 | 31 |
| % of new development in mixed use areas | 0% | 45% | 65% | 75% | 74% |
| % of new development infill/redevelopment | 0% | 3% | 7% | 11% | 6% |
| Vehicle miles (000s) | 4,516 | 4,796 | 4,458 | 3,942 | 4,426 |

Elected Official Participation/Public Involvement

Envision Cache Valley was initiated by the Cache Valley Regional Council, a group created by an inter-local agreement between Cache Valley local governments and made up of elected officials from Franklin County, Idaho and Cache County, Utah. The Council appointed a steering committee comprised of local citizens from a wide range of backgrounds and perspectives to direct the project. The project began with a regional growth summit and stakeholders meeting, attracting nearly 250 residents. Additional stakeholders meetings attracted another 200 individuals. The purpose of these meetings was to begin a dialog about 150-year history of development and the prospects for future growth and what that might mean for regional livability. That dialog continued with a series of public workshops and online questionnaires, where participants brainstormed on how growth should occur in coming decades. Collectively, more than 1150 people worked to create 53 maps using the "growth chip" game described above. These maps, along with responses from several surveys, presented the themes that staff used to craft the scenarios described above.

In addition to generating maps, workshop participants identified the issues and values most important to them and most central to dealing with growth issues. Those included the following:

- maintain/improve air quality
- maintain/improve water quality; conserve water
- retain viable agricultural land
- preserve scenic beauty
- keep housing reasonably priced
- create high-quality jobs in Cache Valley
- focus on infill and redevelopment of underutilized parcels
- reduce drive times/alleviate traffic congestion

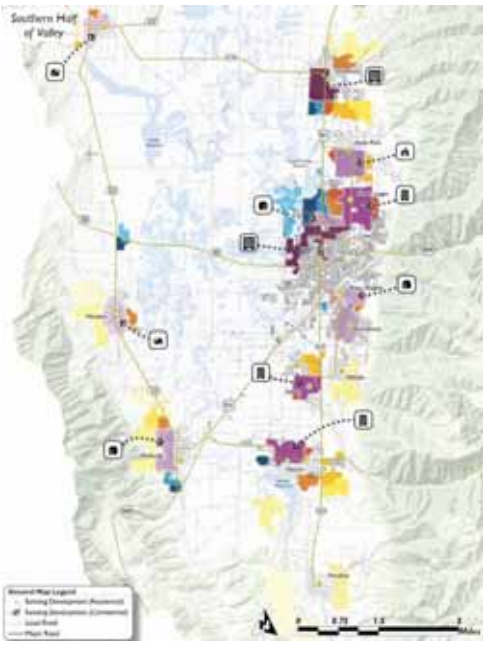



After the project staff completed analysis of the scenarios, that information was taken back to second round of public events, including 14 town hall-style meetings and an online feedback survey. At these events, participants evaluated the scenarios, expressing their preferences regarding general growth patterns and the elements of the scenarios that they most preferred. Only 11% of the approximately 650 citizens that were involved at these events indicated a preference for the trend-based growth pattern in Scenario A, while more

than three-quarters favored the scenarios that focus growth in towns and existing urbanized areas (C and D). Relying on these results, the project steering committee crafted a final regional vision, incorporating elements from scenarios C and D. The process culminated with a Vision Summit where valley residents review the entire study process and the resulting regional vision.

Resulting actions

The Cache Valley Regional Council adopted the final regional vision in early 2010. The council also hosted a regional forum of more than 100 local officials—mayors, city council members, and planning commissioners—to craft a number of implementation steps, including establishing a series of local priorities and initial goals. The final Cache Valley Vision incorporates a set of growth principles, covering topics including growth patterns, housing, employment, mixed use, transportation, infrastructure, natural resources, agriculture, and recreation. The final report on the project also includes a "tool kit," containing detailed recommendations on implementing actions for topics ranging from accessory dwellings to water efficiency.

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**Project Title:** Vision Dixie

**Sponsor:** Washington County Commission

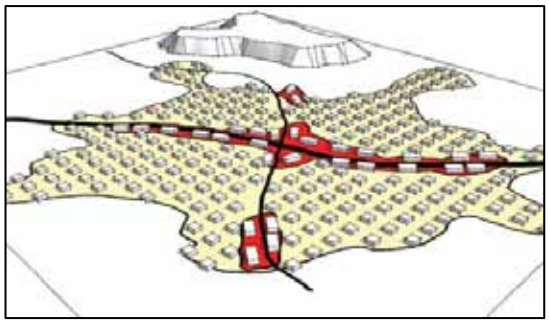
**Completion Date:** 2007

**Planning Horizon**: 2035

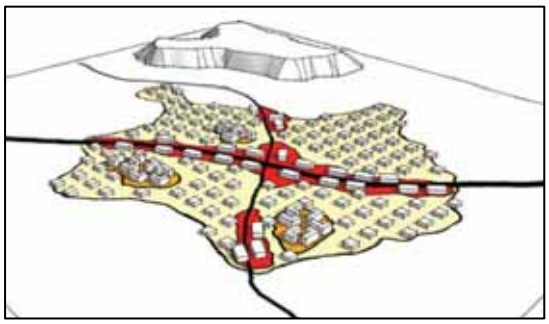
**Source**: http://www.envisionutah.org/VisionDixie-Book4-SM.pdf

According to the U.S. Census, the population of the area surrounding St. George, Utah (Washington County) has nearly doubled in size during each of the past three decades (1970 to 2000). According to some projections, the county's population may triple in the next 30 years. The recent growth has raised many concerns about land and water availability, traffic congestion, and environmental impacts. The prospect of continued high growth rates has substantially heightened those concerns. Recent public controversy over proposals to transfer public land managed by the U.S. Bureau of Land Management (BLM) into private ownership and to build a new water pipeline to Lake Powell in southeastern Utah have catalyzed the issues. Washington County initiated the Vision Dixie project to address these and other concerns.

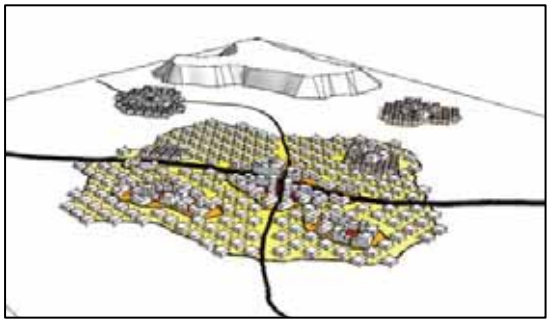
The nature of the scenarios



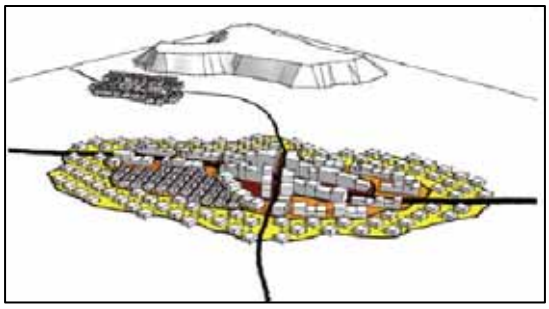
**Scenario A:** Based on existing municipal and county plans, almost all residential growth in Scenario A occurs beyond the edge of existing cities in separated groupings of larger lot single-family homes. Employment growth is kept away from residential neighborhoods, focusing in major business areas. People shop in big box centers and enclosed malls. To accommodate this pattern of growth, some BLM lands that are separated from existing cities are converted to private ownership. The St. George metro area develops a ring of new freeways in this scenario to serve growth. Sun Tran, the region's transit agency, extends bus service further into neighboring cities, but buses operate about as frequently as they do in 2007. Floodplains and designated critical habitats are conserved for recreation or open space. Development sometimes occurs on steeper slopes, ridgetops, and on animal habitat.



**Scenario B:** In Scenario B, most residential growth occurs beyond the edge of cities in single family subdivisions, with some lot sizes smaller than recent growth. Employment growth is mostly kept away from residential areas. Most people shop in big box centers and enclosed malls; however, some Main Street-type shopping occurs. As in Scenario A, some BLM lands are converted to private ownership. A freeway arc links the east and west sides of the St. George metro area, connecting south of St. George. Sun Tran extends bus service further into neighboring cities, and buses operate more frequently than in 2007. Steeper slopes, floodplains, and designated critical habitats are conserved for recreation or open space. Development sometimes occurs on ridgetops, and on animal habitat.

