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Evaluating Alternative
Land Use and Transportation Scenarios
–An Overview of the Process–

Prepared for:
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Prepared by:

Anthony James Catanese Center
FOR URBAN & ENVIRONMENTAL SOLUTIONS
AT FLORIDA ATLANTIC UNIVERSITY

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Prepared for the Florida Department of Transportation
Office of Policy Planning

By the
Anthony James Catanese Center for
Urban & Environmental Solutions
at Florida Atlantic University

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> *By failing to address the true costs of population growth, both past and future, we continue to borrow against future revenues, while the quality of life in our communities slowly dissipates. As we respond to new growth and address our existing infrastructure deficits, communities must evaluate their choices in a fiscally responsible manner*. (Florida Growth Management Study Commission, 2001)

This report was prepared in cooperation with the State of Florida Department of Transportation by Sara Lira Forelle, AICP, with the assistance of Robert Bruce, and additional support provided by Jacobus Vos, PhD, and MaryBeth Burton, from the Anthony James Catanese Center for Urban and Environmental Solutions.

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Executive Summary

In 2001, the Florida Department of Transportation (FDOT) requested that the Anthony James Catanese Center for Urban & Environmental Solutions at Florida Atlantic University (Catanese Center)[1] review full cost accounting, a method being proposed to measure the impact of new development on state, regional, and local infrastructure and services. This development impact accounting approach was first proposed by the Governor's Commission for a Sustainable South Florida in 1998. Later, the 2000 Florida Growth Management Study Commission reviewed full cost accounting and concluded that this type of evaluation tool would be both difficult and costly for local governments to implement. They recommended instead that the state develop a standard fiscal impact analysis model to assist local governments in determining the full costs and benefits of new development. Recommendations from both commissions evidence the state's desire to evaluate capital funding decisions in a fiscally efficient manner that will also take into account other costs and benefits of implementing local policies, plans, projects, and programs. In addition, a significant number of recommendations made by the 2000 Growth Management Study Commission were dedicated to enhancing citizen involvement in community planning and the decision-making process. They also demonstrate a growing desire for more democratic decision-making processes that provide citizens and planners with the appropriate opportunities and tools.

This report provides an overview of the processes that the Department of Transportation and land use planners use to evaluate and select transportation and land use policies, plans, projects, and programs in Florida. It focuses on current evaluation methods used in Florida in land use and transportation planning at the state, regional, and local levels and how public participation can be used to enhance the planning process, particularly during the establishment of evaluation and selection criteria. The document provides examples of studies and initiatives from Florida and other states, and from federal agencies. Since land use and transportation evaluations are conducted separately, this report identifies linkages and gaps that influence a more holistic approach to land use and transportation planning.

Today's transportation planning process is under greater pressure to evaluate public spending beyond traditional factors such as forecasted travel demand, air quality, and energy conservation. Federal transportation guidelines now include the equitable distribution of benefits and costs, environmental protection, and incorporation of community desires in the list of planning factors to be considered in the planning process. Transportation spending is also being measured in the context of linking agency goals with those of other agencies at the federal and state levels. Transportation planning is no longer just about improving mobility, but also about promoting economic development, enhancing quality of life, and providing greater opportunities for minority communities, urban and rural. State agencies are being asked to be more accountable, efficient, and equitable in the provision of services. And, in doing so, they are being asked to provide greater opportunities for public involvement as part of the decision-making process.

The Florida Department of Transportation (FDOT) has been eager to implement new policies, processes, and programs that address some planning process components that historically have been overlooked. Among other innovations, the Department is implementing environmental

[1] Formerly the Florida Atlantic University/Florida International University Joint Center for Environmental and Urban Problems.

streamlining, increasing planning efforts in rural areas, using performance measures to tie outcomes with future planning, and incorporating more public involvement at all planning levels. These improvements coupled with state required local intergovernmental coordination elements are promoting early communication and coordination between agencies and local governments. They are helping FDOT to resolve conflicts, avoid overlap, and anticipate controversial issues early in the process so that needs can be met in a timely manner. However, with new policies and processes come new demands.

Several issues became evident throughout the research process:

- Greater expectations are being placed on the transportation process to consider impacts to other systems such as land use and the environment.
- Increased expectations on transportation planning seem to be occurring for several reasons, including the fact that increased resources at the state and federal levels are dedicated to transportation planning than to other planning systems.
- The transportation and land use decision-making process should involve in a meaningful manner those who will benefit or be impacted by the decision; therefore, the public should be part of the discussion very early in the process.
- Several obstacles to promoting greater linkage between land use and transportation affect the exchange of information between the two separate planning processes, and funding will be required to overcome those obstacles.
- There are several obstacles to meaningful public involvement, including the fact that from the public's perspective, vision, goals, and objectives are not adequately linked to the decision-making process.
- Regardless of the number of evaluations conducted, if land use and transportation forecasting are not linked to each other, there will be conflicts.

The FDOT continues to implement programs and procedures that over time will help to overcome some of these problems and issues, including the Community Impact Assessment process, the establishment of public involvement programs at the MPO level, and the development of an environmental streamlining process that incorporates public and resource agency involvement earlier in the planning process. However, other steps can be taken to support these efforts in providing greater linkage between land use and transportation planning and result in better environmental protection. Addressing some of these issues lies beyond the responsibilities of the Department of Transportation. Some of these steps involve greater collaboration from local governments and MPOs, and may require the oversight of other agencies.

Evaluating Alternative Land Use and Transportation Scenarios in Florida

--An Overview of the Process--

The Florida Department of Transportation (FDOT) has retained the services of the Anthony James Catanese Center for Urban & Environmental Solutions at Florida Atlantic University (Catanese Center)[2] to study the relationship between transportation, land use, and the environment for the Department's trends and conditions analysis process.

I. Introduction

Federal, state, and local governments continually face the challenge of determining how best to spend revenues to provide services and infrastructure. At the same time, they must also determine how to mitigate the impacts the services provided will have on other systems, including fiscal, social, environmental, and the economy. Planning processes use evaluations and assessments to determine the impacts of a decision on affected systems. Many different types of evaluations and assessments are currently in use. Each one has been designed by different professional fields for a specific use and are often adapted for other fields. Although evaluations and assessments are critical to understanding impacts on the different systems, they are not necessarily the best tools available for balancing transportation needs with community desires. Current evaluation and assessment procedures are being enhanced to make them more responsive to these demands. Other more appropriate tools are also being developed and implemented. Some of them are currently being tested by Florida's Department of Transportation.

In 2001, FDOT asked the Catanese Center to review full cost accounting, a method being proposed to evaluate the impact of new development on state, regional, and local infrastructure and services. This development impact accounting approach was first proposed by the Governor's Commission for a Sustainable South Florida in 1998. A few years later, the 2000 Florida Growth Management Study Commission reviewed full cost accounting and concluded that this type of evaluation tool would be both difficult and costly for local governments to implement. This commission recommended instead that the state develop a standard fiscal impact analysis model to assist local governments in determining the full costs and benefits of new development. The recommendations highlighted the need to include costs of providing transportation and school facilities. Other cost evaluations could include infrastructure required by concurrency (water, sewer, stormwater, and solid waste).[3]

Recommendations from both commissions evidence the state's desire to evaluate capital funding decisions in a fiscally efficient manner that will also take into account other costs and benefits of implementing local policies, plans, projects, and programs. In addition, a significant number of recommendations made by the 2000 Growth Management Study Commission were dedicated to

[2] Formerly the Florida Atlantic University/Florida International University Joint Center for Environmental and Urban Problems.
[3] Florida Growth Management Study Commission, 2001.

enhancing citizen involvement in community planning and the decision-making process. They also demonstrate a growing desire for more democratic decision-making processes that provide citizens and planners with the appropriate opportunities and tools.[4]

A. Project Purpose

The purpose of this report is to provide an overview of the processes that the Department of Transportation and land use planners use to evaluate and select transportation and land use policies, plans, projects, and programs in Florida. It focuses on current evaluation methods used in Florida in land use and transportation planning at the state, regional, and local levels and how public participation can be used to enhance the planning process, particularly during the establishment of evaluation and selection criteria. The document provides examples of studies and initiatives from Florida and other states, and from federal agencies. Since land use and transportation evaluations are conducted separately, this report identifies linkages and gaps that influence a more holistic approach to land use and transportation planning.

B. Overview

1. Evaluation and Assessments as Planning Tools

As the transportation planning process evolves and changes and funds are spread more thinly to cover growing needs, there is greater pressure to evaluate public spending beyond traditional factors such as forecasted travel demand, air quality, and energy conservation. Planning factors now also include the equitable distribution of benefits and costs, environmental protection, and incorporating community desires. Transportation spending is also being measured in the context of linking agency goals with those of other agencies at the federal and state levels. Transportation planning is no longer just about improving mobility, but also about promoting economic development, enhancing quality of life, and providing greater opportunities for minority communities, urban and rural. These linkages will allow governments to leverage additional funds to meet similar objectives and provide more comprehensive planning and implementation.

In short, federal and state policies require state agencies to be more accountable, efficient, and equitable in the provision of services. To increase accountability, governments are being asked to provide an open decision-making process that incorporates the most recent and best information available and allows for meaningful feedback.

As a means for being more efficient, some state governments and agencies are using tools to evaluate alternative solutions that will lead to better and quicker decisions. Although some evaluation tools have been around for a long time, they are striving to be more comprehensive with the aid of new technology. By assessing a greater number of impacts, planners hope to do a better job of reflecting benefits and costs of implementing alternative solutions. Better tools, however, have greater hardware, software, and data requirements, which can be costly and time consuming to obtain in the short term, particularly for local governments. Tools also require initial assumptions and criteria to make them more responsive to each application.

Equitable solutions in transportation and land use are achieved when costs and benefits are spread out more evenly throughout the community. Since different communities have different

[4] Florida's Growth Management Study Commission, 2001, Rec. 2, 20.

needs, values, and preferences, one tool size cannot fit all applications. When the criteria used in evaluations are developed with little community input, they fail to reflect community desires causing the process to fail and result in costly setbacks. Although opportunities are provided for community input throughout the planning process, those participating in the planning process are often not members of the community that will ultimately be impacted by the new facility. Transportation planning agencies hope to incorporate community desires and obtain the support needed to implement solutions in a timely manner by improving channels for public information, education, and input earlier in the planning process. Earlier communication between transportation and the other agencies involved in project permitting will also facilitate negotiation and avoid dead-end confrontations.

The results of evaluations and assessments should be used, not only in the decision-making process, but also in the process of evaluating whether goals have been achieved. While the practice of goal setting is common, generally speaking, there has been very little consistency with monitoring outcomes and tying them to the future decision-making process. Setting and monitoring measurable goals and objectives in the decision-making process are closely linked with establishing the assumptions and criteria at the beginning of the planning process, preceding evaluations and assessments.

The Florida Department of Transportation (FDOT) has been eager to implement new policies, processes, and programs that address some of these components of the planning process that have historically been overlooked. Among other innovations, the Department is implementing environmental streamlining, increasing planning efforts in rural areas, using performance measures to tie outcomes with future planning, and incorporating more public involvement at all planning levels. These improvements coupled with state required local intergovernmental coordination elements are promoting early communication and coordination between agencies and local governments. They are helping FDOT to resolve contradictions, avoid overlap, and anticipate controversial issues early in the process so that needs can be met in a timely manner. However, with new policies and processes come new demands.

2. Transportation and Land Use Planning

Apart from evaluating the impacts on other systems, transportation planning also evaluates the impact of other systems on transportation. Human activity and land uses generate the trips and the need for transportation infrastructure. Likewise, transportation infrastructure impacts human activity by generating new opportunities for access and changes in land use. However, despite the interdependence of these systems, land use and transportation planning are conducted separately. Transportation and land use planning have many parallels, but their different focuses make linking decisions a challenge. While transportation planning is federally mandated at the national, state, regional, and local levels, land use planning is primarily a local matter. Beyond better communication, linking land use and transportation planning requires tools to forecast the interrelated behavior of both systems, and link the plans that regulate them. Florida has also been innovative in addressing these issues.

In Florida, state transportation and growth management legislation and local initiatives are demonstrating the emergence of greater linkage between land use and transportation planning. To strengthen these efforts and strike a better balance between urban development and environmental protection, agencies and local governments are collectively trying to find more sustain-

able development patterns, particularly in the state's larger metropolitan areas. Planners need tools to help them understand the benefits of one form of development over another or the benefits of a combination of transportation alternatives. Cost/impact assessments could provide planners, decision makers, and the public with information and the means for comparing the costs and benefits of alternative forms of design and development. This report reviews some of the existing forms of assessment currently applied in the land use and transportation process.

II. An Overview of the Comprehensive Planning Process

For the past 40 years, planning has generally followed the basic comprehensive steps illustrated in Figure A. Both of the key planning processes reviewed in this document—land use and transportation—generally follow this process which will be reviewed in separate sections. The elements described in this diagram will be used as the basis for the review of both planning processes, with an emphasis on alternative evaluation and selection where fiscal accounting and cost-benefit analysis are used. These concepts apply generally to all planning processes, but more specific issues will be discussed in later sections of this report.

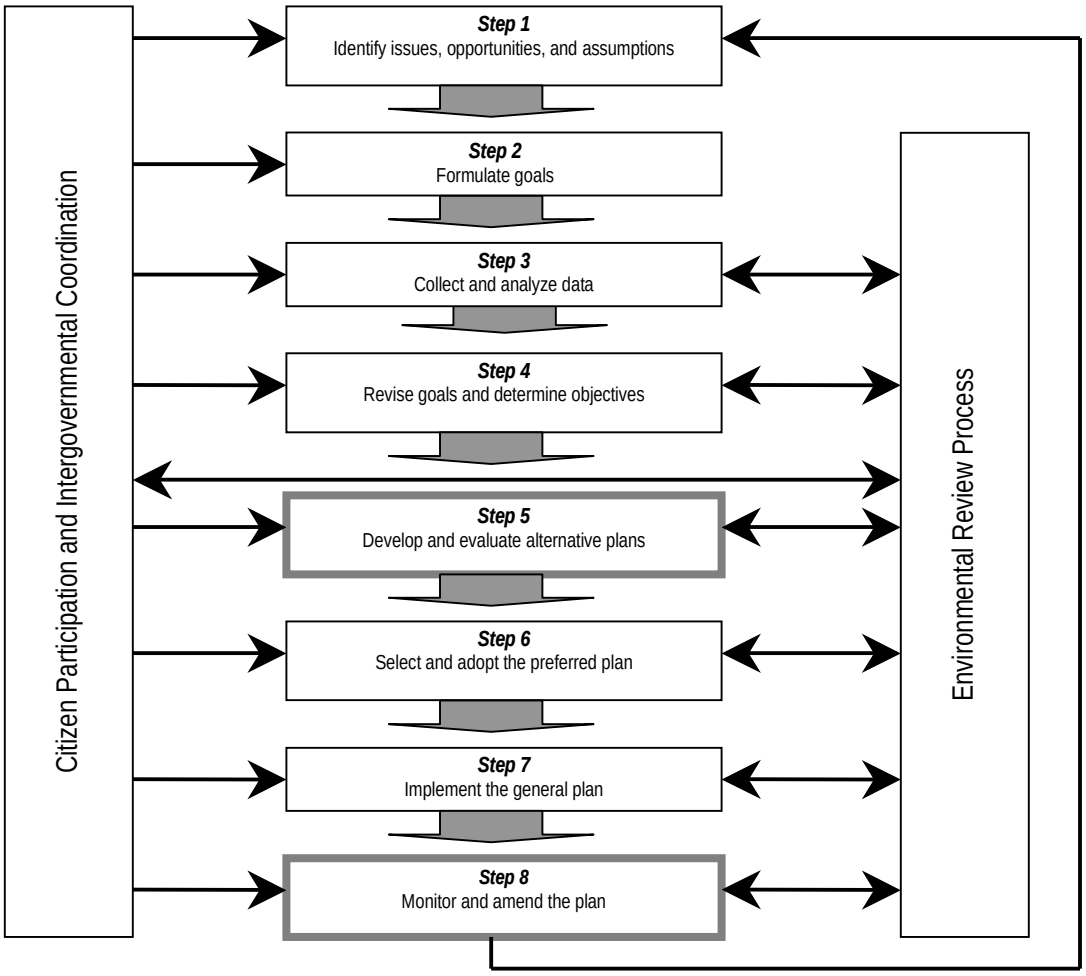
A. Proposing Alternatives

Once the need for a new plan, project, or program has been determined, planning proceeds with the proposal of alternative scenarios or solutions that will meet the identified need. Policies and goals guide the process by setting parameters or criteria for the alternatives. A scoping process then follows to help identify a general format for the proposed solution. From a transportation perspective, that means scoping alternative corridors for new facilities or identifying demand or supply solutions for congested roadways. From a land use planning perspective, the scoping process may include alternative scenarios to accommodate growth: allowing higher densities in one area and/or extending the urban service boundaries further outward. Each alternative must then be analyzed. The potential impacts of each alternative are measured, evaluated, and compared.

B. Evaluations

Evaluations and assessments are used to contrast present with past performance or to compare alternative solutions. They can also be used to measure the effectiveness of the planning and implementation process. Evaluations permit comparisons between costs and benefits of potential impacts. Government agencies use performance evaluations to determine whether programs, processes, or personnel have met goals and objectives. Local governments assess property values for taxation or acquisition purposes. Impact assessments are commonly used to measure the impacts of a policy or project on revenues, neighborhoods, or the environment. Some assessments, like fiscal impact assessments, are clearly quantitative in nature, while others, like community impact assessments, are descriptive and more qualitative in nature.

Figure A. The Comprehensive Planning Process



Source: Suggested local general plan process in California in *The Practice of Local Government Planning*, 3rd. ed., p.25.

