



FINAL REPORT

Project E

September 2021

The Challenges of Predicting Travel Behavior Based on Estimating Trip Generation: Local Traffic Impact Assessment in Four Southeastern & Mid-Atlantic States

Dr. Ruth Steiner | University of Florida

Dr. Noreen McDonald | University of North Carolina at Chapel Hill

Dr. Tabitha Combs | University of North Carolina at Chapel Hill

William Leimenstoll | University of North Carolina at Chapel Hill

Xinyuan "Poppy" Yang | University of Florida

Andre Soucy | University of Florida

TECHNICAL REPORT DOCUMENTATION PAGE

1. Report No. Project E		2. Government Accession No.		3. Recipient's Catalog No.	
4. Title and Subtitle The Challenges of Predicting Travel Behavior Based on Estimating Trip Generation: Local Traffic Impact Assessment in Four Southeastern and Mid-Atlantic States <i>(Original title: Predicting Congestion: The Challenge of Shifting Travel Behavior on Estimating Trip Generation, Traffic and Other System Impacts)</i>				5. Report Date 9/10/2021	
				6. Performing Organization Code	
7. Author(s) Dr. Ruth Steiner, University of Florida Dr. Noreen McDonald, UNC Chapel Hill Dr. Tabitha Combs, UNC Chapel Hill Graduate Research Assistants: William Leimenstoll, UNC Chapel Hill; Xinyuan "Poppy" Yang, University of Florida; Andre Soucy, University of Florida				8. Performing Organization Report No. STRIDE Project E	
9. Performing Organization Name and Address University of North Carolina at Chapel Hill, New East Building, CB 3140, Chapel Hill, NC 27599-3140 University of Florida, Architecture Building, 1480 Inner Road, Gainesville, FL 32611				10. Work Unit No.	
				11. Contract or Grant No. Funding Agreement Number 69A3551747104	
12. Sponsoring Agency Name and Address University of Florida Transportation Institute Southeastern Transportation Research, Innovation, Development and Education Center (STRIDE) 365 Weil Hall, P.O. Box 116580 Gainesville, FL 32611 U.S Department of Transportation/Office of Research, Development & Tech 1200 New Jersey Avenue, SE Washington, DC 20590 United States				13. Type of Report and Period Covered 5/15/2017 to 9/10/2021	
				14. Sponsoring Agency Code	
15. Supplementary Notes					
16. Abstract In recent years, transportation professionals have become increasingly aware that transportation planning and engineering practices need to be matched to the context in which they occur and the population they serve. Communities, primarily urban ones, have struggled with how to measure traffic impacts of development in dense, mixed-use communities where residents can walk, bicycle, and use transit to get to destinations. Conventional traffic impact assessments are often based upon the Institute for Transportation Engineers (ITE) <i>Trip Generation Handbook</i> , which many argue is based upon auto-oriented suburban development. In 2017, ITE issued a position paper describing the purpose and need for a new recommended practice (RP) (<i>Draft Update to Recommended Practice</i>), which proposed a Multimodal Transportation Impact Assessment for Site Development, which would shift the emphasis from traffic (i.e., impact on highways) to transportation impact assessment. This project explores the implementation of traffic impact assessment (TIA) in urban communities throughout the Southeastern and Mid-Atlantic States. We conducted a literature and practice review of state and regional policies for transportation impact assessment to understand the framework within which local governments operate with respect to the preparation of TIA. Interviews with 93 cities and counties in four states – North Carolina, Virginia, Maryland, and Florida – were conducted to understand how cities and counties use innovative methods to conduct TIA. We learned that state regulations vary significantly across these states, and regional agencies have a limited role in traffic impact assessment. Local governments use a variety of innovations, including waivers and variances based on the characteristics of the development, requirements to accommodate non-auto modes, ad hoc modifications to project design, and adjusting the level of service measurements. This research can inform local governments about the options they have to modify transportation impact assessments to make them multimodal and context sensitive.					
17. Key Words Transportation impact assessment, multimodal planning			18. Distribution Statement No restrictions		
19. Security Classif. (of this report) N/A		20. Security Classif. (of this page) N/A		21. No. of Pages 46 Pages	22. Price N/A

DISCLAIMER

The contents of this report reflect the views of the authors, who are responsible for the facts and the accuracy of the information presented herein. This document is disseminated in the interest of information exchange. The report is funded, partially or entirely, by a grant from the U.S. Department of Transportation's University Transportation Centers Program. However, the U.S. Government assumes no liability for the contents or use thereof.

ACKNOWLEDGEMENT OF SPONSORSHIP AND STAKEHOLDERS

This work was sponsored by a grant from the Southeastern Transportation Research, Innovation, Development, and Education Center (STRIDE), a Regional University Transportation Center sponsored by a grant from the U.S. Department of Transportation's University Transportation Centers Program. The research team wishes to thank the planners in communities throughout the states of Florida, Maryland, North Carolina, and Virginia who took the time to speak to us about how traffic impact assessment is completed in their community, and the barriers and challenges they face in completing it.

NOTE: This project was funded under the original title of: "Predicting Congestion: The Challenge of Shifting Travel Behavior on Estimating Trip Generation, Traffic and Other System Impacts."

Funding Agreement Number - 69A3551747104

LIST OF AUTHORS

Lead PI:

Ruth L. Steiner, Ph.D.

University of Florida

rsteiner@dcp.ufl.edu

ORCID 0000-0001-7276-3742

Co-PI:

Noreen McDonald, Ph.D.

University of North Carolina at Chapel Hill

noreen@unc.edu

ORCID 0000-0002-4854-7035

Tabitha Combs, Ph.D.

University of North Carolina at Chapel Hill

tacombs@live.unc.edu

ORCID 0000-0002-0362-7015

William Leimenstoll

University of North Carolina

Xinyuan "Poppy" Yang

poppyyang@ufl.edu

University of Florida

Andre Soucy

andre.soucy@ufl.edu

University of Florida

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ABSTRACT

In recent years, transportation professionals have become increasingly aware that transportation planning and engineering practices need to be matched to the context in which they occur and the population they serve. Communities, primarily urban ones, have struggled with how to measure traffic impacts of development in dense, mixed-use communities where residents can walk, bicycle, and use transit to get to destinations. Conventional traffic impact assessments are often based upon the Institute for Transportation Engineers (ITE) *Trip Generation Handbook*, which many argue is based upon auto-oriented suburban development. In 2017, ITE issued a position paper describing the purpose and need for a new recommended practice (RP) (*Draft Update to Recommended Practice*), which proposed a Multimodal Transportation Impact Assessment for Site Development, which would shift the emphasis from traffic (i.e., impact on highways) to transportation impact assessment.

This project explores the implementation of traffic impact assessment (TIA) in urban communities throughout the Southeastern and Mid-Atlantic States. We conducted a literature and practice review of state and regional policies for transportation impact assessment to understand the framework within which local governments operate with respect to the preparation of TIA. Interviews with 93 cities and counties in four states – North Carolina, Virginia, Maryland, and Florida – were conducted to understand how cities and counties use innovative methods to conduct TIA. We learned that state regulations vary significantly across these states, and regional agencies have a limited role in traffic impact assessment. Local governments use a variety of innovations, including waivers and variances based on the characteristics of the development, requirements to accommodate non-auto modes, ad hoc modifications to project design, and adjusting the level of service measurements. This research can inform local governments about the options they have to modify transportation impact assessments to make them multimodal and context sensitive.

Keywords:

Transportation Impact Assessment, multimodal planning

EXECUTIVE SUMMARY

Purpose and Findings of the Research

Recently, transportation planning professionals have become aware of the need for transportation planning and engineering practices to be matched to the context and population in a geographic area. Communities, primarily urban ones, have struggled with conventional traffic impact assessment, which is thought to encourage single-use development in peripheral areas over infill and redevelopment projects. Research suggests that conventional traffic impact assessment does not reflect contemporary urban development, which includes substantial demand for non-automobile travel, and it overestimates traffic impacts in dense, mixed-use urban environments, leading to higher costs required to mitigate the transportation impacts. In this research, we explore how state and regional governments develop a framework for local government traffic impact assessment (TIA) and we interviewed 93 local planners in four states with large urban areas – North Carolina, Florida, Maryland and Virginia – to understand how the innovations developed by local cities and counties have modified conventional traffic impact assessment to make it more multimodal and context sensitive.

The states have different regulations for land development and transportation planning, and various regulations related to their guidance for traffic impact assessment. We present an overview of state regulation of land development and transportation for all four states to place local traffic impact assessment into a broader context. Although local governments within regions appear to apply TIA in diverse manners, we learned that regional transportation agencies play a limited role in determining how local governments complete traffic impact assessments.