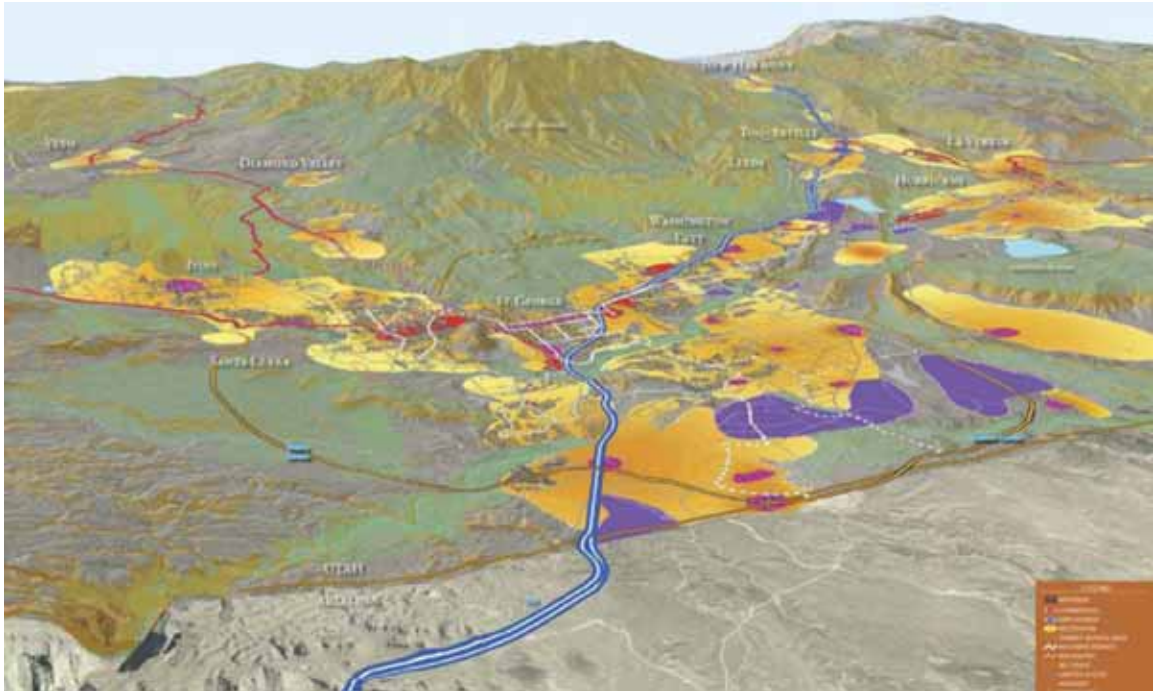


**Scenario C:** In contrast to scenarios A and B, most growth in Scenario C occurs adjacent to the edges of cities. This growth takes the form of villages where single family housing surrounds a center that mixes offices, shopping, townhouses and condos. Growth also fills in vacant developable lands within cities. This scenario, nevertheless, requires that some BLM lands be converted to private ownership; however, this affects only lands that are already within existing city limits. Instead of a freeway, a boulevard links the east and west sides of the region. The region's first bus rapid transit busway is constructed on Sunset Boulevard and SR9. Sun Tran also extends bus service further into neighboring cities, and buses operate much more frequently than they do in 2007. Ridgetops, river corridors, steeper slopes, floodplains, and designated critical habitats are conserved for recreation or open space.



**Scenario D:** In Scenario D, most residential growth occurs within city limits by filling in vacant developable land and through reuse of commercial and industrial areas. This growth places a mix of jobs, shopping, townhouses, and condos at the center of cities, with single family housing nearby. To accommodate this pattern of growth, few, if any, BLM lands are converted to private ownership. A new major city street links the east and west sides of the St. George metro area. Light rail is introduced to the St. George metro area. Sun Tran also extends bus service much further into neighboring cities and buses operate much more frequently than they do in 2007. Ridgetops, river

corridors, steeper slopes, floodplains, and designated critical habitats as well as areas set aside to link these features together are conserved for recreation or open space.



**Vision Scenario:** The Vision Scenario is based on ten Vision Dixie Principles that were derived from responses received from the public as part of a citizen involvement campaign following the release of scenarios A – D. The ten principles are: plan regionally/implement locally, maintain air/water quality and conserve water, guard "signature" scenic landscapes, provide connected open spaces, build balanced transportation systems, focus growth in walkable centers, direct growth inward, provide a broad range of housing types, reserve key industrial growth areas, and preserve critical public lands.

<u>The evaluation process</u>

The scenarios were measured for their impacts on land consumption, driving distances, time spent traveling, the number of transit riders, new dwelling units and jobs within walking distance of transit, water demand, and air pollution. The transportation-related measures on this list were estimated using the Quick Response System II (QRS II) travel modeling package. Notable components of that package include a "transit walkability" variable that permits the user to specify the amount of the study area that is pedestrian-friendly and a transit disutility function that represents the region's transit network, which is also specified by the user. The Smart Growth attributes of the model are indicated in the following table.

| Smart Growth Model Feature | |
|---|---|
| Daily vehicle trip model | X |
| Simple mode choice model (that separates transit and highway trips) | X |
| Modeling multiple modes of access to transit (e.g., ped. vs. park and ride) | X |

Evaluation results

The reported data from the study shows the following results for scenarios A through D.

| | Scenario | | | |
|---|---|---|---|---|
| | A | B | C | D |
| New highway lane miles | 334 | 334 | 287.8 | 155.2 |
| Square miles consumed by new development | 192 | 85 | 67 | 40 |
| New dwelling units within 1/3 mile of transit | 20,000 | 22,000 | 37,000 | 58,000 |
| Percent new housing in village or town center | 3% | 5% | 13% | 19% |
| Daily vehicle miles traveled (thousands) | 11,095 | 10,130 | 9,311 | 7,737 |
| Daily vehicle trips (thousands) | 1,128 | 1,139 | 1,099 | 1,089 |
| Daily vehicle hours traveled | 312, 674 | 283,636 | 277,139 | 245,901 |
| CO emissions (thousands of grams per day) | 23, 593 | 24,393 | 23,485 | 15,643 |

Unfortunately, complete data for the Vision Scenario were not made available. However, project reports indicate the following:

> When compared with Scenarios A and B, the Vision Scenario results in 9,000 more transit trips per day. Households would not need to drive as far. When compared with Scenario B, 200,000 fewer miles of driving would occur in the county every day. The miles saved would top 1,000,000 miles per day compared to Scenario A. As a result of the additional transit use and fewer miles of driving, automobiles would produce between 1,000 and 3,000 fewer pounds of carbon monoxide each day in the Vision.

Elected official participation/public involvement

Vision Dixie was guided by a steering committee consisting of politically and geographically diverse public officials and community representatives. This group launched the project in October 2006, involving more than 400 area citizens. This was

followed by 13 workshops attended by more than 1200 residents. Using the "growth chip" game described in other parts of this bibliography, workshop participants helped craft the four scenarios outlined above. The steering committee presented the analysis of the scenarios in May and June 2007 at nine "Dixie Dialogue" meetings that were attended by more than 500 residents. Another 800 residents responded to the scenarios online. The Dialogue and online participants voiced opinions about the analyses and expressed preferences for how future growth should occur. At the end of this process, the steering committee sponsored a telephone survey of county residents to ask their opinions on growth issues and possible strategies. Based on this input, the steering committee crafted the ten Vision Dixie Principles that provided the basis for the Vision Scenario.

Resulting actions

The Washington County Commission has adopted the Vision Dixie Principles as part of the county's general plan to guide future land use decisions. Other area local governments are considering taking similar action. Helping with this process is a Vision Dixie Implementation Committee, comprised of a county commissioner, two area mayors, the head of the area association of governments, and a citizen representative. A new nonprofit organization—Form Tomorrow—is assisting with implementation by providing planning and consulting services to small communities that do not have planning staff. To bring some accountability to the implementation process, the county economic development department reports on Vision Dixie progress each year at the county-wide economic development conference.

A key moment in Vision Dixie implementation was the adoption of the federal Washington County Growth and Conservation Act, which Congress passed in 2009. Based on Vision Dixie results, the Act transfers a limited amount of BLM lands to private ownership, while designating other lands in the region for protection as wilderness and other similar classifications. Under the Act, any additional transfer of BLM land to private ownership must be done consistent with the Vision Dixie Principles.

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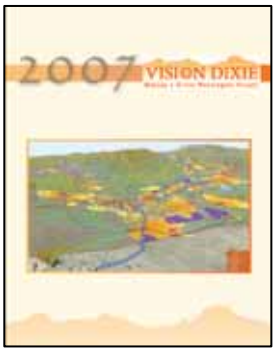
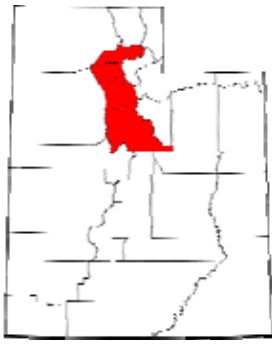


**Project Title:** Wasatch Choices 2040: A Four County Land-Use & Transportation Vision



**Sponsor:** Wasatch Front Regional Council, Mountainlands Association of Governments, and Envision Utah

**Completion Date:** 2006

**Planning Horizon**: 2040

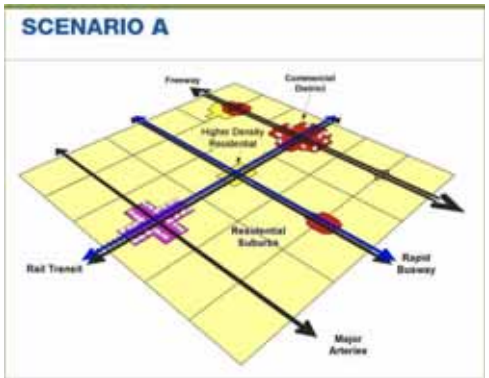
**Source**: http://www.wfrc.org/cms/publications/wasatchchoices2040report.pdf

The Wasatch Front region of northern Utah, which centers on the urban areas surrounding Salt Lake City, has experienced high rates of population and employment growth for decades. Since 1960, the region has seen at least double the national average in population growth, with comparable increases in employment. These high growth rates are anticipated to continue through the first half of the 21st Century, increasing concerns among regional leaders and citizens about possible impacts on open space, air pollution, water availability, traffic congestion, housing affordability, and fiscal expenditures for public infrastructure and services. Envision Utah, a regional nonprofit organization, sponsored a scenario-based visioning process in the mid-1990s that successfully engaged a wide spectrum of local leaders in articulating a Quality Growth Strategy. While the region's two MPOs—the Wasatch Front Regional Council (WFRC) and the Mountainland Association of Governments (MAG)—participated in this process, they did not incorporate the resulting Strategy into their respective long-range transportation plans. To remedy this disconnection, the MPOs collaborated with Envision Utah to undertake another study—titled Wasatch Choices 2040—with the specific intention of using a land use-transportation vision generated by the study as the basis for the region's next set of transportation plans. To create that vision, the three agencies—WFRC, MAG, and Envision Utah—instigated a region-wide scenario planning process.