Evaluations and assessments are of particular importance during two steps of the comprehensive planning process (Figure A): alternative selection and the monitoring process. During alternative selection, costs and benefits for alternative scenarios are tabulated and compared. This provides an opportunity to select the alternative that best fits the identified needs. Other criteria may be used in the selection process, including political or community support, ease of implementation, and opportunity costs. During the monitoring process, performance measures can be used to determine how well the original goals and objectives have been achieved by the chosen alternative. This step is often overlooked, in which case new goals and objectives are often set in the absence of an evaluation process.

For evaluations and assessments to be effective, performance measures must impact the process. Deficient measurements should lead to changes in the planning process and outcomes. It is very important to define measurable goals and objectives at the beginning of the planning process. The same criteria developed to measure performance can later be expanded for alternative selec-

tion and used again during the monitoring process. The goal-setting process, therefore, should include development of measurable criteria for later use in the evaluation of plans and project alternatives.

C. Quantifying Impacts: Cost-Impact Evaluation Tools

Several types of cost-impact evaluation tools have been developed to enable planners to quantify impacts of alternative plans; each tool is tailored for a different function or industry. This explains why a similar tool may have different names. Evaluation tools can be quantitative or qualitative in nature or a combination of both; however, most cost impact evaluation tools are quantitative.

Quantitative tools are better accepted for project evaluation since they provide measures that are easy to compare. Several quantitative tools can be used to compare costs with benefits or against investments such as fiscal analysis (measures costs against revenues); net present worth of discounting (compares benefits and costs of a stream of future impacts at their present value); and cost-effectiveness (compares costs against degree of goal achievement). Quantitative analysis requires that all costs and impacts be quantifiable, so that a unit of measurement can be attributed to the impact, and that the unit can be put in monetary terms.

Other evaluation tools are applied to intangible impacts or impacts that are not easily quantified or cannot be translated to monetary terms. Most factors studied in social impact assessments are quantifiable but very difficult to put into monetary terms. Research has yet to determine the value of community cohesion or the monetary impact of loss of the social support system of a relocated community. Other methods of evaluation fall into a combination of quantitative and qualitative, including performance-based and indicator-based evaluations.

Table 1 is a summary of evaluation and assessment tools used in planning to assess policies, projects, or programs. The table summarizes analytical methods and describes examples of projects where each technique has been applied. Most of the examples are transportation-related. Additional information on these models with references and sources of information can be found in Appendix A.

Table 1. **Economic Evaluation Tools Suitable For Evaluating Transportation Projects**[5]

TYPE OF TECHNIQUE	SUMMARY OF TECHNIQUE	EXAMPLE OF USE		TYPE OF IMPACT (S)	VARIABLES ANALYZED	COMMENTS
		Project Location	Project Description			
1. Cost Benefit Analysis	Quantifies in monetary terms all of the identified costs and benefits that may occur as a result of the implementation of a particular project or program. The expected benefits are financially discounted at a stated interest rate over a specified time period, converted to a current value, and then compared to construction and project related costs.	Oregon D.O.T.	Evaluated the regional economic and user benefits that might result from improvements to a major freight corridor and compared with costs.	Economic and Access	Travel time; vehicle operating costs; accident costs savings (for truck traffic)	Useful for evaluating and prioritizing among alternatives. Does not evaluate non-monetary impacts. An expensive type of analysis to conduct.
2.A. Fiscal Impact Analysis Methods	One of the oldest and most widely used methods in urban planning measures how changes in policy or factors within an economy will affect changes in expenditures and revenues for particular government agencies.	No examples found in transportation planning. Used often in urban planning. See more below (2B, 2C)	Guidebooks for fiscal impact analysis have been written by the Urban Land Institute and the Center for Urban Policy Research at Rutgers University. A second generation fiscal impact software known as "FISCALS" is available for PCs.	Economic and Fiscal	Cost of providing services to development vs. revenues	Useful for determining impacts of new development on local government budgets. Cannot be used to measure social costs and benefits. Can be easily tailored for local use.
2.B. Cost-Effectiveness Analysis (CEA)	Measures the cost of achieving a specific objective. A project is said to be cost-effective if it has the lowest present value cost, when compared to competing alternatives.	University of Zurich, Switzerland	The method was used to evaluate environmental policies designed to reduce different pollutants by using a "damage index."	Economic	Agricultural policies; sources of pollution segregated by industrial sector; polluting chemicals	Requires that the project size or level of service be specified in advance.
2.C. Least-Cost Approach to Alternative Analysis	The approach seeks out the lowest cost alternative to achieving a stated level of service. Similar to cost-effectiveness analysis, but also includes non-economic factors in the analysis.	Oregon D.O.T.	Applied as case study to Mount Hood Corridor planning process to evaluate as method for improving current planning practices.	Economic in combination with non-economic evaluation	New construction methods and other non-construction alternatives to provide transportation services	Allows comparison of different transportation investment modes using comparable measurement units. Parts of the current process are specific to the utility industry and need to be modified to apply to transportation planning contexts. Could not be used to analyze non-construction alternatives.

[5] All references used in this section appear in Appendix A.

		EXAMPLE OF USE				
3.A. Economic Impact Analysis Non-statistical I-O Models (A.K.A. Productivity Analysis)	Uses an input-output model. Simulates the economic system using historical data. Details sales and purchases by particular industries to other sectors within an economy. Uses derived multipliers to estimate the impact, which might result from changes in certain factors within an economy.	Maryland D.O.T.	Conducted a research study that used an input-output model to assess the impact of state highway programs on economic activity.	Economic	Total economic activity purchases of labor, goods, and services; changes in business operating costs; changes in business productivity growth	Requires extensive ongoing industrial surveys and detailed analysis of financial statements. Useful for tracking specific industries.
3.B. Statistical Econometric Forecast Models (EFC)	Uses statistical analysis to determine cause and effect relationships between variables. Uses multiple regression analysis. Regression factors obtained are then applied to estimate the future impact of infrastructure investments on economic activity.	Virginia D.O.T.	A study was conducted to estimate the economic impacts of constructing the proposed highway I-73.	Economic	Changes in total economic activity	Useful for the discerning of long term historical trends. There may be problems with verification of data accuracy.
3.C. Macro Economic Simulation Models	Uses I-O, as well as statistical analysis. Allows for the estimation of the impacts of transportation or other investments on various aspects of an economy over a specified time period. Analysis is aided by computer models such as the Regional Economic Model, Inc.	Columbus, Ohio	Evaluated and compared to costs the regional economic and user benefits that might result from improvements to a major freight corridor.	Economic and Access	Travel time; vehicle operating costs; accident cost savings, (for truck traffic)	Does not measure non-economic benefits and costs to society.
4. System Efficiency Analysis (User Benefit Analysis)	Uses performance measurement to compare the actual system performance with stated goals and objectives.	Florida DOT	Performance measures are used to compare system performance with the goals and objectives of the State Transportation Plan.	System performance	Percentage achievement of objective.	Useful in evaluating goals and objectives to determine future plan directions. Can measure systems for improvements (e.g., travel time, travel expense, and traveler safety). Does not measure costs or benefits of the system.
5. Full Cost Accounting (A.K.A. Social Welfare Analysis)	Attempts to quantify in financial terms all benefits and expenses associated with a policy, project, or program. It utilizes a combination of cost benefit analysis, economic impact analysis, fiscal impact analysis, and cost effectiveness analysis.	South Florida Water Management District	Recommended for application to evaluate alternative water management solutions to flooding in a rural/agricultural area. The full concept was not applied and resulted in mostly cost and fiscal impact analysis of providing services to future development (see Appendix A).	Economic	Construction of water management devices, fiscal impact of providing services to potentially increased population.	In theory, allows for the better understanding of economic, as well as non-economic, politically sensitive issues. There has been no generally accepted approach to the evaluation of non-economic benefits under F.C.A. All Florida Water Management Districts have subscribed to a "Convention for Economic Assessments" since 1991. This convention has all the elements of F.C.A. but has rarely ever been used by the Districts. Costs and benefits of some projects are difficult to monetize and may result in negative net benefits even when popularly regarded as beneficial (e.g. affordable housing, places of worship)
5.B. Multi-Criteria Analysis	Simple matrix format employs quantitative and qualitative criteria. Compares how well various options meet stated criteria. Requires "weighting" or ranking of criteria.	Amsterdam, Netherlands, Europe	Used to evaluate expansion options at airport in Southern Netherlands.	Economic and Social	Insufficient information	Useful for the comparison of the types of impacts which are not easily expressed in financial terms.

D. Alternative Selection

Alternative selection combines a technical process with a political one, particularly because public funds are being expended. Two important elements in the comparison of alternatives are the impacts and criteria. Impacts are the measured values (scientific or monetary), while criteria can be stated values—personal or community. They are used to weight or rank alternatives in the decision-making process. Criteria are used to determine whether the impacts analyzed are desirable, and whether they require mitigation measures to make them desirable or, at the very least, acceptable. Criteria should be tied to goals and objectives.

E. Public Participation

Public participation is being incorporated more and more into different phases of the comprehensive planning process and is affecting the way policies, plans, and programs are evaluated. Some processes provide greater opportunities than others to exchange ideas and build confidence and support. Consensus building, as a form of the public participation and collaborative problem-solving where public and private entities can interact, is becoming the norm.[6]

Until recently, "public participation" was often interpreted as the opportunity to listen and comment on final plan presentations (part of Step 6 in Figure A). Public input was not a requirement of the planning process and could be easily ignored. These occurrences have led the public, through both broad-based citizen groups and single-issue interests, to actively oppose policies or projects perceived as a threat, thus helping to create an antagonistic relationship between planning bodies and those affected by the plans. At the same time, public officials have felt pressured by narrowly focused interest groups that do not necessarily reflect the attitudes and opinions of the community as a whole. [7] Moreover, the great majority of those affected cannot understand the benefits of participating since decision makers, particularly public officials, often renege on implementing adopted plans. This practice, however, is changing.

Agencies and local governments are experimenting with a variety of methods to incorporate meaningful public participation in their planning processes. Meaningful participation is achieved with a sequential approach that allows for timely information, review and discussion, opportunities to provide input, and recognition or reflection of the input in the final product (policy, plan, or program). Civic advisory committees, made up of local community representatives and organization members, are commonly used as a venue for organized participation. Although decision makers are not required to abide by the recommendations of the advisory groups, they are recognizing their importance and trying to reflect their input in the planning decisions. This participatory approach also allows decision makers to garner support for projects and avoid time consuming standoffs. The participation of advisory groups does not necessarily ensure that the final decision will go without opposition; sometimes access to a broader group of interests is necessary.

Given the opportunity, why aren't more people participating? Unless a program or project has a direct impact on their person or property, people have a difficult time understanding how the change will impact their lives. The public in general is used to and accepting of other people

[6] Hoch, et al., (2000), "Building Consensus," pp. 423-438.
[7] Ibid.

(planners and elected or appointed officials) making particular decisions for them. Furthermore, the information presented is often too technical or the language confusing, also hampering the public's ability to understand potential impacts. Information should be conveyed so that the public in general can relate to the issues. This means providing the information in a simplified format and using common language (if necessary in other languages commonly spoken in the area that will be impacted).

Consensus building is one of the many techniques being used to bring about better public participation. "*Planners use consensus building strategies to improve collaboration among citizens and interest groups and to negotiate public conflicts."*[8] For example, consensus building used for goal setting can help create a shared vision, replace stonewalling and stereotyping when used to facilitate negotiations among suspicious parties, and build an infrastructure for agreement when opposing sides find common ground for their different points of view.[9] Successful consensus building requires inclusiveness and diversity, involving interests as early as possible, tailoring the process to the issues and community involved, identifying and nurturing shared interests, maintaining the momentum, and sharing and validating results with the participants and the public at large.

Public participation is also being used as a venue for developing decision-making criteria. As new opportunities for participation are being provided earlier in the planning process, the public is engaged in the development of a vision and goals and objectives. As the participants become more educated about the issues, participation and the planning process can become more fluid and less fragmented—ongoing and cyclical in the truest sense.

III. Land Use Planning

A. Florida's Planning Framework

Florida has a unique statewide planning and growth management system, which has been developed over the past thirty years to support the growing population with the necessary services and infrastructure, while protecting resources for future generations. The state planning system (see Figure B) consists of a State Comprehensive Plan, Regional Policy Plans, and Local Comprehensive Plans. These plans work in conjunction with resource agency functional plans and regulations, in particular with the Florida Department of Transportation (FDOT), the Department of Environmental Protection (DEP), and the Department of Community Affairs (DCA).

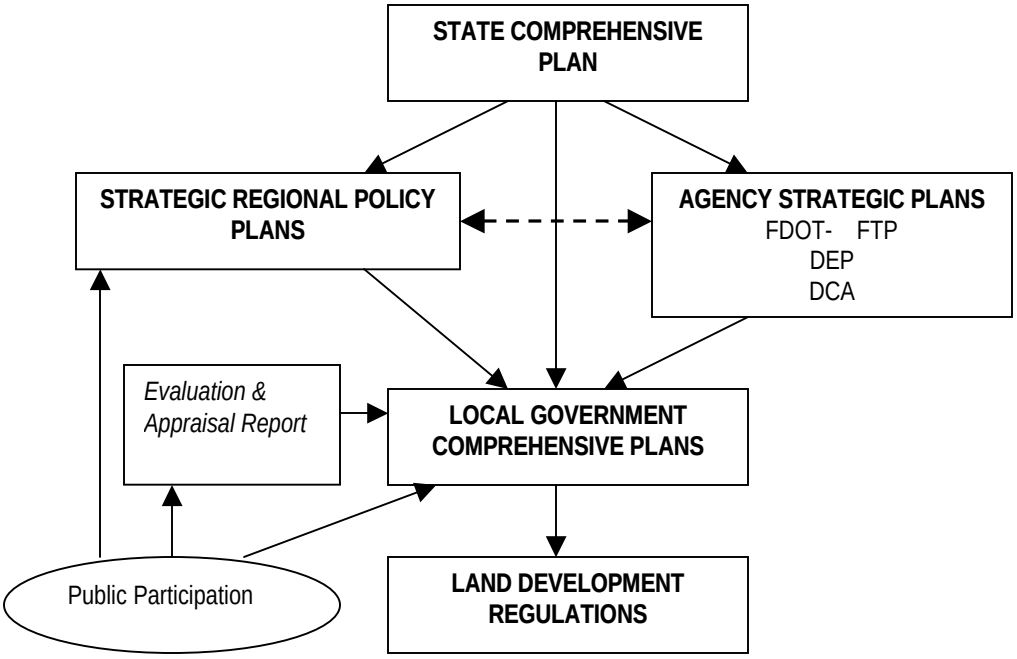
Four principles guide the state's planning: consistency, coordination, concurrency, and compact development. The state plan lays the foundation with general policies. Local plans are required to be consistent with the appropriate regional plan, which in turn must be consistent with the state plan. In addition to the vertical integration of goals, policies, and implementation strategies, there is a provision for horizontal compatibility as well within the state, regional, and local levels. Although local governments are encouraged to consider their neighbors in the planning process, that is not a requirement. To fill the gap left by the consistency rule, local governments must

[8] Ibid, 424.
[9] Ibid.

provide an intergovernmental coordination element in their plans to facilitate coordination with other local governments and with resource agencies.

Another key tool of this system has been the evaluation of plans and proposed development based on their ability to provide basic services and infrastructure concurrently with the new development. Also known as *concurrency*, this "pay-as-you-grow" principle was introduced to the system to add accountability into growth and change in Florida.[10] Local governments are also required to develop a capital improvement plan to demonstrate how the services will be budgeted and implemented over time.

Figure B. Florida's Planning Framework



Source: Modified from the Environmental Land and Management Study Committee, (1992). *Building Successful Communities—Final Report*, Tallahasee, FL.

The compact urban development policy is not stated as clearly in the law as the other guiding principles of growth management. The policy was developed in reaction to the initial effects of applying concurrency and level of service requirements to transportation facilities. This resulted in the determination that there was insufficient capacity in the downtowns, thereby inadvertently pushing development further outward and encouraged sprawled development patterns. Thus the policy to "discourage urban sprawl" appears in Rule 9J-5, which contains the requirements for local comprehensive plans.[11] The concept of compact urban development appears in legislation

[10] De Grove, (1992), 16.
[11] Ibid, 18.

in the form of policies that promote urban infill development and redevelopment and downtown revitalization.[12]

The Local Government Comprehensive Planning Act of 1975 required that all local governments adopt a comprehensive plan. The 1985 Growth Management Act added language to enhance the local comprehensive planning process. Some of these requirements appear in Rule 9J-5 which provides the minimum criteria for the plans. Most local governments adopted their first plans in the late 1980s and are currently required to review them every seven years by preparing an Evaluation and Appraisal Report (EAR). Once prepared, EARs are submitted to DCA and other agencies for consistency review and recommendations. Since local land use regulations (e.g., zoning) must be consistent with the comprehensive plan, local governments are permitted to submit amendments to DCA on a biannual schedule (June and November). Smaller amendments (less than 10 acres) are not required to be submitted to DCA for review.

B. Evaluations

Currently, two types of evaluations are required by the state's growth management system and used in the land use planning process. The first occurs when local governments prepare amendments to their local comprehensive plan. Evaluation and Appraisal Reports (EARs) are prepared every seven years when the entire local comprehensive plan is required to be updated. Local governments are also allowed to submit smaller amendments to the Department of Community Affairs (DCA) twice a year. All amendments require supporting data and analysis. The second type of evaluation consists of the fiscal impact assessment of development on local services and programs. Fiscal impact assessments are used to measure how proposed development or annexations will affect budgets and capital improvement plans to determine whether or not they should be approved.