The analysis at the local level is completed separately for the state of Florida, while the other three states are analyzed together. Florida is analyzed separately because of its history of implementing transportation concurrency under its 1985 Growth Management Act, which evolved to include options for multimodal transportation planning at the local level. For the other three states, we identify three categories of TIA – never adopters, conventional municipalities, and innovators. The never adopters either have no formal TIA policy, or they do not require TIA except when required by or in accordance with state Department of Transportation (DOT) policies. Municipalities that use conventional approaches either follow state DOT or other conventional TIA practices, and most adopt a few innovations that generally represent minor deviations from these conventional approaches. The innovators use a variety of TIA practices that can be grouped into the following categories: leading, aspiring, following, or lagging. Innovations include prioritization of non-car modes of transportation, and/or development patterns that are intended to increase urban densities and to enhance walkability and livability. All local governments in Florida use some form of innovative practice, but these practices could be grouped into three categories based upon their attitude towards growth – development oriented, mixed oriented, and multimodal emphasis.

This research provides a more nuanced understanding of how local governments innovate when completing traffic impact assessment. At the same time, the study includes a relatively small sample of communities. As such, it is difficult to understand the prevalence of the use of innovative multimodal and context-sensitive transportation impact assessments. Additional research is needed in several areas, including: (1) the connection by local experts to the ITE efforts to create multimodal traffic impact assessment; (2) research to understand how transportation impacts are measured in innovative communities in an attempt to standardize the methods designed to understand TIA; and (3) the connection between local TIA and the state and federal regulatory environment, including planning laws, environmental impact statements, global climate change, and federal regulations on the coordination of land use and transportation for air quality improvement under conformity and transit-oriented development (TOD) ordinances. In addition, this research identifies a need for additional training of professionals on options for more multimodal, context-sensitive TIA.

1.0 INTRODUCTION

In recent years, transportation professionals have become increasingly aware that transportation planning and engineering practices need to be matched to the context in which they occur and for the population that they serve. Whether determining trips generated by new construction, ensuring site plans adequately provide for transport needs, or assessing how development impacts the transport network, there is increasing recognition that there is no one answer. Communities, primarily urban ones, have struggled with conventional traffic impact assessment (cTIA)¹, which is based upon the Institute of Traffic Engineers (ITE) Trip Generation Handbook (ITE, 2020). It is thought to encourage single-use development in suburban and peripheral areas, where existing surplus traffic capacity minimizes the need for mitigation, over infill projects (Steiner, 1998; ITE, 2017). Furthermore, many argue that ITE trip generation estimates are based upon an auto-oriented suburban development and don't reflect the contemporary urban development, which has a substantial demand for non-automobile travel modes (Currans, 2013; Clifton, Currans & Muhs, 2012; Steiner, 1998; Schneider, Shafizadeh & Handy, 2013). Finally, research suggests that cTIA overestimates the traffic impacts of development in dense, mixed-use urban communities, which leads to higher costs for infill and redevelopment, and an oversupply of roadway capacity that detracts from the urban fabric, and undermines efforts to improve community livability (Steiner, 2007; Currans, 2017).

In 2017, the ITE issued a position paper describing the need for an update to including a Multimodal Transportation Impact Assessment for Site Development. These recommended practices signal a shift from the focus on traffic impact (i.e., only highways) to transportation impact (i.e., all modes of travel). The ITE (2017) cites several motivations for this update to recommended practice including: (1) the shift in many urban communities from predominantly greenfield (suburban and exurban) development to infill and redevelopment, due to both market forces and growth management policies – largely related to fiscal costs of growth outward from the center and transportation and other community investments; (2) an increasing understanding of differences in travel behavior across a variety of land use types and contexts, from urban to rural; (3) interest in measures of effectiveness beyond traditional automobile levels of service (LOS) developed at the federal, state, and local levels; and (4) recognition that traditional LOS measures based on roadway capacity thresholds often result in a “free rider” problem or “last-in” concerns that affect equity and predictability of the

¹ It is important to note that the terms “traffic impact assessment” and “transportation impact assessment” reflect the changing perspectives on how to address multimodal impacts associated with new development in urban areas. Traffic impact assessment (TIA) has developed over the past few decades as a method to understand “suburban, single-use, vehicle-oriented development with unconstrained parking” (Currans, 2017: 335) while transportation impact assessment can be seen as the “estimate of multimodal impacts at new developments in urban areas” (Currans, 2017: 335). This research began with a goal to examine conventional traffic impact assessment (cTIA). Ultimately, it documents efforts by communities to work towards transportation impact assessment.

calculation of transportation system impact fees and other exactions (ITE, 2017). The move to Multimodal Transportation Impact Assessment is intended to provide more context-sensitive solutions that allow a community to more closely align its transportation and land use system with the vision of the community (ITE, 2017).

The focus of this project is to better understand the implementation of TIA as applied in mixed-use environments that often support travel by multiple modes. These neighborhoods are referred to in diverse ways, including transit-oriented development (TOD), traditional neighborhood development (TND), neo-traditional design (NTD), and New Urbanism. While these terms have subtle differences, in general these forms of development are characterized by high density, a mix of land uses, a connected street pattern, and frequent transit service. Evaluations of travel in these types of areas have shown lower automobile trip generation, more trips by non-automobile modes and shorter trips than might be predicted using traditional planning techniques (Ewing and Cervero, 2010; Clifton, Currans, & Muhs, 2012; Schneider, Shafizadeh, & Handy, 2013). Major national studies have confirmed these results in many contexts. The challenge is to define where the reductions in impact are warranted based upon local conditions. For example, the National Cooperative Highway Research Program (NCHRP) and the Transit Cooperative Research Program (TCRP) have sponsored several projects to address concerns about the accuracy of trip generation calculations, including adjustments for mixed-use (internal capture) (Bochner, Hooper, Sperry & Dunphy, 2011), urban infill (Daisa, Schmitt, Reinhofer, Hooper, Bochner & Schwartz 2013), and TOD (Arrington & Cervero, 2008). Collectively, these reports have been used to enhance the methods recommended in the ITE Trip Generation Manual (2020).

This is an important topic to explore in the Southeast for several reasons. First, after the Great Recession, millennials and empty nesters moved into urban locations and demanded walkable neighborhoods, ridesharing, and transit services to support their lifestyles (Kolko, 2020; Frey, 2018; Maciag, 2015). Second, trip generation rates are used to calculate the required parking and amount of money that developers are required to pay to mitigate the impacts of development. If the traffic impact is overestimated, disincentives will be created for redevelopment in TND neighborhoods. Third, the Southeast lags the rest of the country in the supply and demand for transit. However, the increase in demand for TNDs is creating challenges for neighborhoods that are designed for transit and walking, yet do not have adequate transit services to support these modes.

Changes to the Highway Capacity Manual and the ITE Trip Generation Manual and Parking Manual are part of a national effort to develop multimodal measures for transportation planning at the planning and implementation level. There have been extensive efforts to improve practitioner tools, but little evaluation has assessed how these tools have influenced practice. The current study fills this gap by assessing current practice around traffic impact analysis and site design in the southeastern United States (focusing on the processes and tools used to estimate trip generation).

1.1 OBJECTIVE

The main objective of this research is to understand current practice and the extent to which new tools and guidelines around traffic impact and site design have impacted practice throughout the United States and, in particular, in the Southeastern United States. Sub-objectives in the research include understanding best practices in planning for all modes of travel, understanding practices in state policies and guidance in southeastern states, and understanding how these practices are used in a sample of diverse urban communities throughout the southeastern United States.

1.2 SCOPE

The literature review covers recent work throughout the United States. The state and regional policy framework are considered in the national context, while the analysis of national implementation focuses on two Southeastern states – North Carolina and Florida – and two nearby states – Virginia and Maryland. The project addresses the implementation within both the state and local context for these states by attempting to understand the state context with respect to state environmental policy acts, statewide growth management, and state Department of Transportation guidance for TIA. At the local level, we attempt to understand the following: (1) the adoption of guidelines and practices using a survey of non-rural jurisdictions in the southeastern United States; and (2) the key barriers and facilitators for adoption of new practice. We compared the results from North Carolina and Florida to Maryland and Virginia. Based upon this analysis, we can make recommendations about how jurisdictions can better predict travel behavior and develop road and parking capacities to more accurately match expected demand.

2.0 LITERATURE REVIEW

Several studies suggest that the method included in the ITE Trip Generation Handbook are not sensitive to the built environment, and over-estimate the traffic impact of developments. As a result, this causes more vehicle-focused designs that exclude other modes of travel (Schneider et al., 2013; Clifton et al., 2012). In their study, Cervero and Arrington (2008) point out that, on average, the residential vehicle trips in TOD neighborhoods are 44% fewer than what has been generated by the ITE manual. The actual rate reaches 50% in some cases. A study of two comparable neighborhoods in the Research Triangle area of North Carolina concluded that “single-family households in the neo-traditional development make a similar number of total trips, but significantly fewer automobile trips and fewer external trips, and they travel fewer miles, than households in the conventional neighborhood, even after controlling for demographic characteristics of the households and for resident self-selection” (Khattak & Rodriguez, 2005; p. 481). In essence, these trip generation rates have a suburban bias, where the rates are derived from low-density land uses with plentiful parking (Kimley-Horn & Associates, Inc., 2009). In terms of the trip reduction factors, or internal capture rates, these figures were developed based on a few mixed-use projects in Florida with few observations of development patterns, such as complete street, TND, TOD and infill (Arrington & Cervero, 2008).