<u>The nature of the scenarios</u>

The scenarios developed for the study were crafted using input from a series of public workshops (described below). Staff analyzed the workshop results using three primary questions: Where in the region did workshop participants prefer for the location of new growth? What type of development did they prefer in those locations (residential, commercial, or mixed use)? How dense did they prefer that development to be? A series of "hot spots" emerged from this analysis, indicating some degree of consensus about the appropriate location and intensity of new growth. The assessment also identified four themes that were common among workshop participants: an emphasis on growth centers, a desire for "land recycling," a preference for a variety of housing

types, and strong support for pedestrian and bicycle facilities. Utilizing the hot spots and common themes, agency staff crafted four contrasting scenarios.




**Scenario A – Business as Usual:** Scenario A is based on existing city, county and multi-county plans to guide future growth and transportation.

**Scenario B – Transit Station Villages:** Scenario B emphasizes urban development in transit station villages. In this scenario, more development centers are clustered near transit stops. The suburbs generally remain at the same densities as found in Scenario A, with some occasional neighborhood villages that mix apartments, condos and neighborhood shopping. Scenario B significantly increases the amount of rail transit by emphasizing rail extensions and bringing light rail and commuter rail to more communities than currently planned.

**Scenario C – Interconnected Network of Complete Streets:** Rather than encouraging development around transit nodes (like Scenario B), Scenario C intensifies mixed-use development along boulevards that support a complete set of transportation choices: walking, biking, transit and auto use. These boulevards are lined with townhouses, shopping, and employment. New suburban neighborhoods in Scenario C remain largely residential and lower density in character.

**Scenario D – Centers of Employment:** Scenario D envisions stronger suburban centers of employment in closer proximity to housing areas. Suburban neighborhoods in the scenarios have a greater mix of lot sizes. Scenario D emphasizes construction of new interstates and major roads to serve the region's growing areas.

## The evaluation process

The scenarios were tested for their impacts on customary transportation indices using the region's travel demand modeling system, which, at the time of this study, contained the following Smart Growth components:

| **Smart Growth Model Feature** | |
|---|---|
| Daily vehicle trip model | X |
| Modeling peak period as well as daily travel | X |
| Simple mode choice model (that separates transit and highway trips) | X |
| Transit network & assignment of daily trips to that network | X |
| Supply & demand model equilibration | X |
| Income stratification in distribution and mode choice models | X |
| Auto ownership modeling sensitive to land use characteristics | X |
| Travel time feedback loops between model components | X |
| Non-motorized modes (ped/bike) estimated in mode choice model | X |
| Modeling multiple modes of access to transit (e.g., ped. vs. park and ride) | X |

In addition, the scenarios were also evaluated for their impacts on water consumption, land consumption, proximity to transit, and public infrastructure costs.

## Evaluation results

The evaluation of the scenarios demonstrated several key themes. First, mixed-use development can be effective in reducing travel. Scenario C mixed more homes with destinations (accounting for more than 20% of future growth); this significantly reduced average driving distances, which in turn reduced congestion and emissions of air pollutants. Second, locating growth near transit—as in Scenario B—encourages people to ride transit. Third, people will walk and bicycle if the trip is short and the street design is right. Fourth, transportation choices help determine where growth will occur and how much land will be developed. Fifth, interconnected streets help to keep short trips off of highways and regional arterials. Last, relatively small changes in development locations and densities, if well chosen and implemented, can have surprisingly significant impacts on travel patterns and transportation consumption; for example, Scenario C contains only 6% more multi-family housing units than Scenario A, but has 10% less congestion and 3% fewer vehicle miles travelled.

| | Scenario A | Scenario B | Scenario C | Scenario D |
|---|---|---|---|---|
| Lane miles of highways, ramps, arterials & collectors | 8,757 | 8,147 | 9,099 | 9,067 |
| Annual transit revenue hours* | 175,349 | 191,849 | 181,849 | 181,349 |
| Total developed land (sq. mi.) | 854 | 798 | 845 | 905 |
| % dwellings in mixed use areas | 0.6% | 13.5% | 17.6% | 5.8% |
| % growth through redevelopment | 24% | 27% | 26% | 23% |
| % dwellings walking distance to transit | 22% | 46% | 40% | 9% |
| Average daily VMT (millions) | 81.2 | 79 | 80.9 | 85.4 |
| Average daily hours of delay | 450,000 | 530,000 | 350,000 | 400,000 |
| Acre feet of water consumed per year | 193,865 | 111,363 | 162,765 | 240,281 |
| Public infrastructure costs (billions) | $31.5 | $23.2 | $18.6 | $37.4 |

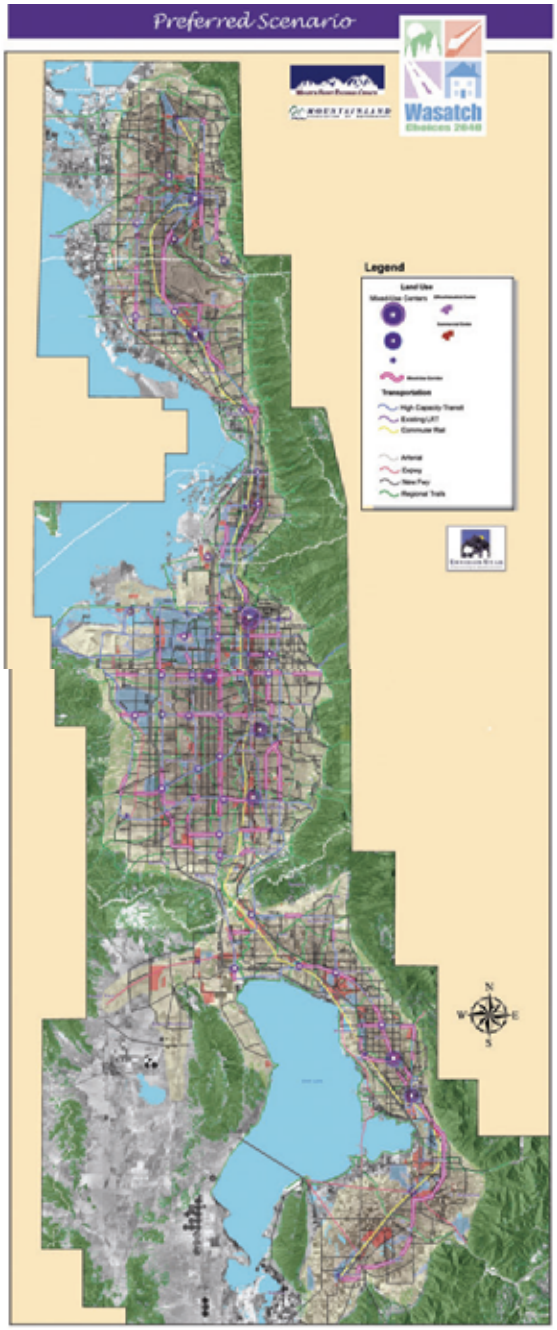
* estimated

Elected Official Participation/Public Involvement

The Wasatch Choices process employed multiple techniques to engage citizens and local leaders. The study was directed by a steering committee composed of mayors, city council members, county commissioners, environmental advocates, representatives of other regional agencies, and business executives. Members of the steering committee and agency staff sponsored 13 public workshops around the region that attracted more than 1000 citizens. Workshop participants engaged in the "growth chip game," allocating expected future growth on large scale maps using chips that represent more than two dozen different development archetypes and quantities. They also used different colored tapes to represent their preferred transportation improvements. A total of 119 maps were created through this process. Workshop participants also completed surveys about key environmental, growth, and transportation issues in the region. These workshop results provided the structure for creating the four scenarios outlined above. Once the impacts of the scenarios had been assessed, the agencies hosted an additional 13 public workshops to receive reaction and input on the analysis.

Resulting actions

From the feedback received in the final set of workshops, the staffs of the three agencies crafted a preferred Vision Scenario, which borrowed elements primarily from scenarios B and C. The workshops also provided the basis for a draft set of regional Growth Principles and Objectives that were further refined by a new Regional Growth Committee created by the two MPOs. The final set of principles and objectives were formally adopted by the boards of the two MPOs and, eventually, by all but four of the local governments in the region. The MPOs are currently working with elected officials, stakeholders, and the public to further refine the Vision Scenario in preparation for new updates to the regional transportation plans, which are expected to be completed late in 2010.