1. The Comprehensive Plan and Amendments

Local governments forecast population growth and determine the extent to which the needs of the future population are addressed by the local comprehensive plan. This information is used to support proposed amendments to the plan's goals and objectives and the distribution of future land uses on the official map. These, in theory, guide future development decisions. Development, however, is market driven and forecasting market interest in a specific area over the long term is difficult. Many larger cities complement traditional forecasting methods with "expert" roundtables that include developers to determine growth and market trends that may affect future land use changes. In addition, some communities use geographic information systems to store and analyze data, such as demographics, land use, infrastructure, and zoning. All this data is linked to physical attributes that allow the information to be visualized in the form of maps. This tool is resource intensive but very useful.

Pursuant to Chapter 163, Part II, F.S., Section 163.3191, local governments are required to provide information for the EAR on:

(a) Population growth and changes in land area.

(b) The extent of vacant and developable land.

[12] For example, see "Concurrency," 163.3180(5)(b), *Florida Statutes.*

(c) The financial feasibility of implementing the comprehensive plan and of providing needed infrastructure to achieve and maintain adopted level-of-service standards and sustain concurrency management systems through the capital improvements element, as well as the ability to address infrastructure backlogs and meet the demands of growth on public services and facilities.

(d) The location of existing development in relation to the location of development as anticipated in the original plan.

(e) An identification of the potential social, economic, and environmental impacts.

(f) Relevant changes to the state comprehensive plan, the requirements of this part, the minimum criteria contained in chapter 9J-5, Florida Administrative Code, and the appropriate strategic regional policy plan since the adoption of the original plan or the most recent evaluation and appraisal report update amendments.

(g) An assessment of whether the plan objectives within each element, as they relate to major issues, have been achieved. The report shall include, as appropriate, identification as to whether unforeseen or unanticipated changes in circumstances have resulted in problems or opportunities with respect to major issues identified in each element and the social, economic, and environmental impacts of the issue.

(h) A brief assessment of successes and shortcomings related to each element of the plan.

(i) The identification of any actions or corrective measures, including whether plan amendments are anticipated to address the major issues identified and analyzed in the report.

(j) A summary of the public participation program and activities undertaken by the local government in preparing the report.

(k) The coordination of the comprehensive plan with existing public schools and, where relevant, the success or failure of the coordination of the future land use map and associated planned residential development with public schools and their capacities, as well as the joint decision-making processes engaged in by the local government and the school board in regard to establishing appropriate population projections and the planning and siting of public school facilities.

(l) Consider the appropriate water management district's regional water supply plan approved pursuant to Chapter 373.0361, F.S. The potable water element must include a 10-year work plan to serve existing and new development.

(m) Jurisdictions located within the coastal high-hazard area must evaluate whether any past reduction in land use density impairs the property rights of current residents when redevelopment occurs, including after a natural disaster.

This information above is then used to modify and update the required elements of the comprehensive plan, including:

1) Land Use: existing and future.
2) Transportation.[13]
3) Housing.
4) Sanitary sewer, solid waste, storm water management, potable water and natural groundwater aquifer recharge.
5) Coastal management.
6) Conservation.
7) Recreation and open space.
8) Intergovernmental coordination.
9) Capital improvement.
10) Public school facilities.[14]

Of the above, roads, sanitary sewer, solid waste, drainage, potable water, parks and recreation, and mass transit (where applicable) need to be concurrent with new development. This is to ensure that permitted development is conditioned by the availability of public facilities and services needed by the proposed development. In reality, backlog, insufficient resources, case-by-case negotiations, and the failure to systematically account for cumulative impacts of smaller developments are the cause of the failure to maintain the desired levels of service.

Comprehensive plans and amendments, as well as land development regulations, are reviewed by the appropriate regional planning council (RPC) for consistency with the Strategic Regional Policy Plan and by the Department of Community Affairs (DCA) that monitors compliance with the requirements of Chapter 163, Part II, Florida Statutes, as well as the criteria of Rule 9J-5 of the Florida Administrative Code. The plan and amendments may also be reviewed by the water management district and other state agencies, including the Department of Environmental Protection (DEP) and the Florida DOT, when applicable. Plan development and adoption take place at the local level. Public participation is required in the form of public hearings, but recently DCA has promoted other forms of outreach and public participation, including workshops.

Local governments have the power to regulate the pattern of development. Efficient allocation of land uses requires a clear vision of the future of the community and an understanding of how the land use patterns promoted will affect the functioning of the local transportation system. The vision must be reflected through clearly stated policies in the comprehensive plan, accompanied by supporting land development regulations. The local vision in Florida is generally patterned on existing development, market pressures, and, traditionally, automobile-oriented development (low-density, spread-out, with plenty of parking).

2. Fiscal Impact Assessment and Fees

Fiscal impact fee determination is another form of evaluation that is conducted at the time development is being permitted. Impact fees are charges applied to new developments, as one of the

[13] The transportation element consolidates all local transportation policies into one section for local governments with MPOs; all others local governments are required to provide traffic circulation, mass transit, and ports and aviation as separate elements, except that local governments with a population of 50,000 or less isn't required to prepare elements for transit, ports, or aviation.

[14] This element is optional and has been implemented by very few counties so far. The 2002 Legislature adopted a new law requiring that local governments and school boards enter into interlocal agreements to address school siting, enrollment forecasting, school capacity, infrastructure, and safety needs of schools.

conditions of development approval, for construction of capital facilities located outside the new development that will offer benefits to the development. These fees had their origin in the mandatory development dedications, in lieu of fees that were often used as practical substitutes for those required dedications. The fees also have historical origins in the environmental impact analyses required by the National Environmental Policy Act (NEPA). The idea of fees arose from a new awareness in the 1970's, particularly in fast growing communities, that the only way for the communities to pay for expanded infrastructure and facilities was to make new developments pay for the increased costs.

Impact fees have been and continue to be the subject of court challenges throughout the United States. Today, however, a properly worded impact fee program, linked to a capital improvements element of a legally required comprehensive plan, will probably result in a court ruling that the fee is a legal part of land use regulations. The courts have been asking local governments to show a reasonable connection between the fee charged to and the future benefit to be received by the development and to specify the type, cost, and scheduling of facilities that are to be developed.

Impact fees are also used to reduce infrastructure backlogs by allocating infrastructure resources where they are most needed. Increases in fees are generally assumed to be borne by the final purchaser in a development, causing the final product to be more expensive. Developers will sometimes avoid jurisdictions with high impact fees and instead build in areas with either no fees or lower fees.

C. Public Involvement in the Planning Process

Chapter 163.3181 of the Florida Statutes states:

> (1) *It is the intent of the Legislature that the public participate in the comprehensive planning process to the fullest extent possible. Towards this end, local planning agencies and local governmental units are directed to adopt procedures designed to provide effective public participation in the comprehensive planning process […]*
>
> *(2) […] the procedures shall provide for broad dissemination of the proposals and alternatives, opportunity for written comments, public hearings […] provisions for open discussion, communications programs, information services, and consideration of response to public comments.*
>
> *(3) A local government considering undertaking a publicly financed capital improvement project <u>may</u> elect to use the procedures set forth in this subsection for the purpose of allowing public participation in the decision […]*

Most public involvement occurs at the local level. At the state level, public involvement consists mainly of governor appointed committees intended to represent a variety of interests throughout the state. Participation at the regional and local levels is much more open. Some regional planning councils have put together workshops to review updates to their strategic policy plans, but attendees usually include more technical staff than members of the public. Most local governments rely on the public hearing requirement as their sole source of public input, but a few are promoting public workshops at the neighborhood level in anticipation of zoning changes or in the process of updating their comprehensive plans. When these workshops are well noticed and

conducted in a community facility, they are generally well attended. Various agencies and government offices are also using the internet to communicate with the public and receive feedback and input. While a greater degree of public involvement is being promoted in different planning processes around the state, little has been done to evaluate the effectiveness of this tool other than self assessments conducted by the facilitators of the individual processes. A formal assessment would provide useful information.

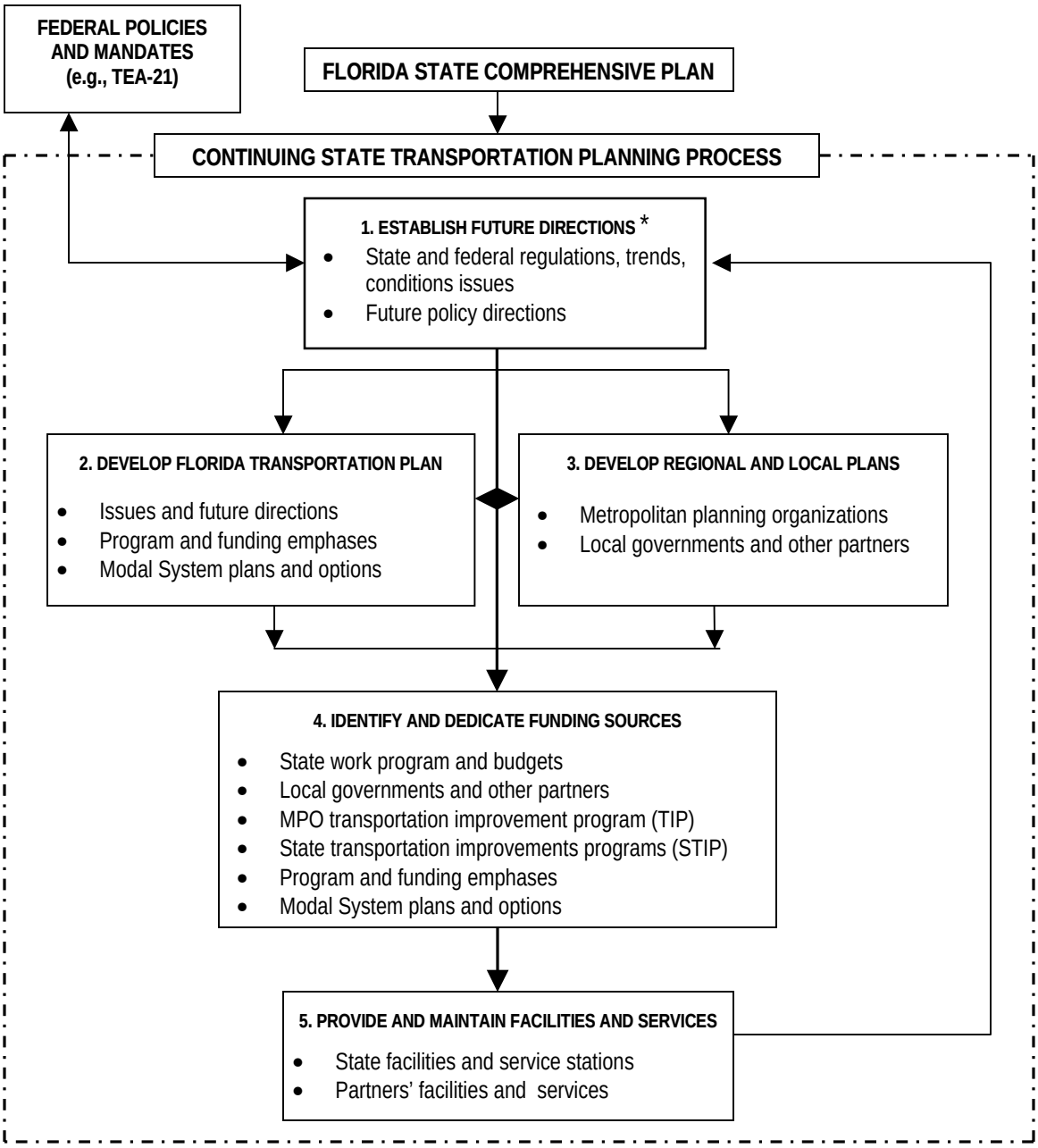
IV. Transportation Planning

A. Florida's Planning Framework

The state transportation planning process involves a tight scheduling and budgeting loop (see Figure C). Every year, state and local transportation agencies review and update their short-range transportation plans and work plans, based on policies dictated by federal laws and agencies and by the Florida Transportation Plan and the Short Range Component. This means that every year budgets, plans, projects, and programs are evaluated against funding sources, policies, and other plans. Coordinating needs with the budget requires a great deal of collaboration and an efficient evaluation process.

The Florida Department of Transportation (FDOT) relies on a variety of partners to ensure that schedules are met. At the local level, the most important partners in this process are the metropolitan planning organizations (MPOs) who work in conjunction with the FDOT district offices, local governments, and other members of the public to identify local transportation needs as well as policies that will guide the decision-making process. FDOT also relies on its partners to plan and maintain the state transportation system, including the state highway system (SHS), the Florida Intrastate Highway System (FIHS), and, once formally established, the state inter-modal-transportation system (SIS). In addition, the department also coordinates with local governments in the planning and management of the state's local and international airports and seaports. Public-private partnerships help the department to maintain freight and rail movement.

Figure C. Florida's Transportation Planning Process



Source: * Modified from FDOT, 2020 Florida Transportation Plan, p. A-13, 1999.

FDOT is a trend setter in transportation planning innovations from implementing new policies to dealing with constantly increasing congestion, mobility, and safety issues. Many federal programs are tested in Florida. Several programs from the Transportation Efficiency Act of the 21st

Century (TEA-21) have been tested and are now being implemented throughout the state. Some of these programs are described in this section. Many of the programs include innovations to the decision-making process such as enhancements to public participation.

B. Evaluations and Assessments

1. Types of Evaluations

In the transportation planning process, evaluations serve three major purposes. First, they help determine the desirability of one alternative over another by providing comparable values to individual alternatives. The key issues in this determination are how to measure the "value" of each alternative and how to estimate the source and timing of its associated benefits and costs. Second, evaluations are used to inform decision makers about the impacts of project and program proposals, their trade-offs, and the major areas of uncertainty. This requires identifying the magnitude of an alternative's impact including those who will be positively or negatively affected. Finally, evaluations allow planners and engineers opportunity to identify gaps and the need for further study. In this context, evaluations should answer questions about the effectiveness of alternative projects, the efficiency of resource allocation, the impact on an equitable distribution of resources, and the administrative and legal feasibility of alternative project implementation.[15]

Although most tools used in transportation planning are clearly quantitative and used to measure tangible impacts, other qualitative tools complement the former. Qualitative tools evaluate non-tangible impacts such as social impacts and attitudes and community support for the project or policy. Many of these tools have been packaged into the National Environmental Policy Act (NEPA), where the major concern is environmental and community impacts.

2. Evaluation Processes in Transportation Planning

From the vision to implementation, the transportation planning process progresses through several stages: (1) planning and programming; (2) alternatives and project development; (3) design and right-of-way; (4) construction; and (5) operations and maintenance. Every stage has its own forms of evaluation and assessments, most of which are performance-based and answer questions that may include: How well are the state plan goals being met by the system's performance? How well are construction materials performing? How well are personnel performing their duties?

Most evaluations are tied to the federally mandated decision-making process and are conducted during the alternatives and project development phase. Most of these tools evaluate the impacts of transportation on other systems and have been packaged into the requirements of the NEPA process. Other required assessments are often conducted simultaneously with NEPA requirements and referred to under the single term. In Florida, the DOT developed the Project Development and Environment (PD&E) Manual which covers NEPA requirements and procedures.

3. Environmental Impacts

Environmental impact assessments were first required in the United States in 1969 with the passage of the National Environmental Policy Act (NEPA). Regulations implementing the procedural aspects of NEPA were issued by the Council on Environmental Quality (CEQ), the agency

[15] Edwards, J.D. Jr., 1992, 482.

that enforces them. In response to these requirements the Federal Highway Administration (FHWA) issued its own environmental regulations and guidance that related directly to the transportation development and decision-making process. NEPA requires all federal agencies to analyze the possible environmental impacts of any proposed policies or projects along with any alternatives to those proposals. Any proposed action by a federal agency is under NEPA, subject to a possible three-step analytical environmental review process:

a. There must be a determination as to whether or not the proposed action will significantly impact the environment. If the analysis clearly establishes that the course of action will have no significant impact on the environment, then the action will qualify for a Categorical Exclusion (CATEX); no further analysis will be required, and the agency may proceed with the proposed action.

b. If the proposed action does not qualify for a CATEX, the agency must prepare an environmental assessment (EA) to determine possible environmental impacts. The EA should discuss the necessity of the proposed action and any viable alternatives. The assessment must reflect one of three possible decisions: a finding of no significant environmental impact (FONSI); a conclusion that the project should not be pursued; or a determination that there is need to prepare an Environmental Impact Statement (EIS).

c. Once the agency determines the possibility of a significant environmental impact, it must prepare an EIS. The statement should discuss the important environmental issues and viable alternatives to the proposed activity.

A notice of intent to prepare a draft EIS must be published to facilitate public comment and involvement in the process. The draft EIS is then subject to extensive public review and comment and additional analysis, prior to the preparation of the final statement. The final step is the preparation of a Record of Decision (ROD) which summarizes the facts and the final decision related to the proposal.

The PD&E manual requires the review of 21 types of potential "environmental" impacts that include direct, secondary, and cumulative impacts to natural, cultivated, and developed environments are summarized below under general types of environments.[16]

a. Impacts on human activity systems, other than infrastructure
    (1) Social and economic
    (2) Relocation
    (3) Archaeological and historical resources
    (4) Visual impact/aesthetics
    (5) Farmlands
b. Impacts on infrastructure systems
    (1) Utilities and railroads
    (2) Pedestrian and bicycle facilities
    (3) Scenic highways

[16] The general area headings have been provided for simplification purposes. The sub-list under each one of the general areas includes all of the headings of impact analysis that appear in the Florida PD&E manual.

