

# **Summary Report: The Connection between Land Use and Transportation in Land Use Plans**

Prepared for:

**North Carolina Department of Transportation (NCDOT)**

By:

**Daniel A. Rodríguez, Ph.D. and David R. Godschalk, Ph.D**  
**The Department of City and Regional Planning**  
**University of North Carolina, Chapel Hill**

In collaboration with

**Richard K. Norton, Ph.D., J.D.**  
**Urban and Regional Planning Program**  
**The University of Michigan, Ann Arbor**

With the research assistance of  
**Semra Aytur**  
**The Department of Epidemiology**  
**University of North Carolina, Chapel Hill**

Report Summary  
Project 2003-16

## 1. Introduction

A recurrent challenge for conducting environmental impact assessments in the development process of a transportation project is the need to characterize and evaluate the potential for secondary and indirect impacts. This is especially important given the potential of transportation projects to induce new urban growth. Ideally, an assessment of the potential for secondary and cumulative land development impacts from a proposed transportation project within a given locality should build substantially on that locality's land use plan.

This report documents how local land use plans in North Carolina anticipate and account for transportation projects and how related land management tools are actually being used by county and municipal governments in North Carolina. In addition, the report interprets the findings based on existing evidence regarding desirable characteristics that land use plans should have. The premise of the study is that local development plans should address the reciprocal relationship between future land uses and future transportation infrastructure and transportation service needs in a given community.

## 2. Study Approach

The study was developed in two phases. In the first phase we conducted a comprehensive literature review on the connection between transportation and land use; we surveyed all counties and selected municipalities in North Carolina regarding the presence and characteristics of land use plans and adopted tools and policies to manage land development, especially as they relate to transportation factors; and we examined planned transportation investments for all communities in the State for the 2004-2010 time horizon.

In the second phase of the study we selected 30 local plans from communities that reported having land use plans in the first phase survey to

analyze the content of their plans. We also developed a legal primer that can be used by state and regional planners to understand the relationship and potential inconsistencies between land use or comprehensive plans and zoning ordinances (included as an appendix to the main report).

The literature review revealed principles that could assist planners in incorporating and accounting for connections between land use and transportation in land use plans (see Box 1). Application of these principles to land use plans guide towards a more effective and productive use of land use plans in managing growth and improving community outcomes. We evaluated our survey of planners and the content analysis of the plans in the light of these guiding principals.

## 3. Results

For the survey of planners, we received responses from 47 municipalities and 79 counties, for an overall response rate of 77%. We found that 98% of municipalities and 77% of counties reported having land use plans for managing land development. The majority of these plans were developed over the last 10 years, but some plans were developed as early as 1974 and have not been updated since then.

Both the survey and the content analysis suggest that planners are aware of the induced development caused by some transportation improvements. Furthermore, planners' attitudes reflected a belief that land use plans should embody the reciprocal relationship between transportation and land use. Although there is considerable awareness of the connection between land use and transportation, this connection is rarely visible in the analyses and policies of the land use plans. For example, few plans take into account all or most transportation improvements in the community and according to respondents almost a third of plans do not account for any improvements.

**Box 1. Summary of Fourteen Guiding Principles for Connecting Land Use and Transportation in Land Use Plans**

**Plan Presentation**

Guiding principle 1: Plans should contain clear and readable land use maps, conveying usable information without the need to read accompanying text.

Guiding principle 2: The time horizon of the plan determines the extent to which certain impacts, such as the land development impacts of planned transportation projects, are to be examined.

**Information Base and Content**

Guiding principle 3: Differences in the quality and availability of transportation services, transportation infrastructure, and in land uses should be clearly related to geographically identified areas.

Guiding principle 4: Travel demand and the supply of transportation infrastructure should be discussed in the plan.

Guiding principle 5: Plans should include assessments of transportation policies, such as minimum parking requirements, parking supply, and parking cost.