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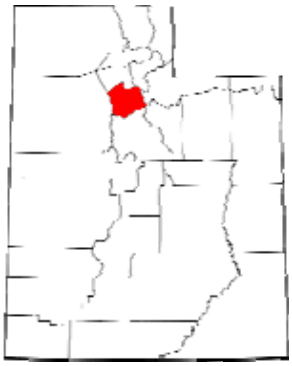
**Project Title:** West Salt Lake County Transit Study



**Sponsors:** Utah Transit Authority, Salt Lake County, Wasatch Front Regional Council, Kennecott Land Corporation, and Suburban Land Reserve

**Completion Date:** 2009

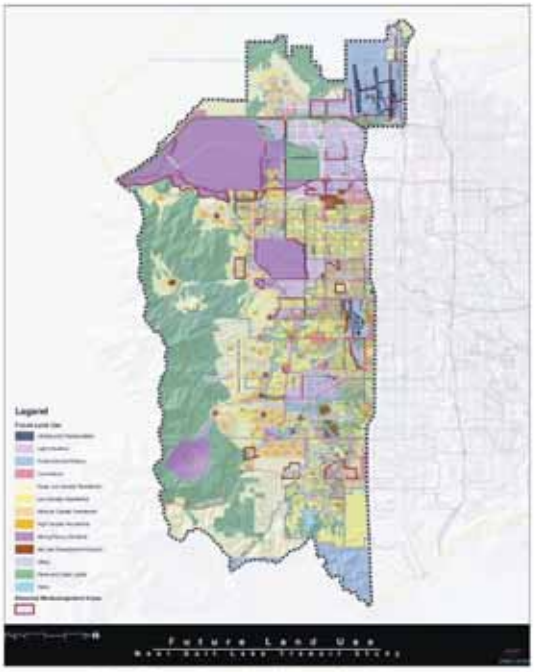
**Planning Horizon**: 2040 & build out

**Source**: West Salt Lake County Transit Study Final Report

The western portion of Salt Lake County has been the fastest growing part of the Salt Lake City/Wasatch Front region during the 1990s and 2000s and more growth is anticipated in coming decades. Much of recent growth in the sub-region has consisted of standard suburban style development: low density single-family houses and low FAR retail situated on discontinuous streets interspersed with large-scale arterials. Nevertheless, the sub-region is also home to Daybreak, a New Urbanist style community developed by Kennecott Land, a subsidiary of Kennecott Copper and the dominant land owner in the region. Recent land use studies of the west county area, including one sponsored by Envision Utah (for the Mountain View Corridor EIS) and another by Salt Lake County, have focused on moving to a transit-oriented development (TOD) structure for future growth in the area. The West Salt Lake County Transit Study was undertaken to build on these earlier studies and to test various possible transit strategies that might work in combination with a more TOD focused development pattern.

<u>The nature of the scenarios</u>

The study assessed three land use allocations and four alternative transit networks. The three land use allocations include:



**2040:** The 2040 land use allocation assumes distributions of future households and employment to the region's traffic analysis zone system (TAZ) based on the amount of buildable land, the attractiveness of specific areas, existing planning and zoning controls, and build-out potential. The allocation is constrained by growth projections for 2040 provided by Robert Charles Lesser Co. based on countywide growth patterns

and economic projections. Tellingly, these projections provide a control total for allocated households, but not for employment; the latter limit cannot be reached given local government plans and zoning ordinances, which limit the availability of land for those use types and density levels.

**Build-Out:** The Build-Out allocation uses the same assumptions as the 2040 allocation, but without the control totals, effectively adding about 30,000 households and 44,000 jobs to the study area.

**Optimized Land Use:** This allocation is designed to test the potential for higher intensity development in 11 station areas, the impact on future transit use, and the resulting improvement in performance of the transit system. Meetings with the cities and other stakeholders confirmed the interest in, and potential for, higher levels of development in the station areas. In some cases, the cities are already modifying their plans to allow higher densities and greater mixed use development. In other situations, there is a recognition that station areas would likely develop or redevelop at higher intensities than currently allowed.

The alternative transit networks include:

**Base Medium Capacity Rapid Transit System:** This alternative establishes a connected network of rapid transit lines (either light rail (TRAX) or BRT) operating primarily in the medians of major arterials, supplemented with local and feeder bus service. A sub-alternative providing less frequent service was also tested.

**Express BRT Service Plan:** With this alternative, the base BRT/LRT corridors are supplemented with a substantial Fast Bus/BRT system, focused primarily on the Mountain View Corridor, and serving longer distance commute trips.

**Higher Speed West Bench Line:** This alternative uses the basic network from the Base Medium Capacity system, but replaces slower moving BRT/LRT service in the primary study area corridor (the West Bench corridor) with faster rail service in order to achieve more competitive travel times. This interurban service is designed to provide an average speed in the 30-35 mph range, longer station spacing and potential use of higher capacity vehicles such as Diesel Multiple Units (DMU).

The alternative land use allocations and transit networks were combined to create five integrated land use-transportation scenarios:

**2040 – Base Medium Capacity Scenario:** combines the 2040 land use allocation with the Base Medium Capacity transit network.

**2040 – Express BRT Scenario:** combines the 2040 land use allocation with the Express BRT transit network.

**2040 – Higher Speed West Bench Scenario:** combines the 2040 allocation with the West Bench transit network.

**Build-Out – Higher Speed West Bench Scenario:** combines the Build-Out allocation with the West Bench transit network.

**Optimized Land Use – Higher Speed West Bench Scenario:** combines the Optimized Land Use allocation with the West Bench transit network.

The evaluation process

The five scenarios were tested for their impacts on transit ridership levels, mode shares, transit revenue hours and transit rides per person, and cost per transit ride. To create the scenarios, the study team used a gravity-based proprietary land use model that allocates growth based on land availability and other attractiveness variables, local planning and zoning, and build out potential. The scenarios were tested using the MPO's regional four-step travel demand model, which contains the following Smart Growth features:

| **Smart Growth Model Feature** | |
|---|---|
| Daily vehicle trip model | X |
| Modeling peak period as well as daily travel | X |
| Simple mode choice model (that separates transit and highway trips) | X |
| Transit network & assignment of daily trips to that network | X |
| Supply & demand model equilibration | X |
| Income stratification in distribution and mode choice models | X |
| Auto ownership modeling sensitive to land use characteristics | X |
| Travel time feedback loops between model components | X |
| Non-motorized modes (ped/bike) estimated in mode choice model | X |
| Modeling multiple modes of access to transit (e.g., ped. vs. park and ride) | X |

Evaluation results

| | Scenario | | | | |
|---|---|---|---|---|---|
| | **2040/ Medium** | **2040/ BRT** | **2040/ High Speed** | **Build-Out/ High Speed** | **Optimized/ High Speed** |
| Population | 744,628 | 744,628 | 744,628 | 823,807 | 960,466 |
| Transit revenue hours (annual) | 834,400 | 1,073,800 | 737,550 | 749,840 | 830,000 |
| Average dwelling density in transit station areas (per acre) | 2.95 | 2.95 | 2.95 | 2.88 | 4.10 |
| % new development near transit | | | | | |
| households | 24% | 24% | 24% | 22% | 36% |
| jobs | 37% | 37% | 37% | 32% | 45% |
| Vehicle miles traveled (000s) | 13,824 | 13,824 | 13,824 | 15,117 | 16,632 |
| Percent of home-based work trips on transit | 8.8% | 9.2% | 8.3% | 8.3% | 9.4% |
| Daily transit trips | 101,375 | 108,156 | 94,331 | 102,554 | 129,970 |

Based on the data from the travel model analysis, the study sponsors came to the following conclusions: A transit system combining local and commute bus service, BRT lines, and rail transit service can be developed in the study area and would be reasonably effective, meeting or exceeding study goals for riders per capita and commute mode share. With current projected land use, the introduction of light rail in the study area is not currently cost-effective. However, because of its lower capital costs, DMU-based interurban service is more cost-effective and may be better suited to the future travel and land use characteristics of the area.

Elected Official Participation/Public Involvement

This study was conceived primarily as a feasibility study. As such, the study's focus was fundamentally on technical, not policy, issues. As a consequence, little public involvement occurred as part of the study. The study authors, however, anticipate that future action furthering the study's results would be the subject of full public involvement and debate. Nevertheless, the study did employ input from local officials and stakeholders, particularly in the development of the Optimized Land Use allocation.

Resulting actions

The study concludes with a recommended transit plan, consisting of a short extension of an existing light rail line and the development of several new BRT lines and a new interurban rail line. The plan suggests corridor preservation steps be taken in the near-term to protect the possible future development of these facilities and services. Additional implementation recommendations include incorporating the study's results in the region's long-range transportation plan and in the general plans of municipalities in the study area.

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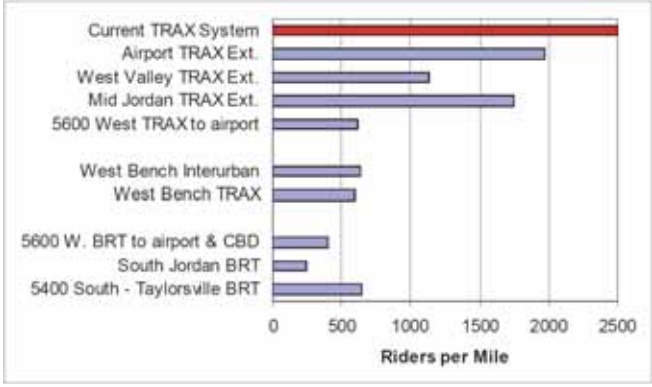