After NCHRP 8-51 was completed in 2011, a report was published on how to estimate internal capture rates based on site conditions and local context. Common features of sites with the highest internal capture rates include balanced and mixed land use, high density, and great connectivity. Evidence suggests the impact of the development patterns on traffic. In her study entitled “Improving Vehicle Trip Generation Estimations for Urban Contexts: A Method Using Household Travel Surveys to Adjust ITE Trip Generation Rates,” Currans (2013) summarizes the built environment factors that are essential for reduced vehicle travel, including “residential density, proximity to employment, pedestrian access, land use mixing, parking costs at the site, transit service frequency, and trip purpose” (p. 29). The study sums up these factors into “the Ds of development” and “area types” (Currans, 2013).

In a more recent research study, Currans (2017) completed a literature review on urban trip generation methods for transportation impact estimation based on land use development. Our intention is not to replicate that literature review. We use it, however, to develop categories to understand the various approaches to transportation impact assessment. Currans (2017) identifies thirteen methods used to predict urban vehicle trip generation impacts: (1) urban context adjustments; (2) smart growth trip generation adjustments; (3) household travel survey urban context adjustments; (4) NCHRP Report 758 urban infill adjustments; (5) NCHRP Report 684 Multiuse method; (6) US Environmental Protection Agency (USEPA) mixed-use (MXD) methods; (7) MXD+; (8) TCRP Report 128; (9) Urban Emissions Model (URBEMIS); (10) CalEEMod; (11) San Francisco Traffic Impact Guidelines; (12) New York City (NYC) Transportation Guidelines; and (13) Washington DC Department of Transportation Guidelines.

She then describes the weaknesses of these methods when estimating person trips instead of vehicle trips, because only three of the areas – the guidance developed in San Francisco, New York, and Washington DC – directly estimate person trips. Most of the methods are adjustments to the suburban, vehicle-oriented data and methods. In theory, the ITE trip generation rates should be adjusted for non-vehicular mode share and vehicle occupancy, the demographics of the population, the aggregation of land use categories, built environment and multimodal travel, and mixed-use and multiuse of development sites (Currans, 2017).

The trip generation rates might be over-estimated because they exclude non-motorized travel, but the Highway Capacity Manual (HCM) for both 2000 and 2010 acknowledge the need to include estimation as well as the LOS thresholds for both motorized and non-motorized modes of urban and suburban arterial highways (TRB, 2010). However, a key issue raised by Kastenhofer (2014) and Dowling et al. (2008) is that the same conditions are perceived differently with distinctive LOS among regions; accordingly, the threshold and practice should vary by local context. In addition, the current method mainly focuses on the needs of transportation professionals rather than the satisfaction of service users. The single-outcome metric is too simplistic to capture the perceptions of diverse users, e.g., cyclists and pedestrians (Brozen et al., 2014). As such, this research seeks to understand regional differences by exploring the extent to which practitioners in the Southeastern United States are using adjustments to traditional ITE trip generation methods to understand the transportation impacts of urban development.

3.0 METHODOLOGY or TASK(s)

Task 1: Literature and Practice Review

The project team conducted a comprehensive review of literature related to multimodal transportation planning and planning for diverse contexts and populations. The literature review began with many of the studies identified above (e.g., Kimley-Horn & Associates, Inc., 2009; Bochner, Hooper, Sperry, & Dunphy, 2011; Arrington & Cervero, 2008; Khattak & Rodriguez, 2005) and other related documents used to understand the connections between these practices with the underlying policies that motivate changes to multimodal planning and context-sensitive planning. The literature and practice review were used to identify states, regions and cities that are on the leading edge in implementing policies and practices, and to develop categories of policies and practices that take place at the state, regional, and local level.

Task 2: Review of State Policies and Plans in the Southeastern United States

The project team used the categories developed in the Literature and Practice Review to evaluate statutes, policies, guidelines and other procedures that determine the framework within which metropolitan planning organizations (MPOs) and local governments operate with respect to the preparation of site impact assessment. Other policies that support multimodal and context-specific transportation planning were also reviewed. We examined the state regulatory framework as it has evolved, and we considered a variety of methods through which TIA might be facilitated, constrained, or otherwise affect how TIA is completed in a given state. In particular, we examined three aspects of state regulations to understand their connection to local TIA – the so-called, mini-NEPA² (National Environmental Policy Act), statewide growth management laws, and the department of transportation websites – to determine which state, if any, included TIA in their regulations and what they required of local governments as a part of TIA.

Task 3: Regional Policies and Planning Practice

Although the research team had intended to complete a review of regional policies and practices, after the literature and practice review, we concluded that the regional transportation agencies played a limited role in the development and implementation of transportation impact assessment. As such, the original Task 3 – regional policies and planning practice – was removed from the project.

² The National Environmental Policy Act (NEPA) is a federal law that requires all federal agencies to complete an environmental assessment of projects and an environmental impact statement for all major agency actions that could significantly impact the environment. Mini-NEPA refers to state environmental policy act regulations that proposed state government actions be evaluated for their impacts on the environment.

Task 4: Local Policies and Practices in Southeastern Cities

Using the information gathered in Tasks 1 and 2, the research team prepared and administered an interview to a sample of cities in four states – North Carolina, Virginia, Maryland, and Florida – to understand how cities and counties are using innovative methodologies to complete transportation impact assessments and other related transportation planning activities. We contacted staff involved with the development review process in 63 cities and counties in North Carolina, Virginia, and Maryland. Staff in 36 of these communities agreed to participate in 20–40-minute structured interviews about their municipality’s current TIA policies and practices, as well as motivations for, enablers of, and obstacles to innovation in estimating and mitigating the traffic impacts of private development. Interviews were audio-recorded, transcribed, and imported into Atlas.ti 8.2 for analysis. In the state of Florida, we contacted 30 communities and completed 18 interviews (17 municipalities and one county) using the same methodology as the interviews in the other three states. The interviews were approved by the Institutional Review Board at each university and respondents were told their identity would not be revealed as a part of the informed consent for the interview.

Our research design was guided by the grounded theory approach to qualitative research, as described by Corbin and Strauss (1990). We used generalized inductive content analysis to uncover themes in the interview transcripts related to our research question, using an iterative process of directed and conventional coding. The major themes uncovered through this process are summarized below.

Task 5: Develop Recommendations

In the previous steps, case studies were developed at the state and local level to understand innovative transportation planning practices throughout the United States. Based upon the results of the interviews, recommendations are made for additional research, technology transfer and workforce development to ensure that transportation professionals in the Southeast can take advantage of these innovations.

4.0 RESULTS

This research began with an assumption that the planning environment of state and regional agencies strongly influenced how the TIA is completed at the local level. When we began this project, we assumed that state and regional agencies were involved in local activities related to TIA. Our research quickly identified two issues associated with this assumption: (1) the determination of transportation impacts associated with development is completed at the time of land development; and (2) land use and development decisions are largely controlled at the local level (Barrella, Ameidzi, Meyer & Ross, 2010). We quickly concluded that the states, who organize impact assessment reviews differently, may have a role in TIA. However, regional agencies, primarily MPOs, take a limited role in TIA.

We examined the state regulatory framework with respect to various methods through which TIA might be facilitated, constrained, or otherwise affected as they are completed in various states. First, we examined the so-called mini-NEPA (National Environmental Policy Act), to determine which state, if any, included TIA in their regulations. According to the Council on Environmental Quality (CEQ), which collaborates with states over the environmental review process, a total of sixteen states, plus Puerto Rico and Washington, D.C., review state government actions for their potential impact on the environment (CEQ, n.d.; Ballotpedia, n.d.). Two of these states – North Carolina and Georgia – are in the Southeastern United States and two other nearby states – Virginia and Maryland – also have a mini-NEPA. Only five states, California, Georgia, Minnesota, New York and Washington – require environmental review for local government actions and projects (Ballotpedia, n. d.), and only three states – California, Minnesota, and New York – require review for private actions and projects (Ballotpedia, n. d.). A closer review of states that review local actions and projects, as well as private actions and projects, shows that only three mini-NEPAs appeared to measure traffic impacts as a part of their environmental review process. These mini-NEPAs include the California Environmental Quality Act (CEQA) (AEP, 2019), New York’s State Environmental Quality Review Act (SEQR) (NYSDEC, 2019a; NYSDEC, 2019 b), and Washington State’s State Environmental Policy Act (SEPA) (WSDOE, n. d.).