(4) Construction impacts

c. Impacts on the natural environment
   (1) Section 4(f) evaluations
   (2) Air quality analysis
   (3) Noise
   (4) Wetlands
   (5) Aquatic preserves
   (6) Water quality
   (7) Outstanding Florida Waters
   (8) Wild and scenic rivers
   (9) Floodplains
   (10) Coastal zone consistency
   (11) Coastal barrier resources
   (12) Wildlife and habitat impacts

4. Social Impact Assessments

Social impact assessments (SIA) can be conducted as a part of an environmental impact assessment (EIA) or separately. An SIA analyzes the possible results of a particular course of action on the social aspects of the environment. Some of the variables analyzed in a SIA would include population characteristics, community and institutional structure, political, social and cultural resources, individual and family factors, and community resources. Relocation issues and economic impacts can also be studied at this time. The SIA must contain research information relating to the community's size, ethnic and social composition, educational and economic resources, and information about societal values and interests. An SIA requires that baseline information be compared with a hypothetical future post-construction scenario resulting from the expected impacts. Data from similar projects or communities may be used to build the future scenario. Since the type of information that is needed can be difficult to define, it would be essential to have significant interaction with the affected community groups when an assessment is conducted.

5. Secondary and Cumulative Impacts

Assessments of secondary and cumulative impacts are required when evaluating each type of impact. The Council on Environmental Quality (CEQ) defines effects as being either direct or indirect. A direct effect is "caused by the action and occurs at the same time and place." An indirect effect is "caused by the action and is later in time or farther removed in distance, but still reasonably foreseeable."[17] Indirect effects may include growth-inducing effects on land use patterns, population density or growth rate, and related effects on air, water, and other natural systems and resources. CEQ differentiates a cumulative impact from direct or indirect by referring to it as an "*incremental impact of the action when added to other past, present, and foreseeable future actions, regardless of what agency or person undertakes such other action."* [18] The cumulative effect of several relative minor impacts can collectively result in a significant impact.[19]

[17] Council on Environmental Quality, *Regulations Implementing 102(2) of NEPA*, 1978, 497, in FAU Joint Center, (1998). *Secondary and Cumulative Environmental Impacts of Transportation Projects.*
[18] Ibid.
[19] Ibid.

6. Major Investment Studies

Prior to the Intermodal Surface Transportation Efficiency Act (ISTEA), communities wishing to use federal funds for new transit service on a large scale were required to provide a detailed analysis of alternatives and a rigorous study of cost-effectiveness in addition to the environmental review required by NEPA known as a major investment study. No such process was required for a new highway and environmental impact statements were often done after engineering had started. Analyses of cost-effectiveness were not required at all. ISTEA sought to rectify this imbalance and required that all new major investments, whether for highway or transit, be treated equally by blending the requirements for highway and transit planning. An alternatives analysis was required for any major investment that included a "*highway or transit improvement at substantial cost that is expected to have a significant effect on capacity, traffic flow, level of service, or mode share….*"[20] Some of the rigor of the transit planning process was applied to proposed new highways, and some of the flexibility of the highway planning process was applied to new transit projects. TEA-21 now requires that a major investment study (MIS) be conducted for corridor projects to assess a range of alternative investments. This analysis will now be integrated with procedures for transportation planning and for review of environmental impacts under NEPA.

7. Innovations from the TEA-21

The 1998 Transportation Efficiency Act for the 21st Century (TEA-21) continued many of the groundbreaking reforms provided by its predecessor ISTEA. The new act consolidated the list of 16 metropolitan and 23 statewide planning factors into seven broad "areas" to be considered in the planning process, both at the metropolitan and state levels. There are several major changes that now affect the timing and processing of NEPA evaluations in the transportation planning process. The requirement for a stand-alone MIS is replaced with a directive to integrate the analyses required under the planning provisions of TEA-21 and NEPA.

The act calls for strengthening financial aspects of the planning process and improving coordination, cooperation, and public involvement. Emphasis is placed on the role of state and local officials, in cooperation with transit operators, in tailoring the planning process to meet metropolitan and state transportation needs. Provisions concerning fiscal constraint, planning horizon, and *public involvement* continue with one modification—adding freight shippers and public transit users to the list of stakeholders in the planning process.

8. Environmental Streamlining

Although NEPA does not preclude projects with negative environmental effects, it does require that those effects be known. Two central concepts have made NEPA an effective law: a fair and open process exploring alternatives to a proposed project and a publicly disclosed analysis of each alternative's environmental impacts. NEPA has one great weakness, however, in that environmental reviews are very time consuming, and that too often environmental agencies wait until the last minute to raise their concerns. TEA-21 seeks to alleviate these concerns by creating a mutually agreed-upon procedural framework under which all parties operating during the NEPA process enter memoranda of understanding with one another and set up timeframes for the review process (Section 1309).

[20] Section 1308, ISTEA.

C. Public Involvement in the Planning Process

Although one of the criticisms of the FDOT transportation planning process has been the lack of public involvement, significant steps have been taken to improve that situation. Since ISTEA and TEA-21, public participation has become more prevalent in the decision-making process. Each planning level, from the state down to the local, has a community advisory committee that provides input to that level's planning process. In addition, for the last update of the Florida Transportation Plan (FTP), the Department conducted a series of workshops around the state and set up a website to provide the opportunity for citizen input. Some MPOs are now hiring "community involvement coordinators" to develop a public participation plan for their planning processes.[21] The Department is institutionalizing public participation in the decision-making process through community impact assessments.

All of these initiatives are heading in the right direction but will take some time before they are fully ingrained in the process and in the mindset of planners and the public. It is unclear whether these initiatives will serve to overcome citizen opposition to change. Much of this opposition relates to facilities with significant localized impacts: urban highways, airports, and transit lines. Citizen opposition is increasingly related to physical changes that appear to threaten the "quality of life," including mixed-use rezoning, road widening, or density increases.[22] Part of the problem can be attributed to the lack of a long-range vision demonstrating how and where growth should occur and reflecting local values and desires.[23] Effective visions are needed to translate broad-based values and individual preferences into specific action strategies.[24]

1. Community Impact Assessments

As mentioned earlier, social impact assessments (SIAs) have been conducted as a part of NEPA's impact assessment package, and in Florida, as an element of the PD&E process. In response to TEA-21, with a focus on increasing public involvement in the decision-making process, the USDOT developed a manual titled *Community Impact Assessments* as a "quick primer for transportation professionals and analysts who assess the impacts of proposed transportation actions on communities."[25] The document devotes several pages to describing outreach efforts and how to conduct public participation processes. A subsequent document details different types of impact assessments that should be conducted: social and economic, land use, aesthetics and livability, relocation and displacement, and civil rights.

In 1999, after a series of DOT-led workshops at the national and state levels, the Florida DOT developed a set of principles to integrate and institutionalize this key component of transportation decision-making. The focus of the document is to promote early and continuous gathering of information from the community and other resources as input into transportation decision-making from planning through project development, design, mitigation, and project construction. The four focus areas are:

a. *Early identification of community issues*, with particular attention to community values;

[21] Broward MPO, 2001, 4.
[22] CUTR, 1994, 59.
[23] Ibid.
[24] Ibid, 60.
[25] USDOT, FHWA, *Community Impact Assessment*, 2.

b. *Proactive, inclusive problem solving and collaborative decision-making*, with particular emphasis on a continual involvement;
c. *Continuous process that transitions throughout project development*, beginning with planning and continuing throughout the life of the project; and
d. *Community-based decision-making*, promoting early evaluation of problems and solutions so that they may be recognized and addressed within a broad collaborative decision-making framework.[26]

The pamphlet emphasizes the many benefits of this approach, including increasing stability to the work program, creating greater efficiency and effectiveness, promoting partnering and program integration and, finally, addressing environmental justice issues and enhancing quality of life. An important focus of the initiative is institutionalization of the practice within the transportation organization. The pamphlet calls for the incorporation of community impact assessment (CIA) principles into the organization's day-to-day activities by:

- Modifying of procedures and practices
- Identifying of common goals and objectives with other agencies and communities
- Forging cooperative processes and integrated programs through operational agreements with other agencies, local governments, and advocacy groups
- Accommodating community needs, to the extent feasible
- Facilitating dialogue between parties when the issues identified are outside the department's purview
- Formally documenting and tracking commitments
- Leveraging and polling funding resources

Finally, the document stresses the need to integrate CIA practices within and outside the organization, in particular with partner planning agencies such as the MPOs, local governments, and federal, state, and local resource agencies.[27]

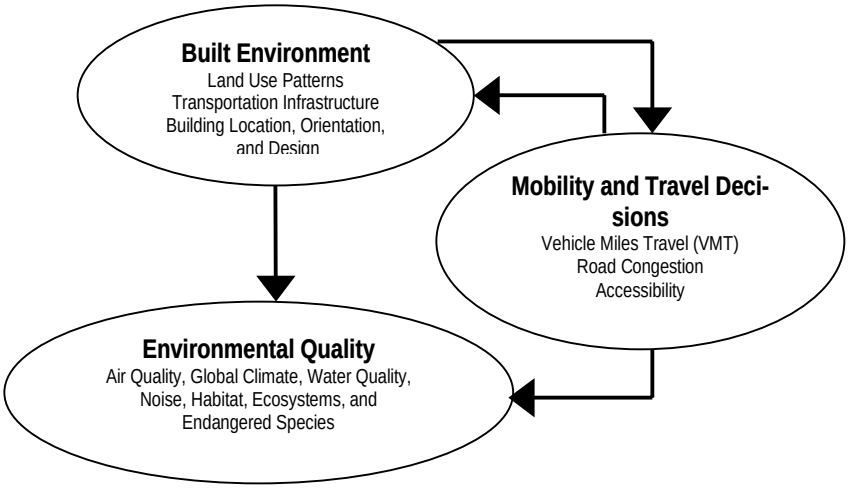
V. Land Use and Transportation Planning

A. The Land Use/ Transportation/ Environment Connection

Land use, transportation, and the environment are intimately related—any activity that takes place in one system will ultimately affect the other two. By the late 1960s, the linkage between transportation and the environment had been established. Legislation was adopted to provide protection through the heightened scrutiny created by the Clean Air Act (1965) and the NEPA process (1969). Additional protection followed through the Clean Air Act and Amendments (CAAA, 1970, 1990), the Clean Water Act (1972), the Endangered Species Act (1973), and other laws and amendments that regulate and protect air quality, water quality, wildlife, noise, solid and hazardous waste, and communities from the impacts of transportation. Most of this legislation also affects land use and development by regulating siting and activity design (effluents, emissions, etc.), and through the connection between land use and transportation.

[26] FDOT, 1999.
[27] FDOT, 1999.

Figure D. Direct and Indirect Impacts of the Built Environment



Source: Modified from EPA, 2001. ***Our Built and Natural Environments: A Technical Review of Interactions between Land Use, Transportation and Environmental Quality,*** Washington, DC: Environmental Protection Agency (EPA).

Figure D models how land uses demand for transportation infrastructure and then generate mobility and travel decisions, which in turn modify the built environment. At the same time, land uses and transportation impact the environment through physical invasion, emissions, effluents, and noise, and by creating barriers to connectivity and changes caused in temperature. However, despite this linkage, land use and transportation continue to be planned and implemented separately from each other in most communities around the country. Although the environmental impacts of development are measured, this does not necessarily mean that development and environmental protection are being planned together. Mitigation is planned on a project-by-project basis, resulting in a piecemeal response. While piecemeal development results in cumulative impacts, piecemeal mitigation does not result in cumulative protection.

B. Modeling Transportation and Land Use

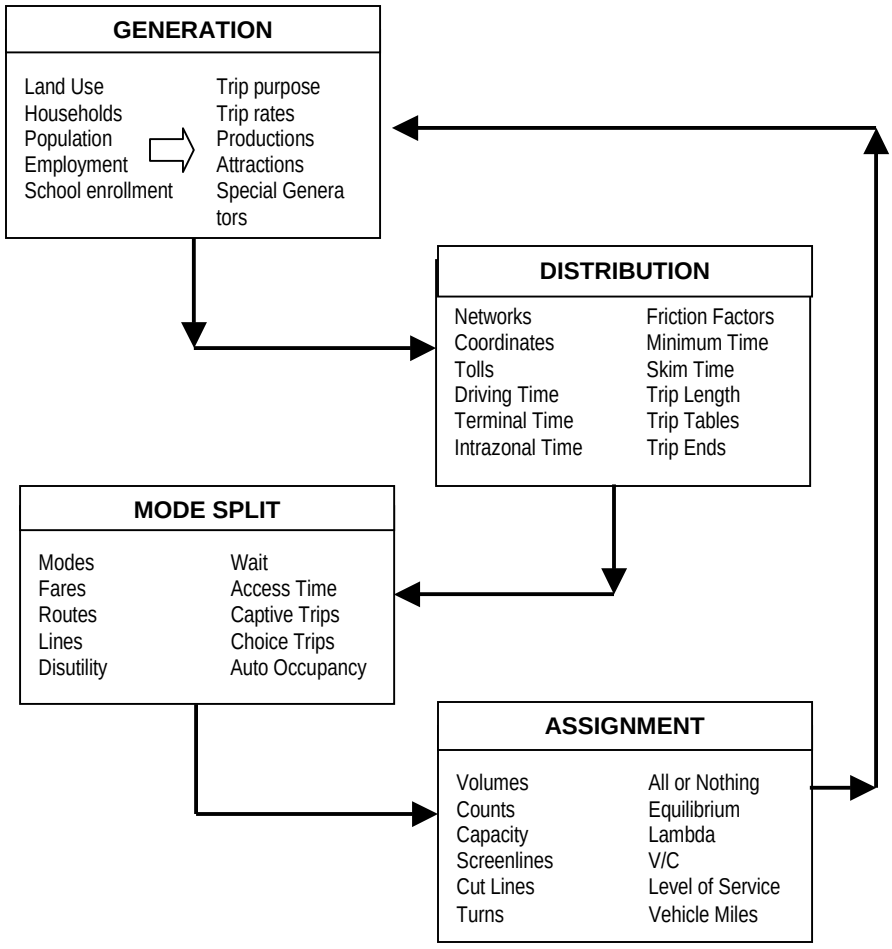
Models are one way to demonstrate the relationship between the elements of a system. Models can be used in impact evaluation because they can simulate impacts through cause and effect. Mathematical equations are used in statistical, gravitational, network distribution, and other types of models to provide numerical interpretations of the relationships. Some models are too simplistic to fully describe the complexity of land use and transportation relationships, and the more complex models are in the developmental stages. Models can be very helpful if used as a support tool but not as a solve-all approach.

With the development of computer technology, models have become highly operational. Operational models are growing in complexity, and require a greater amount of data and resources to maintain and run. For several decades transportation funding has been dedicated to develop and maintain a travel forecasting model, which has been widely used in the transportation planning

process. Urban models popularized in the 1970's were extremely complicated and lacked the resources necessary for computerization. However, recent efforts in linking land use and transportation have promoted the revival of urban models, aided by progress in computer technology and by ongoing research. The main driving force behind this movement has been the need to do a better job of planning to meet the needs of future growth and development.

In travel demand forecasting, location, type, and intensity of existing and future land use patterns are used to forecast trip generation and allocation and the demand for new facilities. The existing travel model is based on a four-step process that begins with forecasting trips generated by residences and jobs. Trips are distributed to the transportation network and then split into the different modes (e.g., automobile, transit, bicycle, walking) and assigned to the network (see Figure E). This model was developed for a simpler analysis but is now being used to predict the effects of new policies and programs, including congestion pricing, demand management, changes in urban development patterns, and a host of other issues for which it was not specifically designed. Improvements to the model are sponsored through a number of federal agencies through the Travel Model Improvement Program (TMIP).

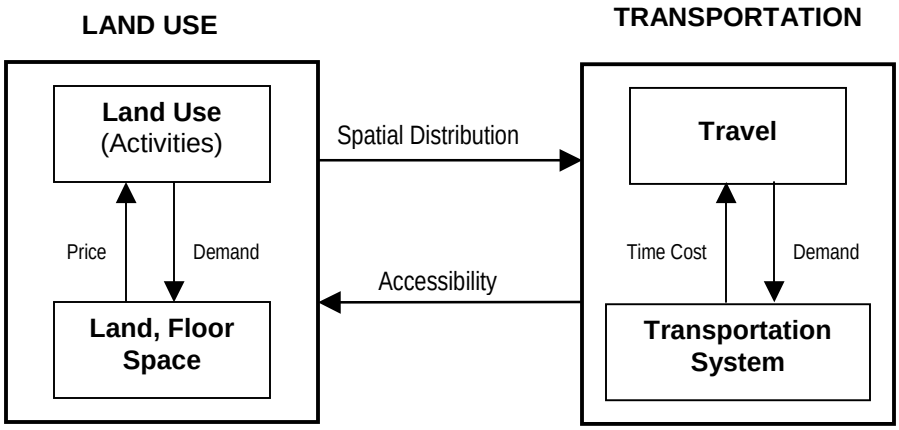
Figure E. Four-Step Travel Forecasting Model



*Source:*Modified from Florida DOT, (1995). *FSUTIMS—Florida's Standard Models: Basic Travel Demand Forecasting Workshop,* Handbook, Tallahassee, FL.

Growth in transportation facilities impacts surrounding land uses by increasing accessibility to land parcels. Proximity to transportation facilities promotes development opportunities, which in turn trigger the land use regulatory process (e.g., zoning, permitting). While this is usually perceived as beneficial to the community receiving the enhancement, accessibility can induce a more intense use of the land, which in turn generates a greater number of trips and the need for more facilities. A simplified version of this relationship is provided in Figure F.

Figure F. Basic Land Use Model



Source: Louden, 1999.