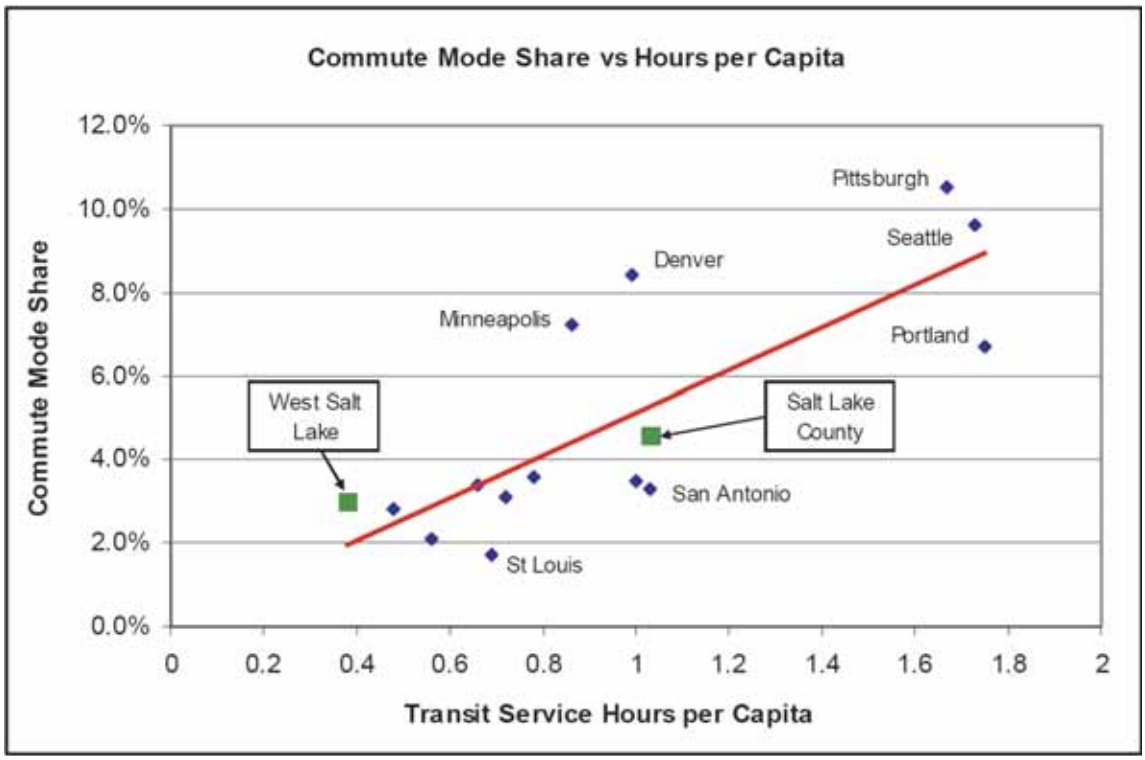

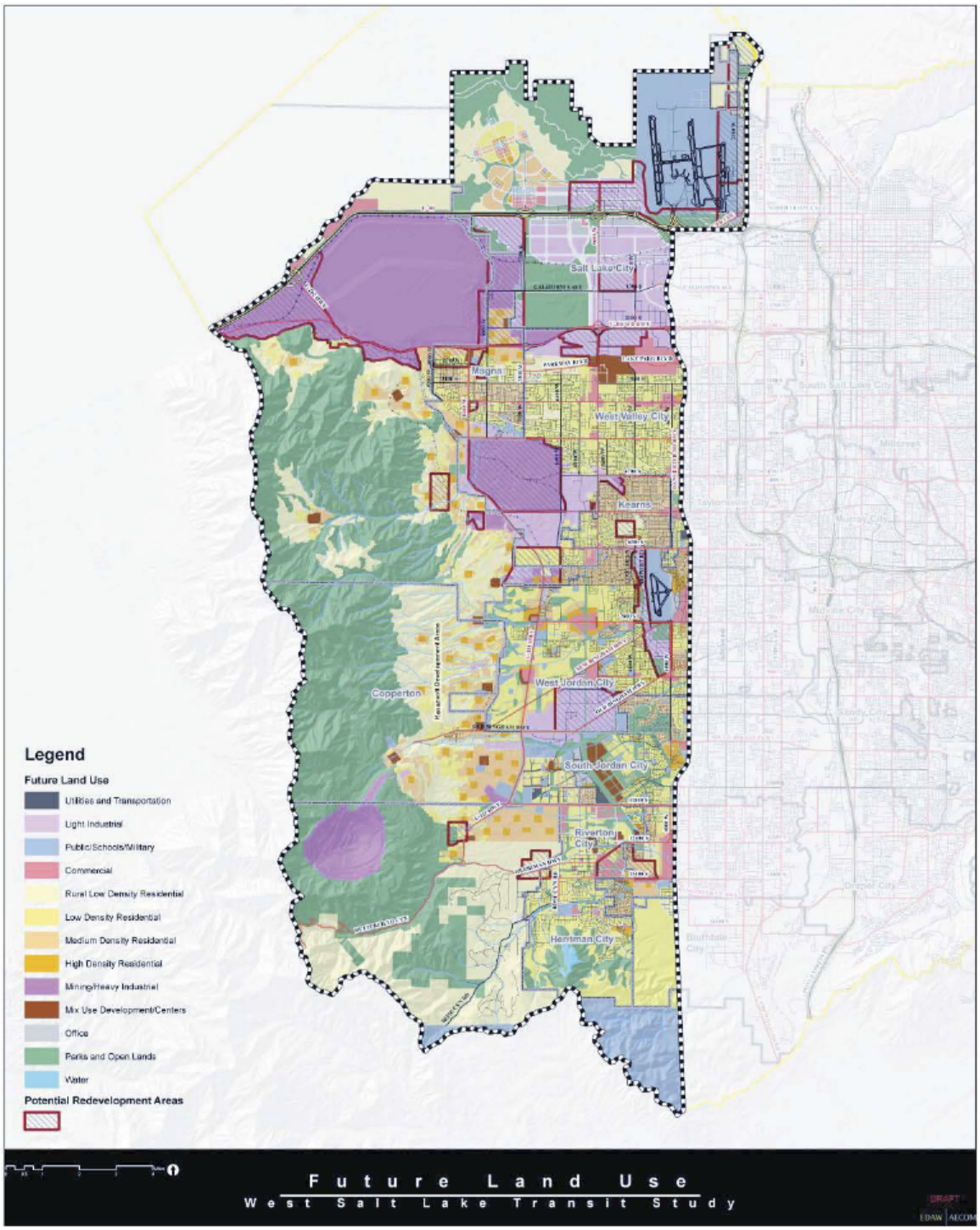
Salt Lake City
Magna
West Valley City
Kearns
Copperton
West Jordan City
South Jordan City
Riverton City
Herriman City
South Salt Lake City
Millcreek
Taylorsville City
Murray City
Midvale City
Sandy City
Draper City
Bluffdale City
Legend
Future Land Use
Utilities and Transportation
Light Industrial
Public/Schools/Military
Commercial
Rural Low Density Residential
Low Density Residential
Medium Density Residential
High Density Residential
Mining/Heavy Industrial
Mix Use Development/Centers
Office
Parks and Open Lands
Water
Potential Redevelopment Areas
Future Land Use
West Salt Lake Transit Study
DRAFT
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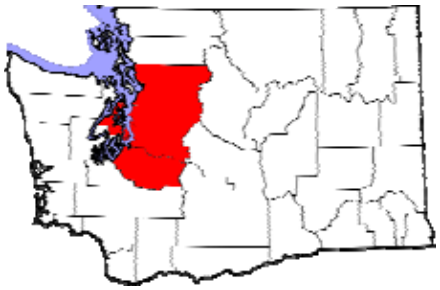
# Washington



**Project Title:** Vision 2040

**Sponsor:** Puget Sound Regional Council

**Completion Date:** 2008

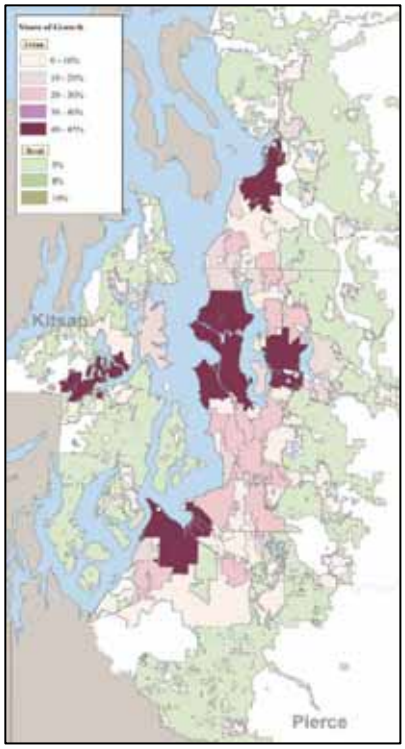
**Planning Horizon**: 2040

**Source**: http://www.psrc.org/growth/vision2040/

The Puget Sound Regional Council (PSRC) has incorporated land use scenario planning into its planning process for a number of years. Vision 2020, the previous regional growth strategy, was one of the first region-wide uses of scenario analysis in the country. In Vision 2040, the PSRC seeks to achieve a closer balance between jobs and housing within its four counties, provide more effective guidance for focusing growth to cities and urban growth areas, minimize rural development, and support economic growth in designated regional and subregional centers. The resulting vision from the Vision 2040 process is intended to both reflect and inform the local government planning policies and growth targets required by the Washington State Growth Management Act. It also responds to the Act's requirement for regional guidelines and principles. Finally, the vision provides the policy framework for the next update to the region's long-range transportation plan.