Next, we examined statewide growth management regulations. We quickly learned that state regulation of land use varies significantly from one state to another. One-third of states address land use coordination at the state level, and the “states with smart growth legislation or comprehensive planning requirements are better able to plan for land use impacts and respond to changes in land use” (Barrella et al., 2010: 14). As described below, we learned that each state has a variety of land use regulations and requirements that cover how they address environmental impacts. Each state varies in what they require local governments to do as a part of developing plans and assessing the impacts of land development, which is generally handled at the local level. Under limited circumstances, regional agencies have been asked to address some aspects of transportation investments with land use decisions (Yarne,

2000; Sciara, 2017). A simple example of such regulation is California’s use of the Air Resources Board to encourage changes in regional land use patterns to reduce greenhouse gas emissions. Even then local governments voluntarily agree to comply with the regional transportation plan (Yarne 2000; Sciara, 2017; Allred & Chakrobarty, 2015). To keep a manageable scope for this research project, we present the results of the four states for which we interviewed local governments as a part of this project.

4.1 Statewide Planning Efforts

In this section we summarize the features of the statewide planning context for the four states where we conducted interviews with local planners about TIA practices. This section is intended to provide a context for understanding the practice of statewide planning as it relates to land development and transportation planning.

4.1.1 Land Use and Transportation Planning in North Carolina

4.1.1.1 North Carolina – State Planning

In North Carolina, under the Land Policy Act, the Land Policy Council enacts the State Land Policy that identifies “principles, guidelines and methods regarding specific land-use and management problems” (General Statute 113A-151,155). The State delegates authority for developing local plans to local governments (General Statute 153A-321; 160A-361). While all zoning is regulated to be in accord with a comprehensive plan (General Statute 160A-383), a separate comprehensive plan is not required from a comprehensive zoning ordinance, according to the court’s decisions (Allred v. City of Raleigh, 173 S.E. 2d 533, 536 (1970), rev’d on other grounds, 178 S.E.2d 432 (1971)). In accordance with the state’s effort to modernize and reorganize the framework of their enabling statutes for planning and development regulations, North Carolina introduced the new chapter 160D to its General Statutes, which consolidates current city- and county-enabling statutes for development regulations under Chapters 153A and 160A. General Statute 160D-5-1(a) requires counties and cities to adopt a comprehensive plan, in order to exercise the authority to adopt zoning regulations. For counties and cities that have zoning regulations, but have not adopted a comprehensive plan, an up-to-date comprehensive or land use plan is required by July 1, 2022, in order to retain their authority to have a zoning ordinance (Lovelady & Owens, 2019).

Also, in North Carolina, the Coastal Area Management Act (CAMA) requires coastal counties to have a local land use plan. The Coastal Resources Commission (CRC) certifies the local land use plan, and the Division of Coastal Management makes CAMA permit and federal consistency determinations based on that plan (North Carolina Department of Environmental Quality, 2020). The CRC guidelines mainly address issues related to environmental hazards and natural resources.

4.1.1.2 North Carolina – Transportation Planning

In terms of transportation planning and development, North Carolina’s state to local governance and planning is rather structured, with the State’s Department of Transportation

drawing clear connections from regional organizations down to local organizations, providing clear oversight, services, and funding.

Referring to the North Carolina Department of Transportation's (NCDOT) Connect NCDOT site, there are several areas where the state's DOT is collaborating with, providing funding for, or advising regional, local, and private organizations. The major avenues of this activity are the Statewide Pedestrian & Bicycle Plan; the Planning Grant Initiative; Regional Bicycle Plans; Municipal Bicycle and/or Pedestrian Plans; and Consultant Participation.

According to NCDOT, a Statewide Bicycle & Pedestrian Plan was developed with a vision for the future of bicycling and walking in North Carolina. Important tasks included reviewing the status of bicycling and walking in the state, researching appropriate strategies for improvement, and identifying the most efficient ways to apply those strategies.

The NCDOT Division of Bicycle and Pedestrian Transportation (DBPT) and the Transportation Planning Branch created an annual matching grant program, called the Bicycle and Pedestrian Planning Grant Initiative, which aims to encourage municipalities to develop comprehensive bicycle plans and pedestrian plans. The program was initiated in January 2004 and is currently administered through NCDOT-DBPT. Since 2004, 193 planning grants have been awarded. To date, a total of approximately \$5.5 million has been allocated to 190 municipalities and three counties through the program.

NCDOT's Bicycle and Pedestrian Division provides funding and technical assistance to develop comprehensive regional bicycle plans. The plans may focus on both on-road and off-road bicycle connections between origins and destinations, such as municipal jurisdictions, recreational resources, and other points of interest, within a defined multi-county region. These connections identified improvements primarily to existing roadways, but they may potentially locate preferred alignments through public lands or new developments for greenways and rail trails. The plans are typically developed over a two-year period and are guided by a broad group of stakeholders. Participants commonly include municipal representatives, NCDOT, regional planning entities, state parks, bicycling groups, business interests, and other special groups.

The DBPT is holding open enrollment for all consultants with experience in multi-modal transportation planning, with an emphasis on comprehensive bicycle and pedestrian planning. NCDOT takes applications from private firms, then forms a list of qualified firms available to carry out bicycle and pedestrian planning responsibilities. The list is provided as a resource to those communities that have received Bicycle and Pedestrian Planning Grants and are looking for assistance in preparing their plans.

Overall, NCDOT plays a significant role in facilitating effective planning down to the local level, providing extensive data and resources for regional and local government organizations to take

advantage of during the planning process. In many ways, NCDOT's programs encourage and guide planning across the state.

North Carolina's Rural Transportation Planning Organizations (RPOs) were established by the North Carolina Senate Bill 1195. Most or all RPO sites list responsibilities as developed via state statutes. According to General Statute 136-212, "The duties of a Rural Transportation Planning Organization shall include, but not be limited to: Developing, in cooperation with the Department [of Transportation], long-range local and regional multimodal transportation plans; providing a forum for public participation in the transportation planning process; developing and prioritizing suggestions for transportation projects the organization believes should be included in the State's Transportation Improvement Program; providing transportation-related information to local governments and other interested organizations and persons." Each RPO has a transportation advisory committee (TAC) and a technical coordinating committee (TCC) as its main functioning units. The TAC is generally responsible for fulfilling actual projects, plans, and programs. TCCs are generally responsible for oversight and guidance of TAC functions. RPOs generally link rural counties and municipal governments to NCDOT and federal entities for long-range transportation planning.

North Carolina General Statutes 160-77.1 through 160-77.6 establish and outline the functions of Regional Councils or Councils of Government (COGs). Based on the information available across individual North Carolina COG sites, COGs are the broadest regional organizations below the state government and above MPOs and RPOs. COGs usually contain multiple MPOs and/or RPOs within their jurisdiction. Most COGs mention community and transportation planning, workforce development, and services to the aging population as their primary areas of focus.

4.1.2 Land Use and Transportation Planning in Virginia

4.1.2.1 Virginia – State Planning

Virginia has enacted a statewide transportation plan (Code of Virginia, Section 33.2-353). The Virginia Department of Transportation (VDOT) manages the construction and maintenance on most roadways in the state and even local neighborhood roads (aside from Arlington and Henrico Counties and some cities or towns³). As for land use, the state mandates local comprehensive plans. Local government is granted substantial powers to adopt local growth management tools, and land use planning function is mainly performed by local government. In 2006, Chapter 527 of the 2006 Acts of Assembly was approved to enhance the coordination of land use and transportation planning. This requires localities to submit a local comprehensive plan or plan amendment that will result in 5,000 additional vehicle trips per day on state-controlled highways to the VDOT. In addition, traffic impact statements are required for certain rezoning proposals that are projected to substantially influence state-controlled highways.

³ See the link to the page of VDOT District Offices for more information: <https://www.virginiadot.org/about/districts.asp#3>.

In the case of Virginia, local government oversees land use planning, whereas VDOT maintains the roadway system. When maintaining the roadway system, VDOT oversees allocating funds for planned infrastructure, reviewing local plans, and distributing information about local planning efforts. VDOT, therefore, has a substantial impact on local planning, especially transportation planning, through its funding and management mechanism.

Virginia's Planning District Commissions (PDCs) were established by the Regional Cooperation Act (Code of Virginia, Section 15.2-4200), and are the main entity that coordinates state-local government cooperation across the major "functional areas" of: (i) economic and physical infrastructure development; (ii) solid waste, water supply, and other environmental management; (iii) transportation; (iv) criminal justice; (v) emergency management; (vi) human services; and (vii) recreation.

According to the introduction to Virginia PDCs (VAPDC, n.d.), PDCs act mainly as regional hubs for technical assistance in planning procedures for local governments and jurisdictions within their region. The major areas they operate in include grant-writing assistance and administration; project and program management; land use planning and mapping/geographic information systems (GIS); transportation planning; and environmental planning. Many areas prepare a regional Comprehensive Economic Development Strategy (CEDS) to outline general measures they plan to take in order to support economic development in their region.⁴ Virginia's PDCs are the broadest organizations below the state and are most responsible for regional planning, with MPOs often acting as their transportation planning branch.