The passage of the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA) and the Clear Air Act Amendments of 1990 (CAAA) signaled a change in approach to meeting transportation needs. ISTEA provided funds for transportation planners to consider alternatives to automobile travel, and the CAAA compelled local transportation planners to work with local governments to find ways to reduce emissions. As it became apparent that changes in travel modes and patterns were going to require changes in land use development patterns, transportation planners became concerned about the limitations of traditional travel forecasting techniques to meet the new requirements.

Local initiatives like the 1990 Land Use, Transportation, and Air Quality (LUTRAQ) project in Oregon increased the focus on and provided opportunities for the development of techniques to model the connection between land use and transportation to help evaluate alternative facilities and development patterns. LUTRAQ combined a host of land use forecasting techniques with the travel forecasting model, an air-quality model, and a greenhouse-gas and energy-consumption model to test transit development alternatives to a proposed highway bypass (see list in Table 2). LUTRAQ used a comprehensive set of approaches to forecast spatial patterns of population, households, and job location and growth as input to the traditional travel-forecasting model.

Forecasting and allocating local land needs by land use type for the comprehensive planning process have led land use planners to more sophisticated tools that help create a better forecast and vision. These same tools are being used by transportation planners in forecasting household and job growth, and location as input for the travel forecasting model.

Table 2. **Land Use Impact Evaluation Tools**[28]		
TOOL	STRENGTH	WEAKNESS
Comprehensive Plan and other land use regulations	Provide policy information on planned future uses of development	Must be balanced with an understanding of market forces which also shape development patterns
Qualitative methods (e.g., Delphi, expert panel)	Can take a holistic approach that considers all aspects of the urban system	Panel of experts must be of sufficient breadth and depth of knowledge; not a substitute for data collection
Allocation rules (e.g., gravity)	Work best for widespread activities like retailing and residential	Based on limited set of factors
Decision rules (e.g., ITE Trip Generation)	Require little time and effort	Can easily be misunderstood; assume that relationships are static
Statistical Methods	May consider wide range of variables	Require considerable data. Provides information about what happens on "average"
Geographic Information Systems	Provide a tool for visualizing and analyzing the interrelationships between different physical systems	Require staff time to create and maintain the data layers and databases; can be misinterpreted
Regional economic and demographic models	Provide information on how changes in the transportation system impact the regional economy	Work best for the multi-county/regional areas; require thorough understanding of assumptions to correctly interpret results
Formal land use models	Forecast growth and changes in land use and development for different scenarios	High level of effort to set up and calibrate; different models include various strengths and weaknesses
Source: Beever, Lisa, 2001. "Secondary and Cumulative Impact Assessment in the Planning Process," *Charlotte County-Punta Gorda MPO Technical Report 01-3*, Tallahassee, FL: Florida Department of Transportation. Found on the ETDM section of the FDOT website.		

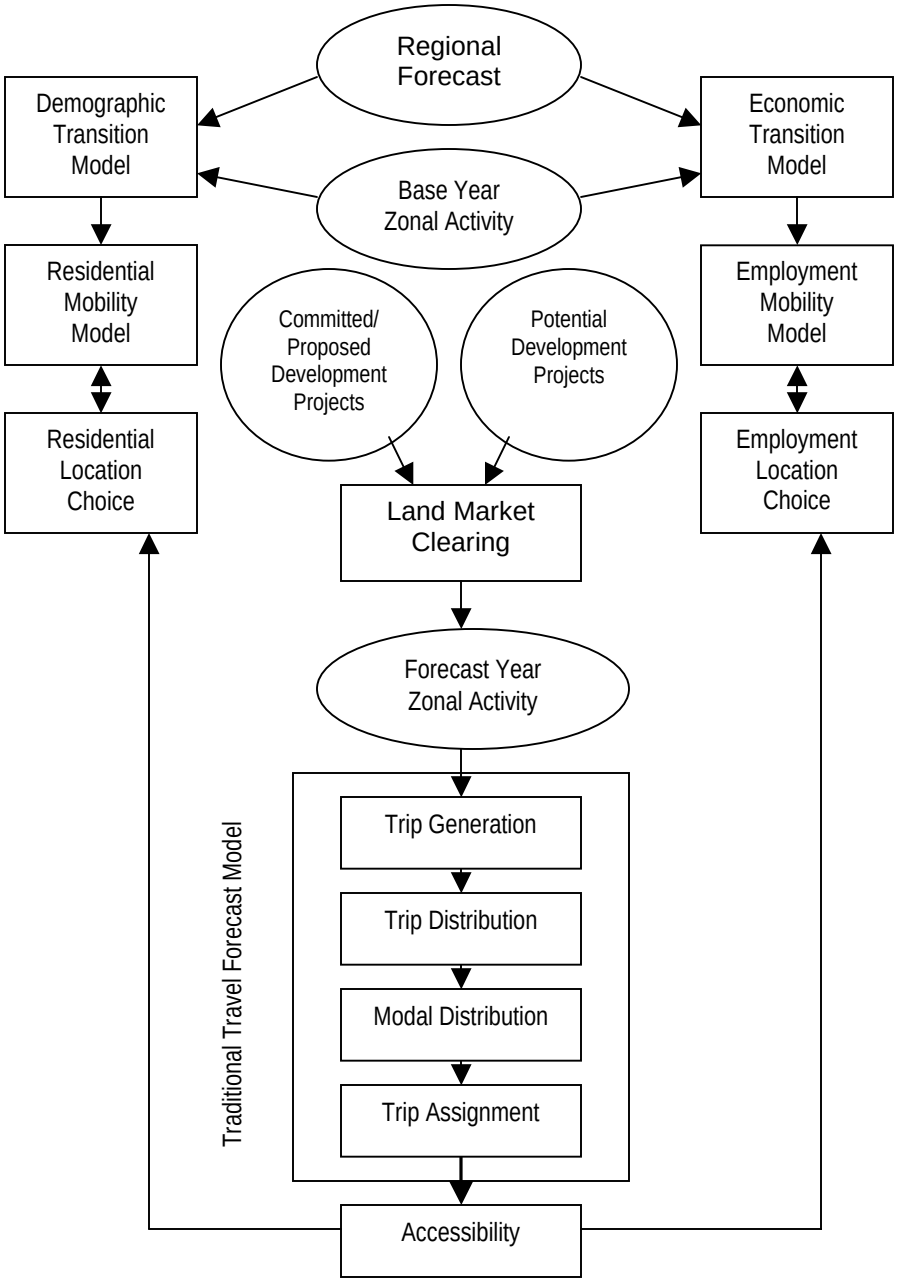
1. Model Improvements

Improvements to the travel forecasting model include the integration of formal land use models. Several models are being developed, but have yet to be considered "fully integrated." They are referred to as "partially integrated" or "loose coupling" models in the literature. Figure G shows an example of components associated with a partially integrated model.[29]

Wegener (1994) reviewed and classified twelve urban models using criteria such as comprehensiveness, overall structure, theoretical foundation, modeling techniques, dynamics, data requirements, calibration and validation, operability, and actual and potential applications summarized in Table 3. Wegener found that TRANUS and MEPLAN were the only two models that encompassed eight subsystems of spatial urban development identified by earlier work: population, land use, networks, housing, workplaces, employment, travel, goods, and transportation. Although large-scale urban models are considered "data-hungry," local governments routinely generate information that can be used in the models, particularly in the fields of population, housing, land use, and transportation. The author concluded that for all 12 models, the urban region is represented as a set of discrete subareas of zones. At this level, the information produced can answer traditional questions such as how land use regulations

[28] Source: Beever, 2001. A similar table appears in Seskin, 2001, where the analytical tools are reviewed in relationship to the behavioral framework and how they are used in impact assessments, p. 55.
[29] Waddell, 1996 in FAU/FIU Joint Center for Environmental and Urban Problems, 1999.

Figure G. Example of Partially Integrated Land Use/Transportation Model



Source: Waddell, in FAU/FIU Joint Center for Environmental and Urban Problems.,1999.

or housing programs would affect land use development and transportation, or how transportation improvements or changes in travel costs would shift the distribution of activities in an urban area. However, questions relating to equity and environment might not be answered with this type of model. The author suggests that new legislation inspired by growing environmental awareness may accelerate the "greening" of urban models.

Table 3 . Wegener's Summary Comparison of Twelve Urban Models[30]			
Model	**Subsystems Modeled**	**Model Theory**	**Policies Modeled**
POLIS	Employment Population Housing Land Use Travel	Random Utility Locational Surplus	Land Use Regulations Transportation Improvements
CUFM	Population Land Use	Location Rule	Land Use Regulations Environmental Policies Public Facilities Transportation Improvements
BOYCE	Employment Population Networks Travel	Random Utility General Equilibrium	Transportation Improvements
KIM	Employment Population Networks Goods Transport Travel	Random Utility Bid-Rent General Equilibrium Input-Output	Transportation Improvements
ITLUP (DRAM-EMPAL)	Employment Population Land Use Networks Travel	Random Utility Network Equilibrium	Land Use Regulations Transportation Improvements
HUDS	Employment Population Housing	Bid-Rent	Housing Programs
TRANUS	All Subsystems	Random Utility Bid-Rent Network Equilibrium Land Use Equilibrium	Land Use Regulations Transportation Improvements Transportation-Cost Changes
5-LUT	Population	Random Utility Bid-Rent General Equilibrium	Transportation Improvements
LILT	All Subsystems, except Goods and Transport	Random Utility Network Equilibrium Land Use Equilibrium	Land Use Regulations Transportation Improvements Travel-Cost Changes

[30] Wegener, 1994.

Table 3, continued . **Wegener's Summary Comparison of Twelve Urban Models**			
MEPLAN	All Subsystems	Random Utility Network Equilibrium Land Use Equilibrium	Land Use Regulations Transportation Improvements Transportation-Cost Changes
IRPUD	All Subsystems, except Goods and Transport	Random Utility Network Equilibrium Land Use Equilibrium	Land Use Regulations Transportation Improvements Travel-Cost Changes Housing Programs
RURBAN	Employment Population Housing Land Use	Random Utility Bid-Rent General Equilibrium	Land Use Regulations Transportation Improvements

2. Regional Modeling

Three new models are described on FHWA's Toolbox for Regional Policy Analysis website. This website was developed for MPOs, state DOTs, and other analysts that house information on impact assessments. The toolbox ranges from sketch-planning methods to integrated urban models. Four models are described below. REMI, SPARTACUS, and STEAM are models described as a part of FHWA's toolbox. The ULAM model has been developed specifically for the state of Florida and has been sanctioned by the FDOT for use by the state MPOs.

Regional Economic Models, Inc (REMI). REMI is an Input-Output (see Table 1 or the appendix) economic and demographic forecasting and simulation model that has been applied to a number of regional highway and transit investment scenarios. User benefits are entered as costs savings or productivity improvements to businesses, including time, operating cost, and accident costs saving. Construction and operating costs are entered as expenditures. This model has been used in several studies: the Portland (OR) freight project evaluation, a comparison between a regional highway and transit investment plans in Los Angeles and New York; and evaluations of intercity highway corridor improvements in Wisconsin, Indiana, and Maine.

System for Planning and Research in Towns and Cities for Urban Sustainability (SPARTACUS). SPARTACUS is a European project developed to analyze the implications of urban land use and transportation policies. Tested in three European cities—Helsinki, Naples, and Balboa—the model integrates a transportation/land use model MEPLAN with a GIS Raster module (MEPLUS). The model permits the calculation of indicator values at a spatially disaggregate level (with the use of the USEIT module). This provides the opportunity to do policy analysis and report results in the form of overall indices of economic, environmental, and social sustainability and view the results in tables or graphical formats.

Surface Transportation Efficiency Analysis Model (STEAM). Of the tools described so far, this is the only one that is specifically designed for transportation assessments. STEAM is designed to provide decision makers with the means to compare proposed alternative multimodal solutions and demand management strategies through a benefit-cost analysis. It compares trade-offs between economic benefits and non-monetized social and environmental impacts. The newest ver-

sion, STEAM 2.0, adds two new features, "the ability to report mobility and safety benefits by user-defined districts and a new accessibility measure."[31] The new features are useful tools for measuring social impacts of transportation investments.

Urban Land use Allocation Model (ULAM). ULAM is a land use planning package that consists of over 60 separate programs to forecast future growth of population and employment at the county level and at the traffic analysis zone (TAZ) level. It is designed to use the existing data files of the Florida travel model (FSUTMS) which reduces duplication of data entry. The model integrates a GIS interface that allows visual outputs as well as editing capabilities of the input files. An additional objective of the model is to provide a basic land use inventory and monitoring system of past, current, and future land use trends. ULAM is currently developing a Fiscal Impact Analysis research study.

C. Visualization Models

Modelers are developing visualization tools as a means for providing the public with a better understanding of the implications of different actions in a language that is more accessible to a larger audience. These often interface with other models to produce visual renditions of impacts. Simple tools include the use of maps on a screen. Architects have long relied on renderings to communicate with their clients. However, with computer aids like the Computer Aided Design Drawing (CADD), planners and designers are able to produce three and four-dimensional graphics from two-dimensional renderings. This is particularly useful in a consensus planning process, because it provides visual information relatively quickly. In the future, this type of model will provide designed renditions that move or change over time (the fourth dimension).

D. Measuring Land Use/Transportation Impacts

Several recent publications from the National Cooperative Highway Research Program address this subject. Additional information can be found on FHWA's website "Toolbox for Regional Policy Analysis." Here we provide some highlights from the findings of these reports.

1. Social and Economic Effects of Transportation Projects

The *Guidebook for Assessing the Social and Economic Effects of Transportation Projects* (TRB, 2001) analyzes the need to measure the impacts of transportation beyond the direct users of the system. In the assessment of the social and economic effects, it is important to understand:[32]

- the need to balance benefits to users and non-users affected by the facility;
- the trade-offs between positive and negative effects;
- the distribution of the effects to different population groups; and
- the variations in personal preferences between what is desirable and what is unacceptable to whom.

The guidebook also defines 11 general types of social and economic effects and evaluates methods, tools, and techniques available to assess them. Table 4 summarizes some examples of evaluations by impact.

[31] FHWA website at http://www.fhwa.dot.gov/steam/
[32] Forkenbrock and Weisbrod, 2001, 1.

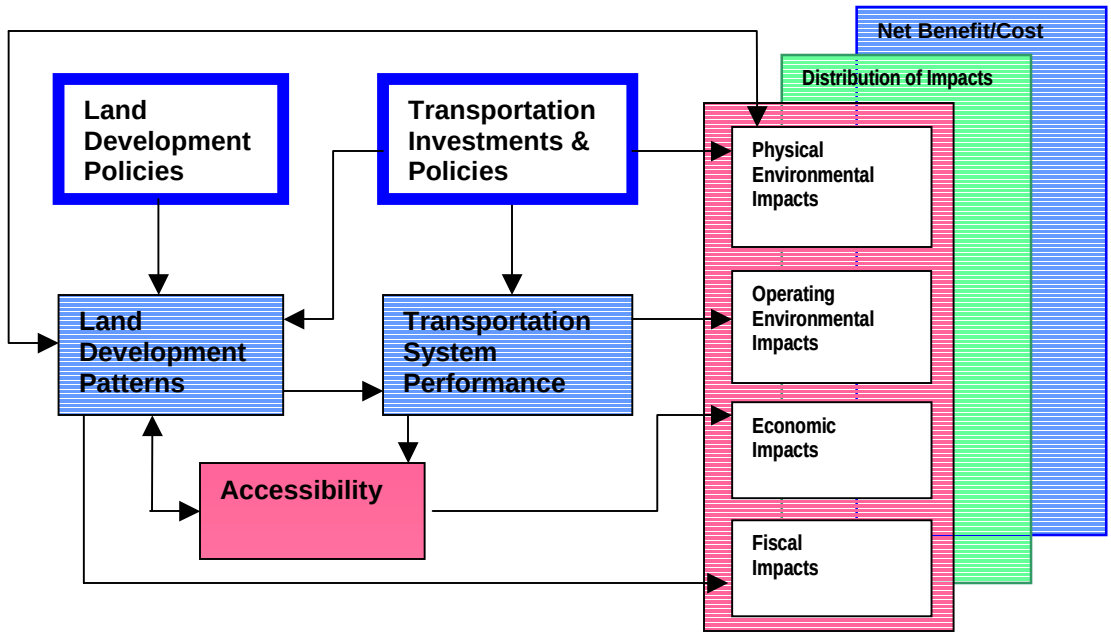
Table 4. **Evaluating Social and Economic Effects**[33]		
IMPACT	**STEPS IN THE ANALYSIS**	**METHODS**
Accessibility	• Identify key origins and destinations • Measure current accessibility between key origin-destination pairs • Estimate accessibility between key origin-destination pairs for each alternative • Estimate accessibility effects in terms of cost	• Interviews, focus groups, surveys • Site analysis • Maps and aerial photographs • Spread sheet analysis • Gravity models • Traffic demand models
Community Cohesion	• Define the study area • Collect information from community leaders and groups active in the community • Spend time in the study area • Estimate the existing level of community cohesion • Extrapolate the project's effects on areas of relative cohesiveness	• Interviews, focus groups, surveys • Site analysis • Maps and aerial photographs • Databases on structures
Visual Quality	• Define the study area • Determine the changes to be considered and possible alternatives • Select a medium or media to simulate the present environment • Identify respondents who will observe the environment and assess the likely effects of the project • Develop a procedure to record observer responses • Analyze the responses and provide feedback	• Visual preference surveys • Analogous case studies • Artist's sketches • Photo-realism techniques • GIS-based approaches • Virtual metropolitan models
Distributive Effect	• Do an initial screening • Develop a community profile and baseline inventory • Analyze project-related effects • Create maps showing relevant data and areas affected • Compare the effects on protected populations with those in the entire impact area	• Buffer analysis • Travel demand modeling • Focus groups, interviews, surveys • Travel diaries • Case study and comparison analyses • GIS overlay analysis • Barrier analysis

2. Toolbox for Regional Policy Analysis

FHWA's toolbox provides information on different regional policy models and case studies around the country. [34] The website provides useful links and contact information with the case studies, along with an overview of each process. The case studies are organized by type of impact (e.g., physical, economic, fiscal. See Figure H below) and by type of policy. Land use policies include regional and micro-scale. Transportation policy categories include infrastructure related (e.g., roadway, transit) and program related (e.g., TSM, TDM, etc.).