Guiding principle 6: The presentation of future land uses in a community should be accompanied by their differential impacts on travel demand and transportation infrastructure.

Guiding principle 7: Plans should consider the cost and feasibility of the extension of transportation services (bus) and infrastructure (sidewalks and roads). When appropriate, such costs should be provided as part of the plan or references to capital improvement

programs or transportation plans should be provided.

Guiding principle 8: Plans should examine the existing and proposed local, state, and federal transportation infrastructure investments.

Guiding principle 9: Plans should use various accessibility indicators to monitor the connection between transportation and land use, such as the % of population or jobs or retail within ¼ mile of transit, % of population/jobs/retail within a 20 minute walk/bike/drive, isochronal curves, or jobs/population ratios at various scales.

**Goals and policies**

Guiding principle 10: The plans should provide clearly articulated goals, including transportation goals achieved with land use policies and objectives, and land use goals achieved with transportation policies and objectives.

Guiding principle 11: The transportation and land use goals should be reasonably achievable with the policies suggested in the plan.

**Implementation**

Guiding principle 12: The plan should facilitate meaningful ongoing public participation and incorporate ongoing monitoring and implementation evaluation procedures, using indicators.

**Coordination and consistency**

Guiding principle 13: The community should use a common, consistent, and persuasive set of assumptions in its integration of future land uses with transportation plans. Most importantly, estimates of the demand for land should be based on the same population and economic

forecasts as the estimates used in the transportation plans.

Guiding principle 14: The plan should achieve internal consistency (between facts, goals, analyses, and policies), horizontal consistency (between the plan and plans of neighboring

jurisdictions), vertical consistency (between the locality and state and federal plans and

mandates), and consistency in implementation (between plan policies and implementation mechanisms such as land use regulations and building codes).

The detailed analysis of the plans confirmed this finding: Seldom do land use plans use land policies or objectives to achieve transportation outcomes, and only a handful of plans explicitly reference the reciprocal connection between transportation and land development.<sup>1</sup>

The vast majority of planners reported familiarity with the State Transportation Improvement Program (TIP) as it affected their jurisdictions, and most were “familiar” or “somewhat familiar” with where and when such improvements would take place. Thus, despite a) awareness of the importance of the reciprocal relationship between transportation and land use; and b) knowledge about programmed transportation improvements, the connection remains unaccounted for in a high percentage of land use plans. It appears that a potential role for NCDOT and other state agencies may be to provide technical assistance enabling localities to develop more transportation-aware land use plans. Such assistance may take the form of a community guide of best practices in land use planning, with respect to transportation.

---

<sup>1</sup> These policies include infrastructure investments to manage growth, recreational opportunities within walking or biking distance, development with direct non-motorized links to surrounding areas, commercial centers providing pedestrian amenities, employer and/or government-sponsored commute reduction programs, parking demand/supply management, transit-oriented developments, regular performance monitoring of transportation modes, local relationship to regional transportation network, use of renewable resources and transfer development rights..

### 3.1 Presence of transportation improvements in plan

We found that plans included far more non-motorized transportation modes than what planners reported in the survey. In fact, the content analysis suggested that plans that included non-motorized transportation elements were also more likely to discuss the environmental impacts of transportation projects, had higher consistency ratings, and were more likely to include transportation facilities in their land suitability analyses.

Likewise, we found that areas with significant non-motorized projects in the TIP seem to have a better integration of transportation and land use. The fact that metropolitan planning organizations (MPOs) tend to include more consideration of land use in transportation planning, may explain this association between non-motorized projects and land use-transportation integration. This finding supports the view that non-motorized modes are more scale dependent, and rely on supportive land uses to be viable. As such, when land use plans incorporate non-motorized modes, we detected a stronger connection between transportation and land use in the plan.