4.1.2.2 Virginia – Transportation Planning

At the state level, the Commonwealth Transportation Board, with the assistance of the Office of Intermodal Planning and Investment, conduct a comprehensive review of statewide transportation needs in a Statewide Transportation Plan. This review sets forth an assessment of capacity needs for all corridors of statewide significance, regional networks, and improvements to promote urban development areas established pursuant to § 15.2-2223.1 (Code of Virginia, Section 33.2-353). VDOT is the primary state agency that oversees and manages the roadway system and approves funding for planned infrastructure. The Virginia Department of Rail and Public Transportation (DRPT) is the state agency that promotes transportation options to the general public, businesses, and community decision makers, and focuses on rail, public transportation, and commuter services. DRPT developed Multimodal System Design Guidelines⁵ and provides a statewide set of tools for alternative approaches for

⁴ Those PDCs include Central Virginia PDC (<https://www.cvpdc.org/regional-initiatives/ceds.html>), Central Shenandoah PDC (<https://www.cspdc.org/programs-services/comprehensive-economic-development-strategy>), Southside PDC (<https://www.southsidepdc.org/index.php/services/ceds>), Middle Peninsula PDC (<https://www.mppdc.com/index.php/service-centers/economic-development/ceds>) and other PDCs.

⁵ More information about DRPT's Multimodal System Design Guidelines: <http://www.drpt.virginia.gov/transit/planning/multimodal-guidelines/>.

transportation planning at the regional, community and corridor scales for statewide cities and towns of various types.

On top of the guidance and direction about coordinating adoption and implementation of tools across cities and counties given by Virginia's DOT and DRPT, several other organizations (including MPOs and PDCs) provide services to and connect with local governments.

4.1.3 Land Use and Transportation Planning in Maryland

4.1.3.1 Maryland State Planning

The Maryland Department of Planning (MDP) is a cabinet-level agency that is responsible for state-level planning. The Maryland Planning Act of 1974 authorized the MDP to prepare and revise the State Development Plan. The plan is developed after consultations with all local governments that are influenced by the plan. In the meantime, all plans, including local plans in the state, need to be submitted to the MDP. The MDP implements land use analyses and supplies technical assistance to local and state governments (Ingram et al., 2009). The State Growth Areas Act (1997) requires counties in Maryland to designate their Funding Priority Areas (PFAs) and submit relevant plans to the MDP for review (Ingram et al., 2009). By applying the state budget as a financial incentive, the smart growth program supports development within the PFAs (Ingram et al., 2009). On top of the MDP, many other entities have important roles in state and local planning, such as the Office of Smart Growth and Maryland Sustainable Growth Commission.

Despite the rich history of state activities, counties remain the dominant player in land use and environment planning (Ingram et al., 2009). Local governments are required to develop master plans covering all areas of the jurisdiction. Once adopted, those master plans are legally binding at the time of development, unlike many other states, and adherence is strongly encouraged. Local governments may also develop and adopt comprehensive land use plans and implement them with land use policy instruments. As a result of political opposition to state intervention (Ingram et al., 2009), local governments in Maryland are provided with more incentives and tools for local planning. MDP provides many services to local governments, assists state agency partners, and provides data to the private sector and the general public. It generally supports the planning efforts of local governments and MPOs in the state. At the local level, some Maryland counties and municipalities have adopted adequate public facilities ordinances (APFOs), which is an effort to facilitate orderly development and growth and to phase in the provision of adequate public facilities in accordance with a locally adopted comprehensive plan (Code of Maryland, section 7-101). APFOs often include standards for transportation (MDP, n.d.), and mandates transportation studies and mitigation measures, such as roadway improvements.

Maryland's Smart Growth Subcabinet is the entity that helps to implement Smart Growth Policy. The Subcabinet recommends changes in State law, regulations, and procedures to the Governor to support the Policy (Chapter 759, Acts of 1997). They also oversee the Priority

Places Strategy (Executive Order 01.01.2003.33), and generally work to support smart growth in direct contact with communities across Maryland (Chapter 487, Acts of 2010). The Subcabinet submits an annual Fiscal Report wherein it reports on the general smart growth-related actions of particular state agencies that it is responsible for monitoring. Said agencies include the Maryland Departments of Commerce, General Services, Housing, Environment, and Transportation.

The National Center for Smart Growth Research and Education, based at the University of Maryland, conducts general smart growth research, but its operations are not strictly limited to the Maryland planning context. However, given its proximity to Maryland's communities, it engages in extensive research and projects in collaboration with the state's regional and local organizations. Three recent initiatives focused on Maryland's communities include the Partnership for Action Learning in Sustainability (PALS), the Purple Line Corridor Coalition (PLCC), and the Plan for Regional Sustainability Tomorrow (PRESTO). The Center also states that it often engages in local planning discussions in Maryland, and that its director is an active member of the Smart Growth Subcabinet and Sustainable Growth Commission.

4.1.3.2 Maryland – Transportation Planning

The Maryland Department of Transportation (MDOT) does not serve a leading role in terms of oversight or assistance to lower regional and local organizations. On the other hand, the MDP plays the greatest role in facilitating state to local planning functions and provided review and assistance for many of the entities across the state. MPO and COG interactions constitute the most concrete relationships and collaboration for most of the state's regional and local planning operations.

Much like COGs established in North Carolina, Maryland's COGs are the broadest group of regional organizations in the state, above MPOs. They recruit most of their membership directly from the state, county, and municipal governments as well as the private sector. COGs manage all major regional planning decisions and functions, with MPOs often acting as the sub-organization fully responsible for transportation planning. Maryland's COGs are also well engaged with such federal agencies as the Economic Development Administration (EDA) of the United States Department of Commerce and United States Department of Agriculture (USDA) Rural Development, among others.

4.1.4 Land Use and Transportation Planning in Florida

4.1.4.1 Florida – State Planning

Changes in the state of Florida's land development regulations have been evolving over the past decade. The Growth Management Act (GMA) in Florida, which was passed in 1985, featured a centralized planning approach based on a comprehensive planning model, and the steering policies of the "three Cs": consistency, concurrency, and compact development. Under the GMA, the state adopted the State Comprehensive Plan, which has been enforced by the Legislature and governors (Chapin, 2007). All local governments were required to prepare,

evaluate, and amend comprehensive plans. Local planning efforts and capital budgets were intended to be in line with the visions and infrastructure investments outlined in the comprehensive plan. This so-called concurrency requirement stated that infrastructure, including transportation, needed to be available concurrent with the impact of development.⁶ The Department of Community Affairs (DCA) was empowered to set up minimum requirements for the content of local comprehensive plans, then known as Chapter 9J-5 in the state's administrative code. Additionally, DCA oversaw and reviewed local comprehensive plans and provided objections, recommendations, and comments (ORC).

Despite some early successes, the implementation of GMA was challenged by the local government's failure to provide infrastructure under the concurrency and compact development requirements, the removal of regional planning councils, and piecemeal enforcement (Boda, 2018). Driven by a recent financial crisis, the framework for growth management was geared toward "increasing competition and individual autonomy" (Boda, 2018). In this context, the 2011 Community Planning Act (Florida Statute 163.3161(1)) was passed, which revised Florida's growth management legislation.

In 2011, Florida Senate 2156 eliminated the DCA and transferred its functions to the Department of Economic Opportunity (Shelley & Brodeen, 2011). Along with the transfer of functions came a reduction in staff and available funding for oversight of local planning efforts in growth management (Boda, 2018). As to the changes in the comprehensive plan, the requirements on the frequency and geography of comprehensive plan amendments have been removed (Boda, 2018), and the state land planning agency can no longer intervene in a small-scale plan amendment (Shelley & Brodeen, 2011). In the meantime, challenging comprehensive plan amendments and future development projects are becoming more difficult to implement, as the burden of "ultimate persuasion and proof of evidence" has been shifted from initiators of the change to the challengers (Boda, 2018).

In terms of concurrency policies, the legislature found that expansion of roadways, as a sole mitigating measure to manage development impact, does not work effectively in urban centers. Thus, it first allowed local governments that qualified as dense urban land areas⁷ to develop transportation exception areas. Under Section 163.3180, urban infill, community redevelopment areas, downtown revitalization areas, and redevelopment and urban services areas may be designated as transportation concurrency exemption areas. Beginning on June 2, 2011, transportation concurrency is no longer mandatory (Florida Department of Economic

⁶ Many cities and counties in other states have implemented adequate public facilities ordinances (APFO), which are sometimes called "concurrency." While the two are similar, the States of Florida and Washington are distinct in being the only states to require all local governments in their growth management programs to have a plan for transportation concurrency in the local planning process (Steiner, 2007).