[33] Ibid.
[34] See http://www.fhwa.dot.gov/planning/toolbox

Figure H. Features of the Toolbox for Regional Policy Analysis



Source: FHWA website at http://www.fhwa.dot.gov/planning/toolbox

E. Scale of Analysis

Evaluation of transportation and land use impacts can be measured by four different scales: state, regional, local, or micro-scale (other scales may include the national scale but are not a subject of this report). At the state level, transportation projects include the state highway system (SHS), the Florida Intrastate Highway System (FIHS), and the state intermodal transportation system (SIS) which is currently being defined. Regional projects are generally corridor projects, large segments of the state system with a clear regional impact which may focus on one or more facilities. Local projects usually include smaller corridor segments or point (intersection) facilities. Socio-demographic information is developed for transportation in the form of Traffic Analysis Zones (TAZ), defined by the US Census as *"a special area delineated by state and/or local transportation officials for tabulating traffic-related data, especially journey-to-work and place-of-work statistics."*[35]

Urbanized areas, on the other hand, are either regional or local. The State Comprehensive Plan does not cover urban systems at the state level; rather, it contains policies that affect regions or localities. There are two types of regional planning areas, Regional Planning Councils (RPCs) areas and those defined by primary or consolidated metropolitan areas. RPCs have state established boundaries that include several counties with both urban and rural areas. Primary and con-

[35] http://www.census.gov/geo/www/cob/tz_metadata.html

solidated metropolitan statistical areas (PMSA and CMSA) [36] are defined for the census for the national budget distribution. They consist of a group of physically interconnected cities surrounding a large central city with a population summing more than one million. In Florida, several metropolitan areas meet these criteria (Jacksonville, Tampa, Orlando, and Miami-Dade/Ft. Lauderdale). At the local level there are counties and municipalities. At the micro-scale, plans and projects include those that occur at the intersection, street, or neighborhood level. Associated evaluation processes have been developed for each planning level. Socio-demographic information is generated by the Census at the lot, block, block-group, and census tract levels, and can then be aggregated to other larger scales. However, not all information generated by the 2000 Census is yet available for smaller levels of analysis.

Most operational urban and transportation models assess issues at the regional scale. Some models, like SPARTACUS, are being developed to analyze micro-analysis level data. Geographic Information Systems that include property appraiser data and detailed information about roadway design and condition that can be useful for micro-analysis as well as other levels of analysis. However, since this type of information is generated at the local level, GIS is difficult to use at the regional level unless the information is compiled in a central location or local information is compatible with information from other jurisdictions.

Data consistency and compatibility are major issues in land use and transportation modeling. Most land use data is developed by local governments. Since there is no state standard for generating and storing land use data, each local planning agency will develop their own. This poses problems for regional analysis which requires that data be integrated and aggregated. A few counties around the state are currently trying to centralize data storage.

VI. Alternative Selection and Public Involvement

After the different impacts from alternative scenarios have been tabulated, reviewed, analyzed, and evaluated, someone will have to determine which alternative is the best for the task. At this point in the process, some value determinations are made which formally or informally become the criteria used to make the decision. Criteria are used to make decisions about the acceptability or desirability of one option over another.

In a truly comprehensive planning process, the goals and objectives of the organization, the plan, or the project will provide the criteria needed to guide the decision-making process. The alterna-

[36] **Metropolitan statistical area (MSA)**: A geographic entity defined by the federal Office of Management and Budget for use by federal statistical agencies, based on the concept of a core area with a large population nucleus, plus adjacent communities having a high degree of economic and social integration with that core. Qualification of an MSA requires the presence of a city with 50,000 or more inhabitants, or the presence of an Urbanized Area (UA) and a total population of at least 100,000 (75,000 in New England). The county or counties containing the largest city and surrounding densely settled territory are central counties of the MSA. Additional outlying counties qualify to be included in the MSA by meeting certain other criteria of metropolitan character, such as a specified minimum population density or percentage of the population that is urban. If an area meets the requirements to qualify as a metropolitan statistical area and has a population of one million or more, it may be defined as a Primary MSA if statistical criteria are met and local opinion is in favor. A PMSA consists of one or more counties (county subdivisions in New England) that have substantial commuting interchange. When two or more PMSAs have been recognized, the larger area of which they are components then is designated a consolidated metropolitan statistical area (CMSA). An area becomes a CMSA if it meets the requirements to qualify as a metropolitan statistical area, has a population of 1,000,000 or more, if component parts are recognized as primary metropolitan statistical areas, and local opinion favors the designation. (US Census website, 2002)

tive scenarios should be measured against the goals and objectives to determine how well they will perform. Despite the process, the chosen alternative may still meet with opposition, unless the goals and objectives are linked to a community vision and community values. Lack of a concerted community vision in comprehensive planning may lead to short term choices with unfortunate long term impacts.

Defining and applying criteria to the process of selecting alternatives require a framework that includes a long term vision with short term actions. This vision must be holistic and comprehensive by including economic, social, and environmental considerations, as well as the physical attributes of land use and transportation elements.

A. Types of Criteria

Criteria can be developed in many ways for different uses. The following are examples of different types that can be used during the decision-making process.

1. Performance Measures

Performance measures are used to measure the extent to which a goal or objective has been achieved through the implemented policy, plan, project, or program.

Florida Performance Measures. Florida has a legal requirement for the use of performance standards by state agencies (see Florida Statute 216.023). It addresses legislative budget requests by state agencies and mandates that all state agencies must submit performance based budget requests, performance measures, and programs. The law states specifically that as part of the final legislative request submitted annually to the Florida Legislature and the Governor, all state agencies must include the following:

a. Output and outcome performance measures, approved by the Legislature, along with any proposed revisions;
b. Proposed performance standards, along with appropriate justification, for each performance measure;
c. Data on performance measures approved for the prior year, with an explanation for any deviation from the expected performance level;
d. Information pertaining to a comprehensive performance accountability system and a list of independent performance measures, separate from measures already approved by the Legislature;
e. Adjustments to their performance standards that reflect the amount appropriated by the legislature for each program. Any adjustments and revised performance standards will be reviewed by the Executive Office of the Governor.

This performance based system in Florida is linked to the transportation system through the Florida Department of Transportation's strategic plan. FDOT performance measures include
quality of life indicators which are another way of measuring performance. Many communities around the country are developing quality of life indicators to measure progress in meeting a community vision. Sustainability indicators are developed to measure longitudinal trends in local quality of life. A community begins by identifying a list of indicators by categories and establishing the baseline measurements for each category. Data are then collected and updated on a yearly

basis. The indicators must be linked to a set of goals and objectives that will set the bar for the trends.

In 1985, the City of Jacksonville, Florida initiated a process to create a citizen-based definition of quality of life. Nine categories were chosen: education, public safety, natural environment, health, social environment, government/politics, culture/recreation, and mobility. A series of indicators were selected to measure the performance of each category. Data have been collected and tracked to demonstrate longitudinal trends over time. These indicators are used for local government budget decisions and influence the way the Chamber of Commerce conducts business. Over the years, linkages have been established between the indicators and community problems.

Under the goal of creating "opportunities for and convenience of travel within Jacksonville and between Jacksonville and other locations," the following indicators are listed:

a. Percentage of working people surveyed who report commuting times of 25 minutes or less (telephone surveys)
b. Average number of seats available daily on flights through Jacksonville International Airport (JIA)
c. Destinations served by direct flights in or out of JIA
d. Total airline passengers flying in or out of JIA
e. Average weekday ridership on Jacksonville Transportation Authority (JTA) buses per 1,000 people
f. Average weekday miles of JTA bus service
g. Percentage of JTA bus headways within 30 minutes during peak hours and 60 minutes during non-peak hours
h. Average weekday ridership on the Skyway.[37]

2. Desirability Criteria

Often the question that follows an alternatives assessment is whether the alternative is desirable. By developing criteria that can determine the level of "desirability" for the community, decision makers can have a better understanding of what type of alternative the community will support and, on the flip side, what is simply unpalatable for the community to accept.

Case Study: The Costs of Sprawl 2000. A recent publication of the Transit Cooperative Research Program, *Costs of Sprawl—2000*, developed desirability criteria which were applied to strategies and tactics to address the outcomes of sprawl that require remedies. The following brief overview of the document is an example of how criteria emerge from a formal study of an urban development phenomenon.

The term sprawl is used to compare the costs and benefits of a type of development that is dominating the developed landscape.

> *Sprawl is spread-out development that consumes significant amounts of natural and man-made resources, including land and public works infrastructure of various types. Sprawl*

[37] City of Jacksonville Indicators of Mobility, 2000.

> *also adds to overall travel costs due to increasing use of the automobile to access work and residence locations more widely spaced due to the sprawl phenomenon. Furthermore, sprawl appears to deconcentrate centers and takes away from the multiplicity of purpose that neighborhoods once delivered. Yet sprawl has benefits. It offers access to less-expensive housing and opportunities for homeownership at the periphery of metropolitan areas. It provides congestion management in automobile dominated metropolitan areas by creating the suburban-to-urban trip and by better equalizing the percentages of the commuting population involved in reverse and forward commutes.*[38]

The study discusses resource impacts of sprawl (costs of land conversion, utility and local road infrastructure, local public-service costs, and real estate development costs), personal costs (costs of travel miles, quality of life, and urban decline), and the benefits[39] of sprawl to develop policy responses to the phenomenon: strategies and tactics rated against criteria of desirability.

The study proposes strategies or general objectives to be applied to the effects of sprawl that need remedies. These seven basic policy strategies are summarized as follows (accompanied by a summarized list of accompanying "tactics"):

a. *Limit the outward movement of new development* by encouraging compact metropolitan development and discouraging new outlying developments (urban growth boundaries, regional urban service districts, large-lot rural zoning; transferable development rights).
b. *Reduce society's current heavy dependence on private automobiles,* and increase the use of other modes of transportation: transit, bicycles, and walking.
c. *Reduce the financial dependence of each local government's revenue on property values and sales taxes occurring within its own boundaries,* through regional tax-sharing or through increased funding from state governments.
d. *Provide more opportunities for low-income and minority households to move out of concentrated-poverty neighborhoods in inner-core areas and into suburbs,* mainly through the provision of housing subsidies.
e. *Introduce new elements of urban design into land use planning.* Examples include greater mixing of land uses, allowing grid street patterns, and encouraging higher-density development around transit stops.
f. *Revitalize concentrated-poverty and other neighborhoods in central cities,* by reducing crime, improving the quality of area schools, and removing governmental obstacles.
g. *Create some type of public agency at the regional level that has the authority to review and coordinate comprehensive land use and other plans drawn up by individual localities* within the entire region. [40]

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[38] Burchell, Seskin, et al (2000), "Preface."

[39] As a part of the report, *Costs of Sprawl--2000* also discusses what some consider to be benefits of sprawl development. The report refers to 13 possible benefits identified by an earlier TCRP study (*TCRP Report 39, The Costs of Sprawl Revisited,* Burchell, et al. 1998). However, the 2000 report recognizes that they are difficult to measure and therefore determination of a net cost or benefit is not possible. Furthermore, while it was fairly easy to understand how lower land and housing costs, shorter commuting times, and better-quality schools, can be beneficial to individuals, the report was unable to determine whether they are also beneficial to society as a whole. For this reason, the focus of this report is on the impacts of sprawl on our society and developing policies in response to sprawl. Burchell, Seskin, et al (2000), pp. 445-482.

[40] Ibid, 494-495.

The tactics are then compared to a list of "desirability" criteria that include:

a. *Likely effectiveness in achieving the desired strategic outcomes* (e.g., actual effect on regional compactness)—the extent to which the specific tactic being considered may actually achieve its goals if implemented.
b. *Ease of administration* refers to the difficulty level of putting tactic into practice through implementation and operation. Also it refers to the tendency of a tactic to be challenged by affected parties.
c. *Low public money costs*—monetary cost in terms of how much it would cost to implement the tactic, which is measured as "inexpensive," "moderate," or "very expensive."
d. *Few negative side effects*—a discussion of the impacts particularly in terms of increasing the current value of the affected unit.
e. *Political acceptability* relates to level of public support.
f. *Permanence of effects* ranges from "ineffective" to "not enough" to "great."[41]

3. Developing Criteria through Consensus

Consensus-building techniques are very useful in developing criteria and can be built into the planning process; criteria can be developed at the same time they are applied. Decision-making often requires weighting or ranking options. Consensus building provides the opportunity to identify and nurture shared interests and values that can be used to develop ranking criteria. Over the past decade, the Florida Conflict Resolution Consortium (FCRC), a neutral service institute created by the Florida Legislature and housed in the state's universities, has assisted the FDOT in facilitating agreements and resolving conflicts related to Florida transportation issues.[42]

The FCRC uses consensus building and mediation techniques in the development of collaborative decision-making processes that involve specific transportation projects. Although their methods do not always bring immediate resolution to the conflict, the Consortium is working with the Department to develop methodologies that will lead to better planning processes.

For the Orlando Urban South-Central Corridor, the FCRC helped the participants develop evaluation criteria for several corridor alternatives. The participants included representatives of the cities of Apopka and Ocoee in addition to representatives of local and state governments, agencies, and organizations. At issue was local opposition to an expressway proposal to connect the city of Orlando with the airport. The FCRC was called in to mediate the process. According to the FCRC report, *"the mediation enabled parties who had waged a long and bitter battle over the proposed Central Corridor to successfully create a consensus agreement that the MPO accepted and included in its Year 2020 Long-Range Transportation Plan."*[43] Table 5 illustrates some of the recommended measurements.

[41] Ibid, 500.
[42] FCRC at http://consensus.fsu.edu/transportation/FDOT_Report_I.html , 2002, 1.
[43] Ibid, Case 3, 1.

Table 5. **Evaluation Criteria for Transportation Alternatives**[44]	
Evaluation Category	**Measurements**
Integrates and/or allows multi-modal systems	Includes multi-modal bus, rail, and HOV
Impact to I-4 at East-West screenline	Volumes, speeds, and operating conditions
Impact to S 417 at East-West screenline	Volumes, speeds, and operating conditions
Minimize division of neighborhoods/government jurisdicitions	Residential/commercial impacts
Study area system performance	VMT, vehicle hours of travel, and fuel consumption
Screenline system performance	Operating conditions, highway person trips, and congested speeds
Net cost estimates	ROW and construction costs, less programmed funds
Relative costs/benefits	ROW and construction costs, loss of tax base
Environmental impacts—lakes, stormwater, air, noise	Stormwater runoff, noise, emissions—CO,HC,NO

B. Innovations in Transportation and Land Use Evaluations and Assessments in Florida

Florida has several recent examples of linking land use and transportation through planning initiatives and processes. Several of these initiatives are described below. Two are TEA-21 initiatives: Florida's Efficient Transportation Decision Making Process and local applications of the Transportation and Community and System Preservation Pilot Program (TCSP). The remaining examples are state government initiatives to link land use and transportation planning.

1. Rule 9J-5. Minimum Criteria for Review of Local Government Comprehensive Plans and Plan Amendments, Evaluation and Appraisal Reports, Land Development Regulations and Determination of Compliance.

Rule 9J-5 implements the requirements found in state statutes (Chapter 163, F.S.) as they relate to urban planning. Rule 9J-5 provides language in both the land use element and the transportation element with the intent of linking land use and transportation decisions and plans. The linking language appears mainly in the transportation element, which has been modified significantly over the past ten years, to incorporate land use and transportation linkages, as well as requirements for multi-modal and intermodal considerations. More importantly, the rule goes beyond statute language in requiring that development density and intensity not only be identified by location, but also that they should be "*consistent with the transportation modes and services proposed to serve these areas*."[45] Additionally, Rule 9J-5 requires that transportation goals, objectives, and policies address "*the provision of efficient public transit services based upon existing and proposed major trip generators and attractors […]*."[46] An option available that allows local governments to reduce concurrency requirements is the multimodal transportation district, "*for which the local comprehensive plan assigns secondary priority to vehicle mobility and primary priority to assuring a safe, comfortable, and attractive pedestrian environment, with convenient interconnection to transit.*"[47]

[44] Ibid, 7.
[45] Rule 9J-5, (4) (b) 2.
[46] Rule 9J-5 (4) (b) 4.
[47] Chapter 163.3180 (15)(a), F.S.

These districts are required to incorporate community design features that will reduce the number of automobile trips or vehicle miles of travel and support an integrated, multimodal transportation system. *"Community design elements of such a district include: a complementary mix and range of land uses, including educational, recreational, and cultural uses; interconnected networks of streets designed to encourage walking and bicycling, with traffic-calming where desirable; appropriate densities and intensities of use within walking distance of transit stops; daily activities within walking distance of residences, allowing independence to persons who do not drive; public uses, streets, and squares that are safe, comfortable, and attractive for the pedestrian, with adjoining buildings open to the street and with parking not interfering with pedestrian, transit, automobile, and truck travel modes.*"[48] This type of district has been adopted by several communities around the state and the city of DeLand has recently completed its district plan.