In contrast, plans that included predominantly motorized modes do not exhibit a strong land use-transportation connection. In fact, the presence of auto-related elements in the plan is associated with plans that were strong procedurally (i.e., generic plan quality, consistency in plan analysis and policy recommendations) but weak in terms of

substantive aspects of the connection between transportation and land use (i.e., goals and policies emphasized through the plans and plan implementation efforts). Of concern is that municipalities and counties with higher auto/road programmed TIP expenditures are significantly *less* likely to account for most or all land development impacts created by transportation projects. These results indicate that encouraging land planners to consider the development impacts of road improvements should be a priority.

### 3.2 Implementation of land use plans

The survey and content analysis indicate that the implementation of land use plans needs to be strengthened. Relevant aspects of plan implementation that need attention include:

- Development of land use indicators to monitor land use goals.
- Development of transportation-related indicators to quantify and monitor land use goals. None of the land use plans examined used basic indicators of accessibility, such as jobs-housing ratios, percent of population within reach of jobs centers, or percent of population within ¼ mile of transit. Although transportation plans commonly include some of these indicators, we suggest that land use plans should also include them.
- Joint presentation in the land use plan of the timing of the implementation of the land use plan and the timing of the planned transportation improvements in the TIP. This will encourage coordination and consistency.

The focus on implementation is important because plans that have better implementation programs, or that are used to guide policy decisions, are more likely to include multiple transportation modes.

Finally, we found that community planners that interact more frequently with their metropolitan planning organizations or their rural planning

organizations appear to be more aware of current transportation conditions, including the need for non-motorized modes, and their plans reflect better use of measurable indicators to monitor transportation issues. In contrast, however, plans from respondents indicating frequent or periodic interaction with NCDOT are actually *less* likely to include non-motorized modes compared to those with infrequent interaction with NCDOT. Frequent interaction with NCDOT provides a natural opportunity to educate local planners about the benefits of accounting for the development impacts of transportation projects and of a land use system that supports multimodal transportation options.

Taken together, these findings suggest that transportation and land use planning are not as coordinated as they could or should be. The absence of this connection in land use planning limits the ability of community planners to anticipate growth from transportation investments. Moreover, the lack of integration between transportation and land use also means that the assessment of indirect and cumulative impacts can build on local land use plans, but cannot rely solely on them. Further reliance on land use plans requires that they incorporate the development impacts of transportation projects in a more systematic fashion.

## 4. Recommendations

In light of these findings, the report provides specific recommendations to NCDOT. These include:

- Working with the Division of Community Assistance (DCA) and other State agencies to provide technical assistance that enables localities to develop more transportation-aware land use plans. Such assistance may take the form of a community guide of best practices in land use planning, with respect to transportation, following the guidelines developed in this report.

- Working with DCA, develop brief best-practice reports highlighting the use of various indicators at different levels of aggregation and under different growth conditions. Such reports could become a key reference when land use planners are revising or updating their local plans.
- Working with DCA, encourage comprehensiveness in land use planning. This involves not only involving other transportation modes, but including water, sewer, and other infrastructure and environmentally-related characteristics of a community that may be related to how and where the community wants to grow. This comprehensiveness can also aid in increasing the acceptance of the plan.
- Creation of institutional mechanisms that enable DCA, NCDOT planners, MPOs and Rural Planning Organizations (RPOs) to reach out to local land use planners to increase collaboration among parties and improve planning outcomes. This joint collaboration can increase the quality and effectiveness of the land use plans.

This study has answered initial questions regarding the strength of the land use-transportation connection in land use plans in North Carolina. Our focus on land use plans suggests that a similar study focusing on how land use elements are incorporated into transportation plans is warranted. This will help address questions such as: How is land use considered in transportation plans? Are land use plans considered when making local and regional transportation plans? How can such connections be strengthened? Related to this study is a recommendation to develop a community guide highlighting how attention to land use plans can help transportation planners. Although this study focused on land use plans, we believe that transportation plans, the other side of the land-use transportation connection, should also be emphasized.