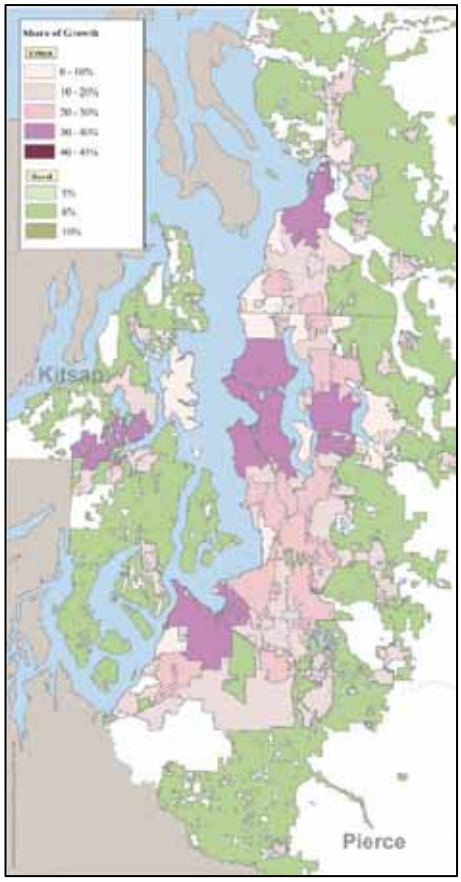
The nature of the scenarios

PSRC first crafted four thematic scenarios, which provided the basis for a fifth, preferred scenario:

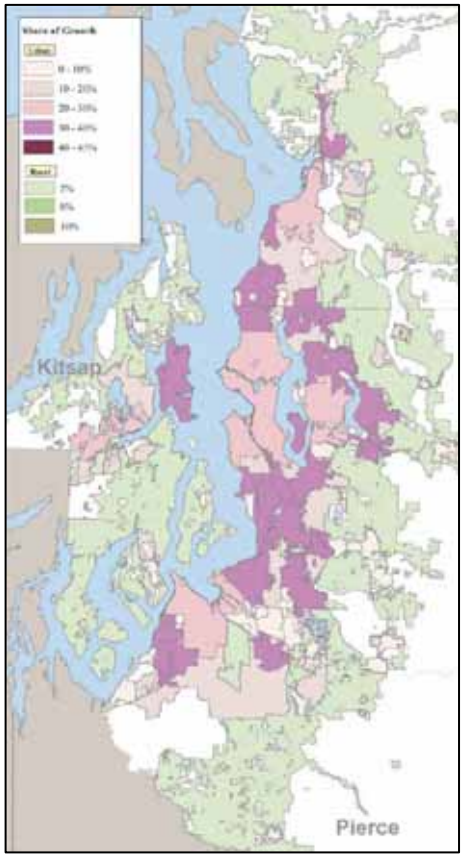



**Growth Targets Extended Alternative.** This scenario continues and emphasizes the population and employment growth patterns anticipated in currently adopted plans. Under this alternative, unincorporated urban growth areas and rural areas would accommodate significant growth. Nearly three quarters of the region's new jobs would be concentrated in the region's largest cities, while medium-sized communities would also become larger employment centers. As currently planned, many new apartments, condominiums and townhouses would likely be built in downtown areas near employment centers. Extensive residential growth would continue in the region's unincorporated urban and rural areas.

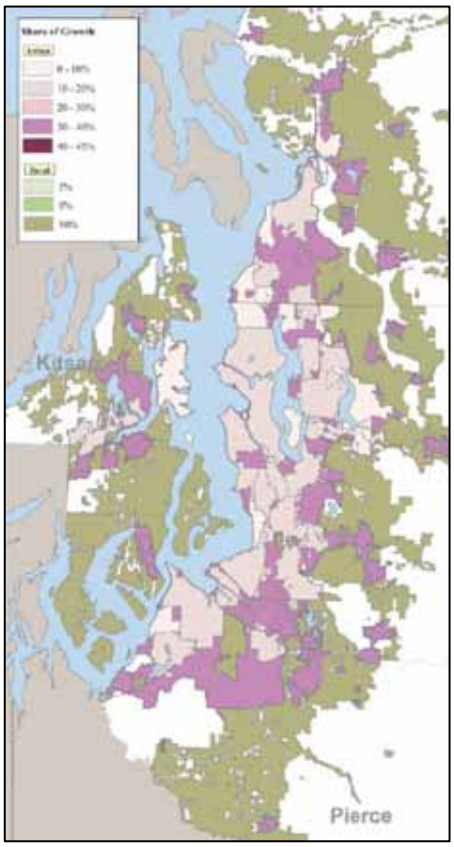
**Metropolitan Cities Alternative**. This scenario represents the most densely focused regional growth pattern among the alternatives. The largest shares of the region's future growth would occur in the region's five major cities: Seattle, Bellevue, Everett, Bremerton, and Tacoma. Growth also would be focused in the region's core suburban cities. In this scenario, considerable redevelopment would occur in the region's largest cities, with most new jobs reinforcing them as major regional employment centers—as is currently planned—along with a significant concentration of new apartments, condominiums and townhouses built near job centers and in areas close to high capacity transit systems. Significantly less growth would occur in the region's rural and unincorporated urban areas than is currently planned. Growth that is currently planned for these areas would shift to the region's main central cities and core suburban areas.



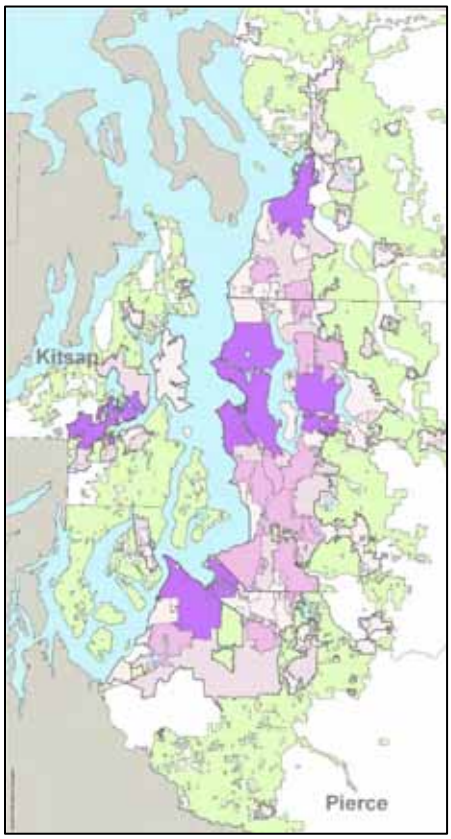

**Larger Cities Alternative**. This scenario assumes suburban cities in the region would accommodate the bulk of future population and employment growth. Suburban cities with designated regional growth centers and other larger suburban cities would be the primary locations for new development. Considerable redevelopment would occur under this scenario in current town center and neighborhood shopping areas, and suburban cities would become major regional job centers. Many new apartments, condominiums and townhouses would also be built in these areas. Less growth than is currently planned would occur in the downtown areas of the region's largest cities, unincorporated urban areas, and rural areas.



**Smaller Cities Alternative**. This scenario has the most dispersed regional growth pattern of all the scenarios. It would disperse growth within the region's urban growth area, with smaller and freestanding suburban cities and the unincorporated urban growth areas receiving a sizable amount of population and employment growth. Redevelopment in what are now small downtowns would produce many more significant, dispersed local employment centers throughout the region. These smaller downtown areas would also develop with new apartments, condominiums and townhouses. Unincorporated urban areas—currently comprising the outskirts of small cities and towns—would experience significant new commercial and residential development. There would also be a substantial amount of single-family housing built in currently undeveloped rural areas. Growth that is currently planned for the region's central cities would shift to small cities and unincorporated areas. For the purposes of analysis, this alternative also assumes that road and highway systems in and around smaller cities would be improved.




**Preferred Growth Alternative.** After a thorough process of public and local official outreach and involvement, PSRC developed a Preferred Growth Alternative, which accommodates future growth in a compact regional pattern resembling the Metropolitan Cities and Growth Targets Extended scenarios. The largest share of growth is distributed to the region's central cities—places with designated regional growth centers that already are connected by major transportation corridors and high capacity transit. Job growth in this scenario would be accompanied by a significant new residential growth, likely in the form of new high-rise and mid-rise apartments, condominiums, and townhouses built near job centers. Planned growth would be focused inside the urban area with growth in rural areas minimized. The focus of growth creates a closer jobs-housing balance than exists today.



All of the scenarios assumed the transportation networks specified in the region's current long-range transportation plan (Destination 2030). "This provides a backdrop from which to compare the effects of the land use alternatives on the transportation system." Underlying the analysis are the investments, programs, and strategies in the adopted plan, which includes the state's 1991 Commute Trip Reduction Act. In addition, PSRC assumed funding and promotion of vanpool programs sufficient to double that mode's 2001 share of work trips by 2010. Additional non-specific policies promoting TDM were also assumed.

The evaluation process

PSRC used a version of Criterion's INDEX sketch-planning GIS model to assist in the creation of the scenarios. The INDEX-Paint the Region function allowed agency officials and staff to assess the impacts of particular growth patterns. This facilitated the specification and testing of scenario possibilities at a sketch level, before defining a final set of scenarios for full analysis. "By developing and analyzing a wide range of growth scenarios it was possible to produce a well-defined range of bookend alternatives to describe different ways the region might distribute population and employment increases to accommodate future growth."

PSRC uses a regional econometric model as the first part of a two-part forecasting process. The model produces forecasts for the region as a whole, which then serve as the regional control totals for a separate sub-county model that allocates population, household, and employment forecasts to specific zones. In 2005, PSRC replaced the former regional model they had been using—the STEP (Synchronized Translator of Econometric Projections) model—with the Puget Sound Economic Forecaster (PSEF) Model, which is better suited to work with the North American Industrial Classification Systems (NAICS). The PSEF model operates as an economic base model, where the performance of base industries determines the performance of the non-basic sector industries. PSRC then uses DRAM/EMPAL to sub-allocate regional growth projections to 219 Forecast Analysis Zones, manually adjusting the attractiveness of each zone to match the requirements of each scenario. In the future, the agency plans to use the UrbanSim model for this function, in place of DRAM/EMPAL.