⁷ A dense urban land area is defined as a municipality that has an average of at least 1,000 people per square mile of land, and a minimum total population of at least 5,000; a county, including the municipalities located therein, which has an average of at least 1,000 people per square mile of land area; or a county, including the municipalities located therein, which has a population of at least 1 million (Florida State Bill 360 (2009)).

Opportunity, n.d.). It becomes a local option either to apply for or rescind transportation concurrency. If concurrency is applied, the local government is required to provide the principles, guidelines, standards, and strategies, including adopted levels of service, to guide the application of its transportation concurrency management system into their comprehensive plan. Local governments are then encouraged to develop tools and techniques to complement the application of transportation concurrency (Florida Statue 163.3180(5)). If a local government chooses to eliminate the transportation concurrency provisions from its comprehensive plan, a plan amendment is not subject to state review (Florida Department of Economic Opportunity, n.d.). However, the local government is required to maintain a certain level of service standards for its roadways for purposes of capital improvement planning. Meanwhile, it is encouraged to adopt an alternative mobility funding system that supports multimodal solutions (Florida Statue 163.3180(5)). At this point, local governments are responsible for managing growth and controlling development impacts in Florida.

Under the Community Planning Act of 2011, the state planning agency is within the Department of Economic Opportunity (DEO). The Division of Community Development within DEO is now responsible for:

- “assisting local governments and their communities in finding creative planning solutions to help them foster vibrant, healthy communities;”
- “administering state and federal grant programs as provided by law to provide community development and project planning activities to maintain viable communities, revitalize existing communities, and expand economic development and employment opportunities;” which include
- “the local comprehensive planning process and the development of regional impact process;” and
- “assisting in developing the 5-year statewide strategic plan” (Florida Statue 20.60(5)(b)).

The restriction limiting amendments of the comprehensive plan to no more than twice a year has been removed from the previous Florida Statue, 163.3187(1)(a). As has been pointed out by Boda (2018), the purpose of Florida’s growth management under the Community Planning Act has transformed from “controlling future growth” to “managing future development consistent with the proper role of local government” (Florida Statue 163.3161(2)).

Regional planning councils (RPCs) in Florida are a multi-purpose entity of local governments. They were established to enhance regional collaboration and help communities grow. The Florida Regional Councils Association (FRCA) is a statewide organization of 10 RPCs. The early responsibilities of the RPCs included preparing strategic regional policy plans; working with local governments to facilitate effective planning and consistency across jurisdictional lines; and providing technical assistance for local development and planning. However, the 1993 Florida Legislature removed the powers of RPCs and further reduced the scope and importance of regional plans (Pelham, 2007). Since then, regional plans and the powers of the RPCs have been

generally limited. Without the coordination of RPCs, counties are interacting directly with the state. The roles of RPCs are limited to providing technical guidance to local governments and, in some regions, providing staff to MPOs.

4.1.4.2 Florida - Transportation Planning

The Florida Department of Transportation (FDOT) is a decentralized executive agency that reports directly to the Governor. As stated on FDOT's website, its statutory responsibility is to "to coordinate the planning and development of a safe, viable, and balanced state transportation system serving all regions of the state, and to assure the compatibility of all components, including multimodal facilities" (FDOT, n.d. -a). The Central Office Planning Team coordinates and oversees a diverse array of efforts and programs related to transportation programming and project development. The central office and district units:

"coordinate Metropolitan and Non-Metropolitan Planning Process; develop and coordinate policies and training regarding public involvement processes; coordinate corridor planning policies and oversee large scale corridor planning efforts; coordinate policy and programming for the Strategic Intermodal System (SIS); coordinate policy and programming for the Shared Use Nonmotorized (SUN) Trail Network; coordinate and establish statewide standards for transportation system modeling to support long range planning; collect and maintain core statistics, measures and trends to inform transportation planning, programming and development; coordinate and report state and federal performance measures" (FDOT, n.d. -b).

FDOT works with multi-level governments, oversees policy and planning efforts, leads transportation research, and provides guidance and assistance to local governments and agencies. FDOT has made efforts to develop the Strategic Intermodal System (SIS), which is a statewide transportation network that covers all modes. To make better decisions for SIS Funds and to prioritize certain SIS projects, FDOT applies the Strategic Investment Tool (SIT), which includes 24 measures and evaluates whether projects are consistent with the Florida Transportation Plan and SIS objectives. The SIT is a transparent, coordinated tool that collects inputs from MPOs, local governments, other local agencies, as well as the state. In addition to the SIS, FDOT has continuously been pushing for a multimodal transportation system. Such efforts include, but are not limited to, the development of intermodal networks, Intermodal Logistic Centers, Future Corridors, and Multimodal Performance Measures.

In addition, while the growth management legislation has undergone many changes, FDOT has been continuously involved in establishing the links among community development, land use planning, and multimodal transportation development. Under the GMA, FDOT produced the *Multimodal Transportation Districts and Areawide Quality of Service Handbook* (FDOT, 2003) to provide the technical assistance necessary for local implementation of Multimodal Transportation Districts. Under the Community Planning Act, various FDOT studies, including *Evaluation of the Mobility Fee Concept* (Seggerman, Williams, Lin, & Fabregas, 2009), and

Expanded Transportation Performance Measures to Supplement Level of Service (LOS) for Growth Management and Transportation Impact Analysis (Elefteriadou, Srinivasan, Steiner, Tice, & Lim, 2012) were published. FDOT researches and develops planning tools and assists planning at a local, district, or corridor scale.

4.2 Local Traffic Impact Assessment

The results are presented separately with the initial analysis for three states – North Carolina, Maryland, and Virginia – and then for the state of Florida. This separation is based partially on the separation of tasks between the University of North Carolina and the University of Florida, but it also reflects expectations from the beginning that cities in Florida have been more aware of multimodal planning due to the evolution of the transportation concurrency system from a roadway-based system to one that included options to plan for multimodal environments (Steiner, 2007). In this section, we first present the results from the interviews in North Carolina, Maryland, and Virginia, and then we present separate results from Florida.

4.2.1 State of TIA practice

Initial coding of interview transcripts suggested three basic categories of TIA practice:

1. Never adopters: No formal TIA policy; no TIA required for development approval except when required by and in accordance with state DOT policies.
2. Conventional municipalities: Formalized TIA approaches that closely followed state DOT or other conventional TIA practices. All conventional municipalities interviewed have adopted at least one form of innovation, but these innovations represent only minor deviations from the state-level conventional TIA approach.
3. Innovators: Multiple forms of innovative or alternative TIA practices were put in place. Innovators are further classified as leading, aspiring, following, or lagging (Combs & McDonald, 2021). Innovations typically indicate an overall prioritization of non-car travel modes and/or development patterns that are intended to increase urban densities and enhance walkability and livability. Innovative practices vary widely across communities, with the leading-edge processes showing divergence into novel, unique approaches.

4.2.1.1 Innovations in TIA

The most common types of innovations identified include offering waivers or variances to the TIA process based on characteristics of the development proposal. These are followed by requirements for applicants to include accommodations for non-car modes in the development proposal, ad hoc or informal modifications to the TIA process, modifications to project design to reduce need for mitigations, and adjusting the level of service metrics.

4.2.2 Stated shortcomings of the conventional TIA approach

Municipalities reported a diverse array of drawbacks to the conventional approach to TIA. The most reported disadvantages are that conventional TIA methods do not account for atypical land uses and there is a sense that the process is biased in favor of developers. Other reported drawbacks include a failure of conventional TIA to capture the full costs of development to the

community, and the imposition of unwarranted burdens on developers and/or municipal staff. Less commonly, interviewees reported that the conventional approach:

- undermines efforts to improve walkability or livability,
- relies on inaccurate trip generation estimates from ITE,
- is too narrowly focused and/or too limited in geographic scope,
- is too technically challenging to be well understood by municipality staff and the public, and
- is biased against developers.

4.2.3 Reasons for introducing new TIA practices

Interviewees also provided a broad range of reasons their municipalities had sought to change their TIA processes. Across municipalities, the most common rationale for innovation was to enable a shift toward more sustainable forms of development. The desire to exact improvements in facilities or accommodations for non-car travel modes and to better align transportation system improvements with the expressed visions of municipalities are also common justifications among innovators.

Another common reason for innovation is a desire for more clarity, standardization, or information with respect to projected impacts and required mitigations associated with development proposals. Interviewees from both conventional and innovator municipalities shared the sentiment that if the TIA process was better understood by the public, the development community, and elected officials, the development approval process would be less contentious.

4.2.4 Champions of innovation

Innovation among conventional municipalities was driven primarily by elected officials, while municipal staff and elected officials worked together to drive change in the innovators. Less commonly, change was instigated by the public or by a specific development proposal.

4.2.5 Barriers to innovation

Surprisingly, few interviewees felt their municipalities faced any sort of barriers to TIA innovation. Of the municipalities that did mention barriers, several described both opposition by or on behalf of developers, and conflict with the state DOT policies or laws as hindrances to innovation.