2. Florida's Efficient Transportation Decision Making Process

Working in conjunction with the FHWA and other federal, state, and local agencies, the FDOT is developing *"a refined and improved methodology for effecting improved transportation decisions."* [49] Florida's Efficient Transportation Decision Making (ETDM) process is a response to the TEA-21 environmental streamlining initiative. An efficient permitting process is built into the current transportation planning and project development process by incorporating two "screening" events, a planning screen early in the planning process and a programming screen that provides agency scoping requirements to satisfy NEPA and related requirements. The screenings will be performed by an Environmental Technical Advisory Team (ETAT) consisting of representatives from planning, consultation, and resource protection agencies. Each appointee will have the responsibility to coordinate transportation reviews within their agencies and provide timely responses to the appropriate FDOT and the MPO entity. With this new process, the FDOT hopes to develop an earlier assessment of secondary and cumulative impacts and identify avoidance and mitigation strategies and linkages between land use, transportation, and the environment in an atmosphere of continuous public representation that will result in timelier project approvals.

2. Transportation and Community and System Preservation Pilot Program

The Transportation and Community and System Preservation Pilot Program (TCSP) was created by Section 1221 of TEA-21. It provides funding over five years "to states, local and tribal governments, and metropolitan planning organizations (MPOs) to develop innovative strategies that use transportation to build livable communities."[50] The program has been used by many communities to expand the range of partners involved in planning, including the non-traditional partners such as economic development corporations, community groups, and private developers. It is also being used to develop new analytical tools to assess the impacts of transportation and land use alternatives on mobility, economic development, community character, and the environment. The program emphasizes new techniques for public involvement and participation. Several projects have been developed in Florida, three of which are described below.

[48] Ibid, (b).
[49] FDOT, ETDM Process , 2002
[50] TCSP website at http://www.fhwa.dot.gov/tcsp/0_summary.html

Plan East Gainesville Project.[51] This project involves a special area, land conservation, and transportation study for East Gainesville under contract with the Metropolitan Transportation Planning Organization (MTPO) for Gainesville, Florida. The plan is a follow-up to the MTPO's Livable Community Reinvestment Plan, a 20-year strategic vision for integrating transportation and land use. Located east of I-75, the area has experienced limited economic investment since the 1960s. The tasks to be completed include:

- Discerning a viable community vision
- Preparing a special area plan element
- Preparing a land conservation plan element
- Supporting development of a transportation plan element
- Preparing an implementation plan that includes adoption of land use plan, design guidelines, conservation priorities, and a capital improvement plan.

Contact information: Marlie Sanderson, AICP, Director of Transportation Planning, Gainesville MTPO. 2209 NW 67th Place, Gainesville, FL 32653, (352) 955-2200, ext. 103

Treasure Coast Regional Planning Council—Martin & St. Lucie County Regional Land Use Study.[52] This is a $350,000 study that evaluates alternative land use and transportation scenarios to avoid major capacity expansion projects on US 1. The study partners two counties, Martin and St. Lucie, with the cities of Stuart, Port St. Lucie, and Ft. Pierce, along with the FDOT, DCA, and the Treasure Coast Regional Planning Council (TCRPC). A portion of the study is funded through the TCSP program. The first phase of the study provided a quantitative assessment of how alternative development patterns can create a more balanced transportation system with improved travel choices. The project includes a public involvement plan. The comprehensive plans and land development regulations are being prepared with supporting language for the implementation of the preferred land use/transportation vision.

Contact information: Terry L. Hess, AICP, Director of Planning, Treasure Coast Regional Planning Council. 301 E. Ocean Blvd., Suite 300, Stuart, FL 34994, (561) 221-4060.

Florida Department of Transportation District 6—Livable Communities Corridor Studies.[53]
The first livable communities general services contract undertaken by the FDOT, this project aims to identify balanced approaches to corridor and subarea transportation issues. The project seeks to balance livability with mobility considerations by treating community issues equitably with transportation issues. For this project, the Department has partnered with local governments and community associations in Miami and the first phase focuses on the 79th Street and 82nd Street corridors in northeastern Miami. Currently the streets form a pair, but the residents would like to see the roads reverted to two-way streets to reduce traffic on 82nd Street and provide opportunities for redevelopment along 79th Street. The second phase will identify changes in traffic patterns in Miami Springs after the Miami Intermodal Center (MIC) interchange improvements are implemented. The results will lead to traffic calming recommendations in the impacted areas.

[51] Information on this project was provided by Renaissance Planning Group (RPG) which is providing the technical support for these projects. RPG is located in Orlando, FL.
[52] Ibid.
[53] Ibid.

Contact information: Susie LaDouceur, FDOT District 6, 602 South Miami Ave., Miami, FL, (305) 377-5894; e-mail: marie.papillonladouceur@dot.state.fl.us

3. Florida Fiscal Impact Analysis Model

Based on the outcome of the Governor's Growth Management Commission in 2001, the Florida Department of Environmental Protection (DEP) put together a solicitation of services to develop a fiscal impact analysis model for application by local governments in their comprehensive planning and development approval decisions. The objectives of the model, as listed in the solicitation form, are:

a. Make the short- and long-range effects of growth evident to local governments and their citizens at the time decisions are made.
b. Provide a comprehensive picture of existing and future infrastructure and service needs of the community so that a local government and its citizens can make more informed decisions about the use of local revenues. This picture should provide an understanding of:
   (1) infrastructure backlogs,
   (2) current revenues and costs by land use or "prototype," and
   (3) projected revenues and costs by land use or prototype.
c. Consider both benefits and costs of land use options (e.g., different uses in a particular place of development in one area versus another) with an emphasis on avoiding increased deficits.
d. Help jurisdictions account for deficiencies, or backlog conditions, and create a basis for developing solutions to these deficiencies.
e. Develop a tool that can be used by local governments to illustrate possible outcomes of new growth and development, so that the effect of land use decisions can be better understood in the context of the local governments long-term ability to provide for infrastructure and service needs of the community.
f. Develop a core model for all local governments that allows for enhancements by individual local governments for specific issues or circumstances.
g. Provide suggestions and options for compiling and maintaining consistent data and determine the availability of information and resources needed to maintain reliable data for the model.[54]

The model is expected to serve as one of the basic tools a local government can use to guide or direct growth. Using information generated by the model, community leaders can use economic or procedural incentives and disincentives to influence natural market-based development decisions.

4. South Florida Regional Modeling Initiatives

Since 1992, the South Florida Regional Planning Council (SFRPC) has been using an input-output model (I-O) for evaluating net new employment and the total economic value to a region that might result from a specific development of regional impact (DRI). The SFRPC is in the process of negotiating for a variation of the REMI model for fiscal and policy analysis, to help

[54] DEP, Solicitation No. 2002022C, 2001.

determine how changes in business would affect the region which stretches on the east coast of Florida from Palm Beach County to Monroe County.

5. 2002 Growth Management Legislation

One of the Growth Management Study Commission's recommendations was to develop a *"uniform methodology for reviewing the costs and benefits of local land use decisions."*[55] In 2002, the Legislature adopted a Growth Management Law that requires municipalities to report deficits and duplication in the provision of services within their jurisdiction to determine if services can be coordinated and shared with neighboring communities through intergovernmental coordination and interlocal service agreements.[56] This is a step in the direction of more efficient service provision. However, local governments will need to determine whether it would be in their best interest to reserve the service surplus for future local development or share it with neighboring communities.

The legislature also adopted a policy to offer responsible local governments the opportunity to make planning decisions with less oversight of their comprehensive planning process. The purpose of the 2002 Local Government Comprehensive Planning Certification Program, a successor to the Sustainable Communities Pilot Project, is to allow local governments to operate with less state and regional oversight of their comprehensive planning process.[57] The newly-adopted certification program requires that interested local governments demonstrate commitment toward promoting more compact and economically diverse development that will be supportive of multimodal transportation systems. It also requires communities to demonstrate that they can ensure the "cost-efficient" provision of public infrastructure and services.[58] If the local government does not substantially comply with the terms of the agreement, the certification expires 10 years after the execution of the agreement. DCA must now adopt rules for regarding the processing and review of applications. With many local governments preparing to undergo their second round of Evaluation and Appraisal Reports (EARs), this program is sure to affect the way transportation is currently planned in communities pursuing certification.

Florida is also trying to implement tools that promote greater fiscal efficiency and that will affect state agencies as well as local governments. Since 1998, TEA-21 has required transportation plans to be consistent with forecasted transportation budgets. Furthermore, in 2000, the Florida Legislature adopted a bill that requires the state transportation planning goals (Section 334.046 of the Florida Statutes) to include the development of a "macroeconomic analysis of the linkages between transportation investment and economic performance, as well as a method to quantifiably measure the economic benefits of the district-work-program investments (SB 772)."

[55] Florida's Growth Management Study Commission, 2001, p. 20.
[56] CS for SB's 1906 7 550, 2nd engrossed, 163.3187(1) 6a.
[57] Senate staff notes, author unknown, "Major Provisions of SB 1906 Growth Management."

[58] See CS for SB's 1906 & 550, 2nd Engrossed, 2002 Legislature.

VII. Conclusions

While federal, state, and local governments face the challenge of establishing how best to spend revenues to provide services and infrastructure, they must also determine how to mitigate for the impacts the services will have on other systems. Planning processes in Florida use evaluations and assessments to determine the impacts of a decision on affected systems, particularly of transportation on the built and natural environment.

This report reviewed initiatives to move land use and transportation planning toward more efficient, equitable, and accountable processes. It also reviewed the tools used to evaluate alternative policies, plans, projects, and programs so that they can better respond to community needs and desires. Currently, methods for evaluating how transportation and land use impact each other and the environment are being translated into operational computer-run models. The models are used to compare the impacts of one proposed scenario with another. Some of these models are capable—separately or in combination—of conducting economic input-output analyses, measuring impacts to and performance of the transportation system, and estimating future land needs to support population growth. Most models require a significant amount of data: the more complex the model, the greater amount of data required and results are only as good as the data provided. However, at this time much of the data is difficult to obtain and needs to be compiled or generated. It also needs to be maintained and updated regularly which can be a costly proposition for a single agency to tackle, but may be more manageable through interagency cooperation and coordination.

Regardless of complexity or comprehensiveness, the models by themselves are not capable of determining which alternative is best for the community. This final decision must be made by government decision makers and elected officials in partnership with the affected community—the citizens who will benefit from and/or be impacted by the chosen alternative and the public and private interests who will be implementing it. This decision-making process is more effective when a meaningful participation process is developed to allow early and continuous involvement in the process. Also, information must be provided in formats that can be understood by the participants. Models may be complex systems, but the resulting information need not be. Several collaborative processes are being developed and applied by the Florida Department of Transportation to address issues before they become conflicts; consensus building is one of the methods currently being used.

Some obstacles identified that affect promoting greater linkage between land use and transportation planning include:

- Incompatibility of data formats between local government sources and other data sources
- Incompatibility between land use comprehensive plan amendment cycles and transportation planning cycles
- Lack of direct feedback between land use policy and zoning changes and the transportation planning process
- High cost of developing and maintaining a database for complex land use/transportation models
- Data for some indicators or model variables are non-existent or difficult to obtain

- No dedicated funding sources to maintain and operate land use/transportation models
- Measurement of impacts for specific projects, with limited secondary and cumulative impact evaluation
- Different scales for land use and transportation planning
- Conducting land use planning at the local level, with regional plans having little bearing on local decisions
- Funding sources (but no control over land use decisions) for transportation, insufficient funding for land use planning
- Local governments are reluctant to increase taxes and fees to generate additional funds for land use planning

Some obstacles identified that affect meaningful public involvement, include:

- The planning processes controlled by agencies and local governments have limited public participation requirements.
- The "public" is made up of diverse interests that sometimes conflict with each other.
- Power within the "public" is unevenly distributed.
- Access to public involvement requires access to education and information.
- Some of the innovative public involvement processes are too new to determine whether they will be successful.
- Decision making is not adequately linked to a vision, goals, and objectives, sometimes because visions, goals, and objectives differ at different planning scales (long vs. short-term; regional vs. local issues)
- Even when goals and objectives exist, more often than not there is a failure to measure system performance against them. Changes are not likely to be made in light of performance.

Regardless of the number of evaluations conducted, if land use and transportation forecasting and planning are not linked to each other, there will always be conflicts. FDOT controls highways, while the local planning commissions control local land use and roads, and their decisions impact highways. Metropolitan Planning Organizations provide a workable link between local land use planning and transportation planning but have no direct control over either. In the process of making transportation decisions, MPOs are at the mercy of the quality of their relationship with local land use planners and planning commissions.

The Florida Department of Transportation (FDOT) has been at the vanguard of implementing new federal programs and procedures. Over the past few years, the Department has worked to implement the policies set forth by the two most recent transportation acts—ISTEA and TEA-21—and incorporated the policies into state transportation policies and procedures. These transportation acts have incorporated greater consideration of environmental and quality of life concerns into the transportation planning process. In addition, they have added greater flexibility in planning and funding alternative modes of travel and provided the opportunity for more meaningful public participation. Initiatives such as TCRPC, Environmental Streamlining Process, and the implementation of Community Impact Assessments allow the Department to be more sensitive to the needs and desires of communities and to be more proactive in mitigating environmental impacts of transportation earlier in the process. Much of the focus of the new state

initiatives has been on increasing the effectiveness of public participation and, at the same time, decreasing the amount of time and effort it takes to go from conception to construction of transportation projects. The assumption is that providing opportunities to address potentially controversial issues earlier in the planning process will lower the risk of defaulting on expensive and time-consuming project planning processes.

Recommendations from the different state commissions designated to study the state's growth management system over the past 15 years and the resulting growth management legislation have made it apparent that the state of Florida is trying to develop a method to help

a. identify infrastructure and service backlog and deficits,
b. identify infrastructure and service surplus, and
c. compare the fiscal impacts of different "prototypes" of development.

Different types of development patterns are being promoted to make better use of existing infrastructure and services while protecting farmland, open space, and natural habitat from encroaching development. In general, redevelopment, infill development, and compact and cluster development promote higher density and intensity land use. Each type of development will generate different types of impacts on infrastructure and services. However, compact development requires comparatively fewer linear feet of utility infrastructure and is, therefore, considered to be more cost effective. Compact development at appropriate densities also creates the potential for the provision of transit service.

On the other hand, compact, higher intensity development unaccompanied by other important urban system components can also increase negative impacts. Higher activity in areas without transit increases congestion on roadways. The lack of appropriate pedestrian facilities in high density locations increases the potential for pedestrian accidents. Also, increased development in areas with outdated or backlogged infrastructure causes breakdowns in the systems. In an environment of limited funds, concessions and compromises will be necessary to achieve long range goals. Armed with better tools like Full Cost Accounting (FCA) and Fiscal Impact Analysis (FIA), decision makers may be able to make better decisions based on true costs. However, even these tools have their shortcomings. Some project benefits and costs can are not easily converted into monetary terms, resulting in net costs. Projects, like community facilities and affordable housing, do not pay for themselves and this would make them more difficult to approve.[59] Also, FCA and FIA may be too expensive to apply on a project-by-project basis.

There are many evaluation tools available that vary in complexity and applicability. A balanced approach to determining the true cost of development may include a list of evaluation tools tailored for task based on project size and scale of impacts, as well as available resources. While there is evidence that transportation planning relies on a uniform set of tools throughout the planning process, there is little evidence of this in land use planning.

While the recommendations for developing the true cost approach to infrastructure planning are directed at local governments, state agencies and departments will need to coordinate the application of tools and data and information collection with local governments to help them make

[59] From a Growth Management Study Commission (2001) discussion about Full Cost Accounting (FCA).

better decisions. Since local communities are going to continue to making the land use decisions, other state and regional agencies should be involved in a collaborative decision-making process given the impact of development on other infrastructure systems such as transportation and water supply.

VIII. Issues for Further Consideration

In the process of conducting research for this report, several issues became apparent that could become the focus of further inquiry. In spite of the causal interrelationship between land use and transportation, there are basically two separate government entities engaged in their planning—state department of transportation and local governments. In this relationship, there appears to be greater pressure on transportation planners (DOTs and MPOs) than on land use planners (local governments) to link land use and transportation planning. This seems to be occurring for several reasons. First, transportation planning is federally mandated, while land use planning is not and remains a function of local decision-making. Second, transportation planning has received a great deal of funding from local, state, and federal sources. Land use planning, on the other hand, receives very little federal funding, if any, and that comes in the form of grants. Another part of the funding comes from state revenues which are in no way comparable to transportation funds. The remaining piece of funding is generated at the local level, and each community decides what percentage of its budget will be dedicated to planning and other land-use related functions (permitting, building, etc.). Finally, while for most citizens the function of transportation planning seems clear, the function of local land use planning departments is not. Planning is associated with permitting, building, and code enforcement, but the concept of planning land use is too abstract for most people to fully understand.

Since the public understands that the power to plan transportation comes from the federal level, there is greater pressure on the Department of Transportation to plan and resolve the conflicts created by the different systems. There is pressure to plan more efficiently, be more equitable in the distribution of benefits and costs, be more accountable to the public, provide more information, and share the decision-making. Some ways of addressing these issues are as follows.

1. Modify evaluation and appraisal reporting/ local comprehensive planning amendment cycles to link the MPO transportation planning cycle and the long range transportation plan. Evaluation and Appraisal Reports (EARs) for local comprehensive planning amendments are required every seven years. This cycle lacks linkage with the MPO LRTP cycle. By coordinating the local EAR cycle with the MPO planning cycle, planning land use and transportation could occur concurrently. This would be further facilitated by a single regional database. In addition, it would help reduce duplication of evaluation efforts and consolidate public involvement into a single process that would provide input to both issues. Implementation of this recommendation would require a state policy and may require amending the State Comprehensive Planning Act and rules governing the EAR process.