PSRC's travel demand model employs EMME/2 software in a traditional four-step modeling process, using DRAM/EMPAL data as demographic and employment inputs. A vehicle availability model and a time-of-day model are included. Five time periods are modeled overall (two time periods for transit trips) with seven vehicle types, as well as bus, ferry, rail, and non-motorized modes. Resulting performance measures include daily and peak traffic volumes, congested speeds/times, mode splits, trips by purpose, and volume-to-capacity ratios. The Smart Growth components contained in the agency's travel modeling process are represented in the following table:

| Smart Growth Model Feature | |
|---|---|
| Daily vehicle trip model | X |
| Modeling peak period as well as daily travel | X |
| Simple mode choice model (that separates transit and highway trips) | X |
| Transit network & assignment of daily trips to that network | X |
| Supply & demand model equilibration | X |
| Income stratification in distribution and mode choice models | X |
| Auto ownership modeling sensitive to land use characteristics | X |
| Travel time feedback loops between model components | X |
| Non-motorized modes (ped/bike) estimated in mode choice model | X |
| Modeling multiple modes of access to transit (e.g., ped. vs. park and ride) | X |
| Trip distribution sensitive to multi-mode options | X |
| Disaggregate simulation of households | X |
| Explicit representation of ped and bike networks | X |
| Activity- and tour-based modeling | X |
| Integrated land use-transportation modeling | X |

Evaluation results

| | Scenarios | | | | |
|---|---|---|---|---|---|
| | **Targets** | **Metro** | **Large** | **Small** | **Preferred** |
| Percent of population in areas with jobs/housing balance | 27% | 32% | 29% | 24% | 27% |
| Percent of employment accessible in 30 mins. by transit | 0.69% | 1.52% | 0.7% | 0.48% | 1.07% |
| Percent pop and jobs within ¼ mile of transit | 75% | 80% | 78% | 71% | 76% |
| Daily vehicle miles traveled (millions) | 137.4 | 122.2 | 121.4 | 131 | 123.5 |
| Daily vehicle hours of delay (000's) | 1,235.3 | 713.9 | 628.4 | 739.6 | 721.9 |
| Average trip length (miles) | 13.1 | 12.1 | 12 | 12.3 | 12.4 |
| Percent of work trips by ped or bike | 4.5% | 72.% | 5.3% | 4.1% | 6.3% |
| Daily carbon dioxide emissions (tons) | 64,138 | 58,736 | 58,588 | 63,756 | 60,503 |

The data indicate that the Growth Targets Extended Scenario has the longest average trip distances, the highest number of vehicle miles traveled, and the most hours of delay of any of the scenarios. The Metropolitan Cities Scenario, by contrast, has a significantly higher percentage of employment accessible by transit and a much higher percent of work trips being made by walking or bicycling than any of the other scenarios.

Elected Official Participation/Public Involvement

Public outreach for the Vision 2040 project utilized a variety of methods, such as a public opinion survey, workshops, open houses, and presentations to stakeholders. Additional methods for receiving public comment included e-mail, fax, mail, and on the agency's website. In all, more than 2000 individuals, organizations, and local jurisdictions participated in the process, generating more than 1200 comments and suggestions. General themes articulated during the process included the following:

- Build on the current Vision.
- Provide regional leadership.
- Be specific when possible.
- Think long range.
- Broaden the Vision.
- Add measurable objectives to policies.

Resulting actions

Transportation and land use planning in the Puget Sound region has evolved into an interlocking step-wise process, beginning in the early 1990s with the adoption of a regional vision as part of the Vision 2020 study. This vision, which was updated in 1995, provided the growth allocation assumptions used for the 2001 update to the region's long-range transportation plan, titled Destination 2030. In that process, the Vision-based growth assumptions were held constant across all of the transportation alternatives considered; the objective was to determine the best transportation network to support the land use patterns contained in the Vision.

In Vision 2040, PSRC took the opposite approach, keeping the adopted transportation network from Destination 2030 constant across all of the land use scenarios. Here, the goal was to find the arrangement of future growth best served by the transportation network from the existing plan. The growth allocation coming out of Vision 2040 will, in turn, provide the basis for the next update of the region's long-range transportation plan, Transportation 2040, which PSRC expects to complete in 2010.

In addition to serving as the basis for regional planning in the metropolitan area, Vision 2040 also provides a primary basis for land use planning and zoning in the region's various municipalities and counties.

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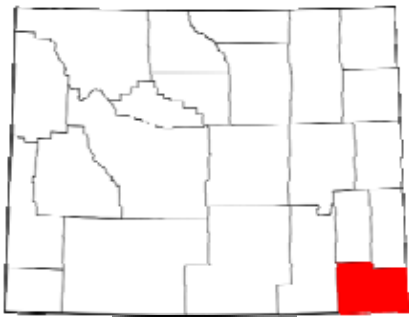
Wyoming



**Project Title:** PlanCheyenne

**Sponsor:** Cheyenne Metropolitan Planning Organization, City of Cheyenne, Laramie County

**Completion Date:** 2006

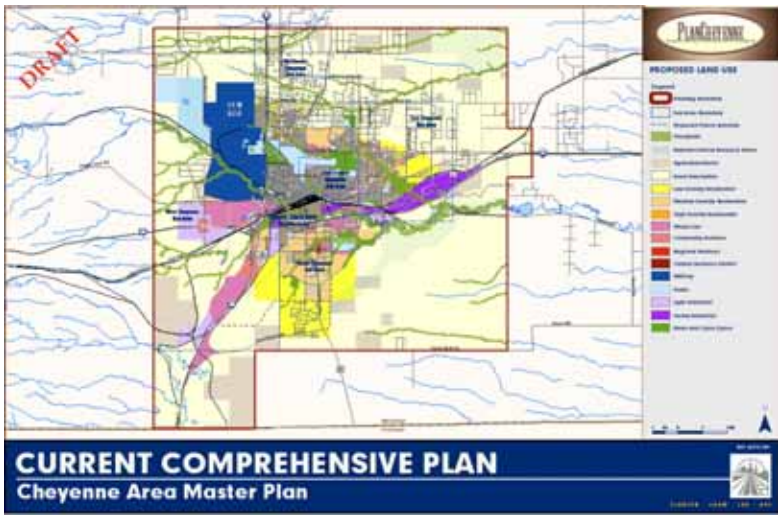
**Planning Horizon**: 2030

**Source**: http://www.plancheyenne.com/welcome.cfm

Estimates indicate that the City of Cheyenne, which had a 2006 population of 75,000, could grow to 135,000 by 2030—an increase of 80%. To more effectively plan for that growth, the city, Laramie County, and the region's MPO combined to create PlanCheyenne. Together, these three agencies have been working to integrate land use, transportation, and parks, recreation, and open space planning, simultaneously producing land use, transportation, and open space plans.

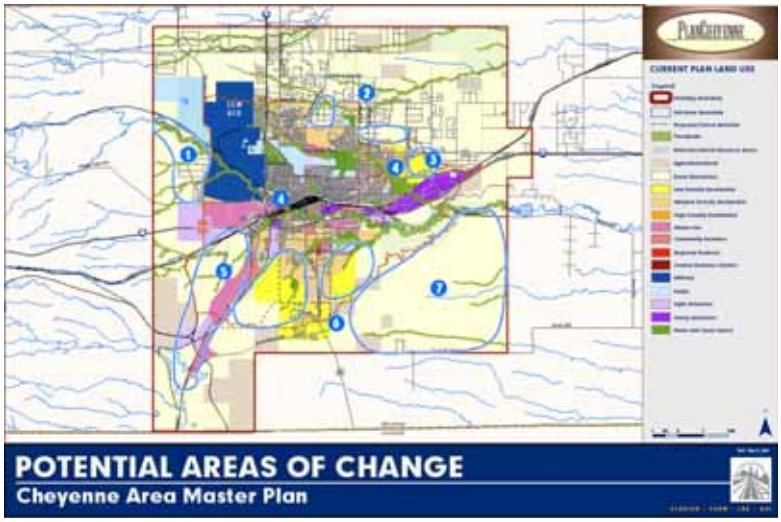
The nature of the scenarios

An early step in this coordinated planning effort was the articulation and assessment of three different land use-transportation scenarios.

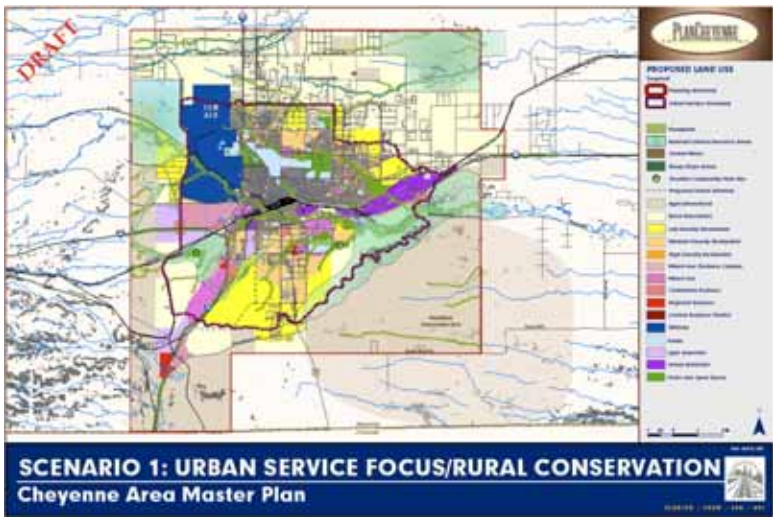



**Current Comprehensive Plan Scenario:** The Current Comprehensive Plan Scenarios allows development to disperse more than the other scenarios. New residential development is predominantly single family—some in the urban area, some in the rural area. New rural "ranchette" development continues to occur on large (5-acre+) lots. New commercial development is low intensity and oriented to automobiles. The plan does not address open space or natural resources conservation in a significant way.

**Potential Areas of Change:** As a precursor to the creation of alternatives to the Current Comprehensive Plan Scenario, the agencies identified seven "possible areas of change and development" within the region. These sub-districts scattered throughout the region consist largely of vacant and under-developed lands. They were, hence, deemed appropriate for consideration of alternative development patterns and became the focus for Scenarios 1 & 2.




**Scenario 1: Urban Service Areas Focus Plan/Rural Conservation:** Scenario 1 is the most compact, with most new development occurring in the urban service area. New residential development is still predominantly single family, but includes a greater variety of other housing types than the Current Comprehensive Plan Scenario. This scenario also focuses on clustering rural residential development to conserve large, contiguous ranch lands and natural and cultural resources.