4.2.6 Information sources

Information-seeking behaviors are more common among innovators than conventional municipalities. Innovators nearly always sought information from multiple sources outside their own departments, and usually included professional development activities (attending conferences, reading literature) as top information sources. Conventional municipalities relied more heavily on existing internal knowledge and on information from peer communities.

4.2.7 The Special Case of Florida

As discussed above, beginning in the late 1980s, as part of statewide growth management, local governments in Florida were subject to the requirement for transportation concurrency. Florida's concurrency management system was simple in concept – investments in transportation infrastructure should be made consistent with the impact of development – but difficult to implement (Steiner, 2007). Under concurrency, local governments were required to include level of service standards into their Comprehensive Plan. When they completed a transportation impact assessment as a part of the review of a development proposal, they would determine whether the project met the LOS standards identified in the Comprehensive Plan.

Even though local governments completed the development review and the associated transportation impact assessment under state requirements, which changed over time, that affected how they developed their concurrency management system. When the concurrency requirement was included in the 1985 Growth Management Act, the language was vague about how concurrency was to be structured. Local governments were required to follow state guidance on how to measure concurrency. Although the statutory language required “transportation concurrency,” the basic method of measuring concurrency was using highway level of service. Over time, the concurrency framework was changed to allow local governments to plan for all modes of travel in more urban contexts, through the use of transportation concurrency management areas, transportation concurrency exception areas, long-term concurrency management systems and multimodal transportation districts. The 2011 Community Planning Act removed the requirement for local governments to include transportation concurrency in their local land use planning. As such, the circumstances under which TIA is completed in Florida differs from other states. Multimodal approaches were incorporated into local planning practice because of the state legislation. In the next section, we report on the results of interviews with 17 local governments in Florida.

4.2.7.1 Survey Results from Florida Communities

All 17 of the local governments engage in some form of innovative practice. However, the focus of local TIA approaches and innovations vary. Local governments could be categorized into three groups based about their approach to TIA – (1) development oriented, (2) mixed orientation, and (3) a strong multimodal and sustainable motivation. The first group, development oriented, which includes two municipalities, attempted to improve the efficiency of the TIA process to reduce the time and cost burdens on developers, and had limited objectives designed to improve multimodal development. This group could be classified as practitioners of conventional TIA. The second group, which includes six municipalities, uses a mixed orientation that acknowledges their multimodal needs while making minor concessions that accommodated a development-oriented approach. The third group, which includes ten municipalities, emphasizes multimodal goals with a weaker emphasis on development-oriented strategies. All of these jurisdictions have adopted multiple forms of innovation or practices in

addressing multimodal development. Nine of the ten municipalities have stated goals in prioritizing non-vehicular models of travel and associated forms of development. Like the case participants in the UNC research, the sample is likely biased towards more innovative jurisdictions.

The overall focus and motivation associated with the TIA approaches are generally consistent with overarching goals. For municipalities in the first category, common innovations include allowing variances and waivers to the TIA process, providing informal means to supplement the TIA process, and moving TIA into the planning process. Municipalities with a clear multimodal focus and strong motivation for sustainable development used a greater variety of changes to TIA and a greater number of innovations, primarily including adjusting ITE trip generation estimates, adjusting or using alternatives to conventional LOS, allowing variances and waivers to the TIA process, and requiring developers to address needs for non-car modes.

When we completed the analysis of how the TIA practices related to the use of transportation concurrency in the planning process, we discovered some interesting trends. All municipalities have made some adjustments to TIA, which ties to concurrency and local planning practices. In recent years, some have rescinded the concurrency requirement, while other still use a concurrency system. Those that have rescinded concurrency are also using an alternative multimodal funding system. Some of our local municipalities shifted the responsibility for reviewing TIA studies to the county. Because of the methodology we used in the study, contacting local governments, we could not determine how prevalent this trend is, but cities in both Broward and Palm Beach County identified it. Broward County has long negotiated with the State over the concurrency management system, and they eventually negotiated for a concurrency management system that was based on transit level of service. Broward County has also planned for activity centers and transit-oriented development.

It is important to recognize that until 2011, communities were using innovations in concurrency, and they needed to negotiate with the DCA over their use of such innovations in their comprehensive plan. Furthermore, local land development regulations, which would include TIA, are required to be consistent with the comprehensive plan. As such, municipalities in Florida have been planning for multimodal environments since the implementation of the GMA in the early 1990s and this trend has increased over time with the introduction of new concurrency management planning tools (Steiner, 2007).

5.0 DISCUSSIONS AND CONCLUSIONS

This exploratory research sought to understand the connections between state, regional and local implementation of innovative TIA practices. We quickly concluded that, with few exceptions, regional agencies do not take a significant role in how local governments conduct TIA. The role that state governments take with respect to transportation impact assessment varies across the states, although some clusters in certain region are identified in the research.

This research has helped us to understand how Southeastern cities and counties are working to adapt and change TIA practices to meet their local needs. Our research shows that the connection between state and local implementation of innovative and multimodal TIA is not direct and is not well understood. The special case of Florida suggests that the state's concurrency requirement may have resulted in a higher level of innovation among local governments. At the same time, the goals and policies of transportation planning vary at the local level and local governments have adapted accordingly. Where multimodal planning is supported, local governments have clear motivations and goals for doing so and they are adapting in a wide variety of ways. The divergence in new practices among leading communities suggests that these communities are at the forefront of developing new best practices. We need to find ways to support these efforts, and to adapt these best practices for aspiring and following communities. This will require better planning support tools and locally calibrated models.

There is clearly an appetite for change and for current information on innovative TIA practices. At the same time, we need to understand how local governments are seeking that information (e.g., peer networks, conferences, and literature) and we need to identify new ways to provide support for such innovation. This information is particularly important because staff are driving change. This means two things: (1) we need to better educate tomorrow's staff, and (2) we need to figure out how to better support and empower planners, in practice.

6.0 RECOMMENDATIONS

The findings of this research lead us to conclude that there is a need for additional research and tech transfer related to current innovations in transportation impact assessment. Admittedly, the research addressed implementation among a small sample of communities in the Southeastern and Mid-Atlantic states that have large urban areas. The research attempted to explore the adoption of innovative methods of TIA, but it does not suggest the extent of implementation of innovation approaches to TIA. We encountered a selection bias among the respondents that was confirmed by short interviews with respondents in Virginia, Maryland, and North Carolina. In Florida, we did not conduct the same survey, but we had a high rate of non-response. Within the Florida context, we also spoke to some communities that contracted out their TIA or the TIA was completed by the county staff. Similarly, the case of Florida communities suggest that we need to understand the context in which TIA is conducted. This study reinforced the understanding that TIA is a part of the culture of a community and that state laws can reinforce or undermine the ability of local government planners to innovate in TIA.

Based upon the results of this research we have concluded that it is important to develop a broader understanding of the use of innovative methods of TIA. We have developed a typology of changes that communities are using, but we would need to complete additional research to understand how they have been implemented. Suggestions for future research include:

- Connection to the ITE efforts to create multimodal TIA – the first step is understanding how these programs could be enhanced.
- Understanding how transportation impacts are measured in innovative communities in an attempt to standardize the methods used to understand TIA; and
- Connections between local TIA and the state and federal regulatory environment, including planning laws and EIS/global climate change; and federal regulations on the coordination of land use and transportation for air quality improvement under conformity and TOD ordinances.

In addition, this research identifies a need for additional training of professionals on options for more multimodal, context-sensitive TIA. During this project, we presented the results of this research on several occasions and the presentations were well attended and well-received. At the same time, because this is an area of research that is recognized by ITE as a changing practice, we have additional opportunities to train transportation professionals on how to adopt innovative professional practices.