2. Develop a single centralized metropolitan or regional database that should be maintained by the MPO or Regional Planning Council. As planning moves beyond local boundaries to metropolitan and regional levels, it is imperative that these planning processes and initiatives have access to a single centralized database. Funding could be pooled from local governments which

would require fewer resources to maintain a database. However, additional funding sources would be needed. Local governments would still need to maintain local databases such as property appraiser information and zoning that could be updated locally but linked to the central database. Such a database could also contain information on other types of indicators, e.g., health, education, local economy, etc. Implementation of this recommendation would require identification of funding sources to build capacity within the MPO or regional planning council to manage the database. Additional resources would be needed to coordinate information sharing between various government agencies and offices.

3. Standardize data formats, forecasts, and GIS data used by planning agencies around the state, in particular land use and transportation planners. Standardized formats and forecasts, similar to what is being done by the Bureau of Economy and Business Research (BEBR) for the state census information, would allow the state to use local data for state planning purposes. It would also allow other planning agencies, such as the water management districts, access to valuable information, and water management district information could also be made available to local planners. Implementation of this recommendation would require funding for research and implementation. Research would be needed to propose a standardized method and data format. The ETDM process is already trying to create a GIS clearinghouse at the University of Florida. Additional funding could help move this process along at a faster pace and expand it to include additional information. The FDOT could partner with DEP and DCA to promote this effort and identify funding sources.

4. Promote greater linkage between land use and transportation planning through the MPOs. The MPOs already provide linkages between the land use and transportation planning processes, but their role could be strengthened through state policy. Federal and state funding sources should be explored to provide the MPOs with additional resources and build capacity. Implementing this recommendation would require changes to state and federal policies. This policy change could be recommended as part of the reauthorization of the federal transportation act (also known as T-3).

5. Conduct research on public involvement activities. Although the Department has already developed a planning toolbox, there is room for developing a report to document "best practices" in land use and transportation planning initiatives. This report should focus on costs, benefits, and appropriate uses of each method.

6. Provide funding sources for linking local land use planning with transportation planning. The only way the federal government can influence land use planning and development is through guidelines and grant incentives. Local governments are reluctant to provide funding for planning purposes and generally rely on federal and state grants and appropriations. Federal funding sources could be provided as an incentive to promote greater linkage between land use and transportation planning. A grant program could be created to fund the recommendations made above. The TCSP program could be continued and expanded. However, more stable funding sources will be needed for maintaining the proposed databases. This policy change could be recommended as a part of the reauthorization of the federal transportation act (also known as T-3).

7. Provide funding to develop, run, and maintain land use/transportation models and evaluation tools that can serve as support tools for the decision-making process. Decision makers must sift through complex and great amounts of information in order to make efficient and equitable decisions that include measures of accountability. Models and evaluations must provide simplified information in terms that lead to better decisions made more quickly. However, this requires significant resources that most local government do not have. By centralizing and sharing information, costs can be shared by different government sources. Additional funding would still be needed, however. This policy would also require state or federal funds.

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Appendix

X. Appendix: Quantifying Impacts: Cost-Impact Evaluation Tools

In the process of quantifying different impacts, several types of cost-impact evaluation tools have been developed for the planning profession. Each tool is tailored for a different function or industry, thus explaining why a similar tool may go by different names. Evaluation tools can be quantitative or qualitative in nature, or a combination of both, but most cost-impact evaluation tools are quantitative. Quantitative evaluation tools monetize measurements, but other physical units may be used. The following evaluation tools are most commonly used to assess policies, projects, or programs.

1.—Cost-Benefit Analysis (C-B) [60]

This method attempts to quantify in monetary terms all the goods and services that may be produced or impacted in the implementation of proposed policies, projects, or programs. A stream of benefits and costs generated by a policy, project, or program is financially discounted at a stated interest rate over a specific period of time to convert it to a current value. This approach allows comparison of total costs incurred throughout the implementation process with initial start-up expenses such as construction costs. Common measures used for C-B measures include:

(1) Internal rate of return (IRR): a discount rate at which the investment has no net present value.
(2) Net present value (NPV): the sum of discounted costs and benefits.
(3) Benefit-cost ratio (BCR): the ratio between discounted benefits and costs, where a value greater or equal to one demonstrates net benefits.
(4) Return on investment (ROI): the rate of interest expected to be received from the investment.

Although detailed and useful in the evaluation and prioritizing of alternatives, the foregoing tools cannot fully account for some types of impacts which are difficult to express in financial terms. They also require the collection of significant amounts of data and are expensive.

Examples of use:

(1) Surface transportation efficiency model (STEAM): was developed by FHWA to estimate user benefits, costs, and external influences of transportation projects.
(2) Net Benefit Cost: is a C-B model that computes benefit cost measures based on travel demand model assignments. This model has been used in Indiana and other areas.

Recent Use of Cost-Benefit Analysis in Transportation Planning: A study done in Portland, Oregon, evaluated and compared the regional economic and user benefits to costs which resulted from improvements in a major freight corridor. The study evaluated the impacts on travel time, vehicle operating costs, and accident cost savings for truck traffic.

[60] FHWA, Impact Methodologies Toolbox; Governor's Commission for a Sustainable South Florida; and Litman, 2001.

2.—Fiscal Analysis

Fiscal analysis compares costs with revenues. The following are several currently used fiscal analysis methods.

2A.-Fiscal Impact Analysis (FIA):[61] One of the oldest and most widely used models, FIA measures how changes in policy or factors within an economy will affect changes in expenditures and revenues for particular government agencies. Guidebooks for fiscal impact analysis have been written by the Urban Land Institute and the Center for Urban Policy Research at Rutgers University. There is also a second generation of fiscal impact software known as "FISCALS," produced by Tischler and Associates, which operates on personal computer spreadsheet programs.

2B.-Cost-Effectiveness Analysis (CEA):[62] This method sets desired objectives at the start of the project and looks for ways to achieve them at the lowest cost. A project is said to be cost effective if it has the lowest present value cost of all competing alternatives, assuming the same amount of benefits. Cost-effectiveness analysis has some similarities to cost-benefit analysis. This method, however, does not evaluate all benefits in financial terms, but instead it focuses on one or more specific or primary impacts that are not easily reduced to financial terms. It uses a cost per unit method to gauge the increase or decrease of the impact. Cost-effectiveness analysis is widely used in the medical field, to evaluate situations such as comparing the effectiveness of one treatment method to another. This evaluation approach would review the major indicators for each proposed alternative based on its marginal cost, compared to the competing alternative.

Examples of use: An article from the University of Zurich, Switzerland, proposed the use of a comprehensive cost-effectiveness analysis study to evaluate environmental policies designed to reduce pollutants by using a "damage index." All effects other than pollutant reductions are expressed as monetary costs. Variables analyzed included agricultural policies, sources of pollution segregated by industry sector, and types of polluting.

2C.-Least-Total-Cost Approach (LTCA) to Alternative Comparison:[63] This appears to be a derivation of the cost-effective analysis approach. This approach uses the common measure of total costs to account for all costs and allows for the comparison between competing alternatives. The approach is said to have the advantage of allowing for comparison of different transportation investment modes by using comparable measurement units, as well as for comparisons of different alternative investment choices. While both LTCA and CEA are technically similar methods of analysis, the least-cost approach includes non-economic variables in the analysis. The main disadvantage of the least-cost approach is that the parts of the approach that are specific to the utility industry cannot be easily modified to meet the needs of the transportation planning field.

Examples of use: The Oregon DOT published a study related to the use of the least-cost approach in the Mt. Hood Corridor. The study translated the least-cost approach from a utilities application to a transportation application. It highlights differences between the least-cost planning approach and the approach that is currently being used in Oregon. The objective of the study was to evaluate construction and non-construction alternatives to increased transportation demand

[61] Shleiniger, 1994; Transportation Research Services, 2001.
[62] Litman, 2001; Transportation Research Services, 2001.
[63] DeCorla-Souza et. al, 1997; Rofolo, 1995; and Rufolo, 1996.

and to improve the effectiveness of the state's current transportation planning process.[64] The authors concluded that the general concept of LCP could readily be adapted to transportation planning, but that the study provided little information on the effectiveness of non-construction transportation alternatives in response to increased demand.

The Washington State Growth Management Act requires that all regional transportation plans developed or updated after July 2000 must be based on a least–cost planning approach. Although state law also requires the Puget Sound Regional Council to use least–cost to develop its Metropolitan Transportation Plan, the law is considered obscure and unenforceable. Several proposed regional transportation projects in the Seattle area would probably not be permitted if evaluated by a least-cost planning methodology.[65]

2D.-Incremental Cost Analysis:[66] Another apparent derivative of cost-effective analysis, this relatively new technique tries to determine the additional cost which results from increasing levels of output measured on a physical, non-monetary basis.

3.—Economic Impact Analysis[67]
This analysis measures a policy's effect on regional or local sectors of an economic system.

3A.-Input-Output Analysis (I-O): Also known as productivity analysis, this model uses an input-output model that simulates the operation of an economic system using non-statistical parameters from actual historical industry data. The I-O models use an I-O transaction table that details particular industries sales to and purchases from other sectors within an economy. The I-O model results in multipliers that represent the ratio of the total impact (of the results of a change in output or demand of a basic industry) to the initial direct impact. Once derived from the model, multipliers can be used to estimate the impact of changes of certain factors (for example employment) within the economy.

The I-O approach requires extensive industry surveys, detailed analysis of financial statements, and on-going update surveys. Since it assumes proportionate and linear changes in production functions in response to changes to either input or output, it potentially ignores efficiency gains due to technological advances.

Examples of use: This approach is being used in transportation analysis, with aggregate data, in conjunction with cost or production models to estimate production gains which may result from transportation system investments. Maryland DOT has completed a research study using an I-O model to assess the impact of state highway programs on economic activity. An econometric model was used in this study to assess changes in operating business costs. The study involved the estimation of the economic impact on total economic activity; purchases of labor, goods and services; changes in business operating costs; and changes in business productivity growth.

[64] Rufolo, 1996.
[65] Durning, 2001.
[66] DeCorla-Souza, et. al., 1997.
[67] FHWA, 2001; Governor's Commission for a Sustainable South Florida, 1998; Weisbrod, 2001.

3B.-Statistical Econometric Forecast (EFC) Models: These models rely on the assumption that the past performance of a set of interrelated economic variables can be used to predict the future behavior of some of these variables. The simplest type of EFC model is the structural or cross-sectional type that is used to explain the "cause and effect" on a simple "affected" or "dependent" variable. The greatest strength of this type of model is the ability to describe within certain statistical probability limits the influences that each independent variable will have on the dependent variable. It can, therefore, be used to analyze complex relationships between various variables. This type of forecasting technique which analyzes the impact of independent variables on dependent variables is known as multiple regression analysis. Impact factors found from these regressions can then be used to estimate the expected future impact of infrastructure investment on growth in a particular region.

EFCs are useful for discerning long-term trends and integrating those trends into the forecast. This method relies heavily on accurate data which is often difficult to obtain. In addition, shortcomings in the methods employed by the data source agency in the compilation of the data can lead to inaccuracy in time series data that has to be assembled over an extended period of time. This is particularly true when the criteria used to aggregate or disaggregate data have changed over time, making it almost impossible to compare data from the two time periods.

Examples of use: EFS was employed in a study for I-73 highway proposed for Virginia, forecasted and evaluating changes in total economic activity based on capital expenditures on highways.

3C.-Macroeconomic Simulation Models: Macroeconomic models include I-O analysis as well as production functions and allow for the estimation of how transportation investments will impact various aspects of a regional economy over a specific time period. This type of analysis has also been performed using other statistically-based economic forecast simulation models. This method generally does not measure non-economic benefits and costs to society as a whole.

The model developed by Regional Economic Models, Inc. (REMI) is a computer simulation model that includes econometric forecast, I-O analysis, policy impact analysis, fiscal impact, and population change analysis functions. It has been widely used to forecast the effects of transportation investments. The REMI model is regional in scope and typically used to evaluate impacts at no smaller than the county level. The model tends to be highly localized or skewed in relationship to affected sectors of the economy because of its use for specific projects. It needs to be tailored to each location.

Regional Economic Impact or Fiscal Impact Analysis can be evaluated by computer programs using integrated simulation systems. The TELUS system is a computer model which estimates economic and tax impacts on local governments. TELUS was developed by a partnership consisting of the New Jersey Institute of Technology, Center for Urban Policy Research at Rutgers University, and Northern New Jersey Transportation Planning Authority. TELUS was developed to help metropolitan planning organizations evaluate impacts required under by the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA).

Examples of use: The REMI has been used to evaluate the impacts of freight projects in Portland, Oregon, and Columbus, Ohio. The studies evaluated the impacts on travel time, vehicle operating costs, and accident cost savings for truck traffic. REMI has also been used to compare impacts between transit and regional highway investment plans in New York City and Los Angeles.[68]

4.—System Efficiency (User Benefit) Analysis[69]

When using this method of analysis, performance measurement is the standard tool used to compare transportation investment projects. This approach allows administrators to compare actual system performance to stated goals and objectives, to find areas of operation that can be improved, and to help identify the most appropriate areas for resource allocation. System efficiency analysis measures transportation benefits of system improvements in monetary terms for travel expenses, travel time, and traveler safety. This approach can be executed using computer-based travel demand models. These models are used in long range transportation planning to forecast the likely impact of proposed decisions.

Examples of use: A study was recently concluded in Sacramento, California, by the University of California-Davis to assess impacts for the years 2005 and 2015 using a travel demand model as well as two transportation land use models. The study measured impacts on travel, emissions, user benefits, and the spatial distribution of population and employment. Performance measures are also used by the Florida DOT to compare system performance to stated goals in the transportation plan.

5.—Full Cost Accounting and Other All Inclusive Methods and Models[70]

5A.-Full Cost Accounting (FCA), aka Social Welfare and Full Cost Analysis:
The Governor's Commission for a Sustainable South Florida published *A Report on Full Cost Accounting* in December, 1998. This report was prepared in response to the need for better financial and other types of evaluations of programs and projects. The commission mentioned in its report that the term full cost accounting is also used to refer to corporate internal accounting and social accounting. The Commission also stated that these two evaluation techniques were not included in its definition of full cost accounting.

The FCA includes the following evaluations:

(A) Cost-Benefit Analysis
(B) Economic Impact Analysis
(C) Fiscal Impact Analysis
(D) Cost-Effectiveness Analysis

An important principle of full cost accounting is the idea of using as many tools as possible that are appropriate for the particular application.

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[68] FHWA, Impact Methodologies Toolbox.
[69] California DOT, 1998; Florida Statutes, 2000; Weisbrod, 2001.
[70] Florida Department of Environmental Protection, 2001; Florida's Growth Management Study Commission, 2001; Governor's Commission for a Sustainable South Florida, 1998; and Weisbrod, 2001.

Examples of use: The Governor's Commission for a Sustainable South Florida recommended that the South Florida Water Management District Governing Board consider applying FCA. The District Board, however, declined to do so. The National Park Service did produce a report entitled *Local Cost Analysis for Improvements and Services in the 8.5 Square Mile Area.* Beginning in 1948, negative environmental impacts were being caused by modifications made to Everglades National Park's (ENPs) hydrological system to facilitate increased agricultural production and urban growth in South Florida. As a result of these impacts, the United States Congress passed the ENP Restoration and Expansion Act in 1989 which called for modified water deliveries (MWD) to the Park to correct the environmental problems created by the previous policies. The restoration plan included a flood mitigation system to protect the "8.5 Square Mile Area" in the eastern section of the Everglades from the flooding which was expected to result from the MWD.

The SFWMD hired a consultant in 1996 to identify the best option from six land use alternatives to analyze water quality and hydrologic and cost analysis data of different schemes for the proposed flood control and maintenance system. Additional work by a second consultant was done in 1998 to calculate all additional costs for local governments to provide construction and services related to secondary drainage, future roads, and local services to the area, for the six different flood control alternative choices. A net present value analysis (NPV) was used to discount capital costs. Neither benefits nor social costs were analyzed by either consultant.[71]

5B.—Multi Criteria Analysis (MCA), AKA Multi Criteria Decision Analysis, (MCDA):[72] In its most basic form, this method includes a simple and easily understood performance matrix format. It incorporates quantitative and qualitative criteria which compare how well each of several options meets various stated objectives. The matrix table features rows describing the various options and columns showing how well each option performs for each stated criterion. The table also requires the scoring of the likely consequence of the individual option as well as the numerical weighting of each criterion. The assigned weight for each objective criterion (which reflects the importance of the criteria to the decision maker) is then multiplied by the numerical score or "weight" of the particular option. The results are then summed up to derive the total weighted points for that option.

This approach is particularly useful when some impacts are not easily expressed in financial terms. MCA may also be used when there is a mix of criteria with and without known monetary values. The approach is limited by its lack of precision and the likelihood of errors caused by double counting. Other problems with MCA include the fact that scoring and weighting of the factors within the matrix are determined subjectively by the analyst or decision maker. It is also very difficult to use the approach to compare different types of project options.

Examples of use: A study using MCA and CBA to evaluate expansion options at an airport in the southern section of the Netherlands was completed by the Department of Spatial Economics of The Free University at Amsterdam in 2001. A search of several different research data sources did not reveal any recent published case study which utilized MCA in a transportation-planning

[71] Governor's Commission for a Sustainable South Florida, 1998; Science Applications International Corp., 1998.
[72] Australia, 1999; Bond, 2002; Guitouni et. al., 1998; Keeney, 1996; Litman, 2001; United Kingdom, 2002; and Vreeker, 2002.

context in the United States. There are 29 well-known types of MCA methods which fit into four main categories; the simplest being the weighted sum method (also known as multiple account evaluations). Use of the MCA method of evaluation appears to be less frequent in the United States than in Europe, East Asia, and Australia.

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111 East Las Olas Boulevard,
Fort Lauderdale, Florida, 33301
Phone 954.762.5255 Fax 954.762.5666
Website *www.catanese.fau.edu*