**Scenario 2: Neighborhoods and Activity Centers:** Development in Scenario 2 is focused in neighborhoods and districts around centers where activities are more intensive, such as shopping and offices. The activity centers are pedestrian-oriented and include parks, plazas and other civic focus.

## The evaluation process

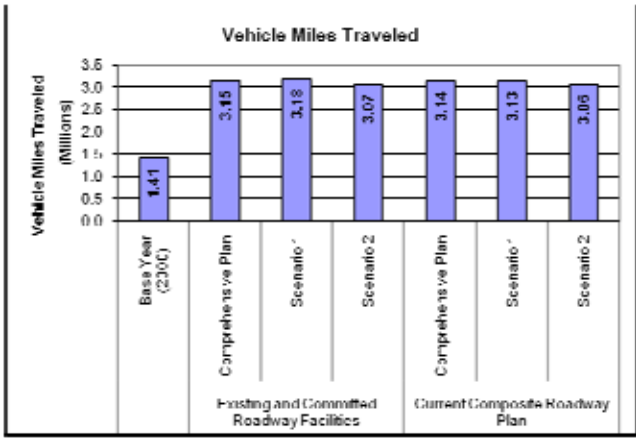
Each of the three land use scenarios was tested using two transportation networks. The first roadway system, the Existing and Committed Facilities network, represents the minimum amount of improvements that will be made during the planning period. The second roadway scenario, the Composite Roadway Plan, represents all roadway improvements from neighborhood plans adopted by the City of Cheyenne.

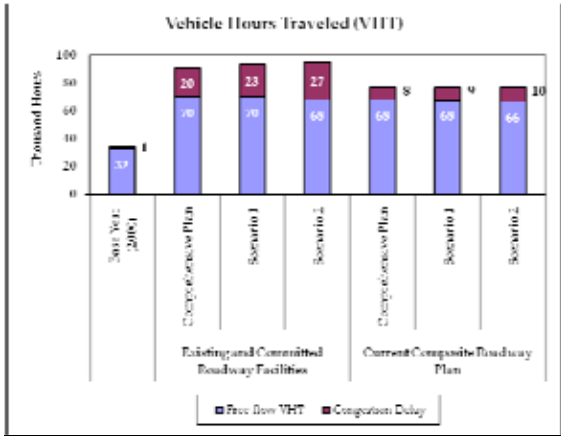
Assessment of the combined land use-transportation scenarios was accomplished using the Cheyenne traffic model. This model, maintained by the Wyoming Department of Transportation, runs on the TransCAD platform and was enhanced as a part of the PlanCheyenne process. The model uses three steps only—trip generation, trip distribution, and trip assignment; there is no mode split function. The model includes the following Smart Growth model components:

| Smart Growth Model Feature | |
|---|---|
| Daily vehicle trip model | X |
| Modeling peak period as well as daily travel | X |

## Evaluation results

In general, the differences in transportation effects between the Comprehensive Plan Scenario and the two alternatives scenarios were small. While Scenarios 1 and 2 did show some increases in congestion, compared to the Comprehensive Plan Scenario, these increases were minor and were generally offset by shorter trip lengths.



Elected official participation/public involvement

The scenario planning portion of the integrated plan development process was portrayed as an opportunity for Cheyenne citizens to "decide now how best to accommodate growth in the future and plan for land uses, transportation, open space and natural resources, parks, infrastructure, and other future needs." Consistent with that outlook, the combined staff of the three agencies conducted two planning charrettes involving members of a planning advisory committee and members of the public. The three scenarios outlined above were derived from those charrettes.

A preferred scenario was selected at the conclusion of the scenario analysis. The selection process utilized public and stakeholder input that was derived from a series of survey/worksheet activities. The resulting scenario is an amalgam of the Neighborhood/Activity Center and Urban Service Area Scenario (scenarios 1 and 2).

Implementation and resulting actions

To implement the preferred scenario, the three agencies crafted community, transportation, and parks and open spaces plans, as outlined above. For each plan, the agencies used a structure based on four conceptual building blocks—Snapshot, Structure, Shape, and Build—each representing a distinct step in the planning process. "Snapshot" reports provide background information and analysis about the current state of the region, including demographic data, economic information, and transportation conditions. "Structure" plans provide the form-giving and design-based portions for each plan. For example, for the land use plan (known as the Community Plan), the agencies crafted a community design handbook that includes principles for public and private development. "Shape" plans establish the guiding principles for how the community should grow in the future, with detailed goals, policies, and specific area plans. Finally, the "Build" plans outline implementation actions, strategies, and processes.

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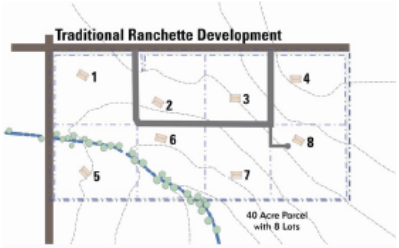


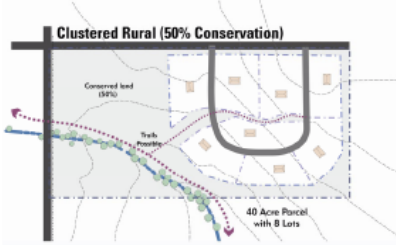

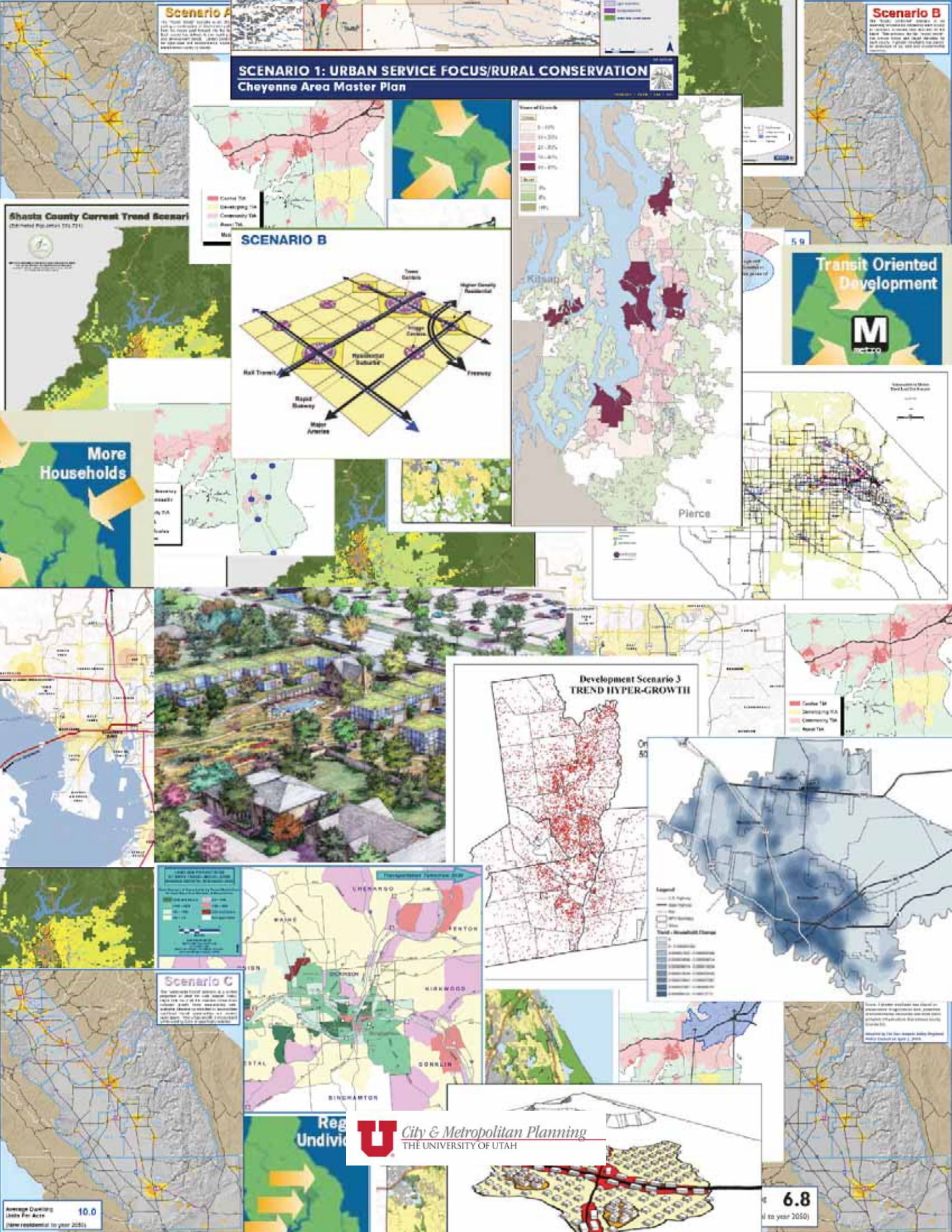
Scenario A
SCENARIO 1: URBAN SERVICE FOCUS/RURAL CONSERVATION
Cheyenne Area Master Plan
Scenario B
Shasta County Current Trend Scenari
SCENARIO B
Town Centers
Higher Density Residential
Village Centers
Residential Suburbs
Rail Transit
Freeway
Rapid Busway
Major Arteries
Kitsap
Pierce
Transit Oriented Development
More Households
Development Scenario 3
TREND HYPER-GROWTH
Scenario C
LINKAGE
WAINE
BENTON
DICKINSON
KIRKWOOD
CONKLIN
BINGHAMTON
Average Dwelling Units Per Acre
10.0
6.8
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