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8.0 APPENDICES

8.1 Appendix A – Abbreviations

APFO	Adequate Public Facilities Ordinance
CAMA	Coastal Area Management Act (North Carolina)
CEDS	Comprehensive Economic Development Strategy
CEQ	Council on Environmental Quality
CEQA	California Environmental Quality Act
COG	Council of Governments
cTIA	Conventional Traffic Impact Assessment
EDA	Economic Development Administration (US)
DBPT	Division of Bicycle and Pedestrian Transportation (North Carolina)
DCA	Department of Community Affairs (Florida)
DE)	Department of Economic Opportunity (Florida)
DOT	Department of Transportation
DRPT	Department of Rail and Public Transportation (Virginia)
FRCA	Florida Regional Councils Association
GIS	Geographic Information Systems
GMA	Growth Management Act (Florida)
HCM	Highway Capacity Manual
ITE	Institute of Transportation Engineers
LOS	Level of Service
MDP	Maryland Department of Planning
MPO	Metropolitan (transportation) Planning Organization
MXD	Mixed-use Development
NCHRP	National Cooperative Highway Research Program
NEPA	National Environmental Policy Act
NTD	Neotraditional Development
ORC	Objections, Recommendations, and Comments (Florida)
PALS	Partnership for Action Learning in Sustainability
PDC	Planning District Commission (Virginia)
PFA	Priority Funding Area (Maryland)
PLCC	Purple Line Corridor Coalition
PRESTO	Plan for Regional Sustainability Tomorrow
RP	Recommended Practice
RPC	Regional Planning Council (Florida)
RPO	Rural (transportation) Planning Organization
SEPA	State Environmental Policy Act (Washington)
SEQR	State Environmental Quality Review Act (New York)
SIS	Strategic Intermodal System (Florida)

SIT	Strategic Investment Tool (Florida)
SUN	Shared Use Nonmotorized
TAC	Technical Advisory Committee
TCC	Technical Coordinating Committee
TIA	Traffic Impact Assessment
TND	Traditional Neighborhood Development
TCRP	Transit Cooperative Research Program
TOD	Transit-Oriented Development
USDA	United States Department of Agriculture
USEPA	United State Environmental Protection Agency

8.2 APPENDIX B. Copy of Interview Questions

TIA-LOS Structured Interview Guide for Municipal Planners

As I mentioned [in my email/on the phone], we are interested in understanding how municipalities in North Carolina handle the traffic impacts of new developments. We understand a number of municipalities have been revisiting their approaches to traffic impact assessment in recent years. We're curious to understand both the state of the practice with respect to traffic impacts, and the factors driving some communities to change their approaches. Are you ready to proceed?

1. Please describe how your community handles the traffic impacts of new developments. Could you walk me through the process of approving new development proposals with respect to traffic impacts?

Prompt specifically for:

- innovation within ITE standards,
- allowance for changing LOS,
- potential for exceptions or waivers,
- different approaches in different parts of town or different contexts (e.g., mixed use),
- collection of local data on trip gen,
- innovation with respect to metrics,
- whether the town collaborates on traffic impact assessments with bordering communities

2. How long has the community been following this approach?

- If the approach varies by context, allows for innovation within the ITE standards, accommodates MMLOS, or is something different altogether, something else: [go to Q13](#)
- If a standard, conventional ITE TIA approach: [go to Q3 \(p2\)](#)

For communities with no or conventional ITE standards:

3. Has the town run into any specific challenges or shortcomings with this approach?

Prompt for specifics

4. Are you aware of different approaches or efforts to change approaches to handling traffic impacts in other, similar, communities?

5. To your knowledge, have there been any efforts within the community or local government to change this approach?

Prompt if needed for types of change, e.g., relaxing of LOS standards, changes in thresholds needed to trigger TIA, changing focus from auto trip gen to person trip gen

- If yes: proceed to Q6, below
 - If no: ask if there is anything else interviewee would like to add, and then end interview.
-

For communities with previous or ongoing efforts to change:

6. What new approaches has the community considered?

7. Is the effort to change approaches still underway?

[If yes,] **Where are you in the process of changing the approach?**

- If yes: jump to Q13, page 3
- If no: proceed to Q8, below

8. Were there any particular individuals, organizations, or events that motivated efforts to change?

Prompt for roles of *people* (e.g., developers; engineers) and *phenomena* (e.g., professional planning networks; public pressure)

9. Did you play a role in the effort to change the standards [either as opponent or proponent]?

[If yes,] **What was your role? What motivated you to take on that role?**

10. How did people involved in the effort learn about new approaches to addressing traffic impacts?

What influence did those information sources have on the effort?

11. Did the community work with a consulting firm in the effort?

[if yes] **What was (is) the consultant's role in the process? Can you provide the name or contact information for your consultant?**

12. Why did the community not adopt a different approach?

Who or what were the barriers or obstacles to adopting a different approach?

Ask if there is anything else the interviewee would like to add, and then end the interview.

For communities with innovative approaches or ongoing efforts to change:

- 13. What's the process (or what's it likely to be) to bring about this sort of change?
Who is or will be involved?**
- 14. Have there been any particular individuals, organizations, or events that motivated (are motivating) efforts to change the standards?
Prompt for roles of *people* (e.g., developers; engineers) and *phenomena* (e.g., professional planning networks; public pressure)**
- 15. Did you play (are you playing) a role in the effort to change the standards [either as opponent or proponent]?
[If yes,] what was (is) your role?
What has motivated you to take on that role?**
- 16. How have people involved in the effort learned about new approaches to addressing traffic impacts?
What influence have those information sources had on the effort?**
- 17. What costs or benefits did / (do) community leaders expect to arise from the change?
Be on the lookout for better communication with neighbors of new developments, multimodal friendliness, and safety, more \$ from developers etc., and probe for additional detail**
- 18. Has the community worked with a consulting firm in this effort?
[if yes] What was (is) the consultant's role in the process?
Can you provide the name or contact information for your consultant?**
- 19. Were there (have there been) any particular legal or regulatory actions that enabled (are enabling) this change?**
- 20. Did you encounter (have you encountered) any challenges to the change process?
[If yes,] Would you mind describing some of these challenges, or sharing an example?
Prompts:
 - From what quarters have these challenges come? (e.g., the public, regulations, external agencies, internal objections, politics, logistics, developers, etc.)
 - What's the expected impact of these obstacles (e.g., might they derail your efforts?)**

Continue to page 4

If the community is in the process of changing their approach, but hasn't formally adopted a new approach:

21. In your professional judgment, will this effort succeed?

Why or why not?

- If yes: *continue to Q22, below*
- If no: ask if there is anything else interviewee would like to add, and then end interview.

22. What do you anticipate to be the most likely impacts or outcomes of the new approach?

- [prompt: impacts on development, traffic, public perception]
 - Ask if there is anything else interviewee would like to add, and then end the interview.
-

If the community has successfully adopted a new approach:

23. Is the current approach working?

What are its strengths and weaknesses?

- Prompt for metrics used to assess whether the new approach has been successful.

24. Do you know if the community has considered (or is considering) further changes to the TIA approach?

Why or why not?

- Ask if there is anything else the interviewee would like to add, and then end the interview.
-

Questions about Concurrency (Florida only)

1. **How has Concurrency motivated or changed your cities approach to traffic impact assessments?**
 2. **Can you describe the evolutionary process of your policy? How changes in concurrency have affected your practice?**
 3. **Do you feel that public facilities and services supporting new developments are planned and built concurrent with the impact of development? Has concurrency succeeded in your city?**
 4. **How does your city balance protecting the capacity while maintaining accessibility?**
-

City Specific Questions (Vary by city. Here is an example.)

- **How do you assure that multimodal planning is taking place?**
-

Closing Interview

1. **Would you be able to send your Traffic Impact Analysis Guide that you send to developers and consultants to me through email?**
2. **Are you interested learning the results from our study upon completion?**

Thank you for your time.

8.3 Appendix C. Copy of Publications From This Research

8.3 Appendix D – Summary of Accomplishments

Date	Type of Accomplishment	Detailed Description
Summer and Fall 2018	Educational Product	Development for structured interviews of municipal transportation planners on transportation impact assessment (TIA)
2018	Other	Development of a protocol for conducting general inductive content analysis of interview transcripts and notes
10/25/18	Conference Paper	Presentation by Tabitha Combs and Noreen McDonald at the conference of the Association of Collegiate Schools of Planning in Buffalo on results for North Carolina and Virginia. Title: <i>What Drives Cities to Consider and Adopt Innovative Approaches to Traffic Impact Assessment</i>
Fall 2018	Other	Presentation at the regional conference of the Urban Land Institute Chapter luncheon
2018-2019	Educational Product	Development of a framework for understanding the connection between state guidance and local TIA practice.
1/15/19	Conference Poster	Poster presented by Tabitha Combs and graduate student Will Leimenstoll at the Transportation Research Board Annual Meeting on results for North Carolina. Title: <i>Innovation in municipal traffic impact assessment approaches: a case study in North Carolina</i>
3/29/19	Other	TRB-Preg. <i>the development and implementation of innovations in TIA in the US</i> . Abstract: Cities and counties across the US are increasingly recognizing a need to update their TIA practices to support more sustainable, multimodal-oriented development patterns. This webinar presents recent research aimed at understanding and addressing the challenges faced by transportation and land use professionals as they seek to adopt new approaches to assessing and mitigating the impacts of urban development. AICP credits available: https://planning.org/events/eventsingle/9171658/
2020	Publication	Combs, T. S., McDonald, N. C., & Leimenstoll, W. (2020). Evolution in Local Traffic Impact Assessment Practices. <i>Journal of Planning Education and Research</i> , 0739456X20908928.

2020	Publication	McDonald, N. C., & Combs, T. S. (2020). Reinventing TIA: Contemporary Approaches to Addressing the Traffic Impacts of Urban Development. <i>ITE Journal</i> , 90(9), 46–49.
2021	Publication	Combs, T., & McDonald, N. (2021). Driving change: Exploring the adoption of multimodal local traffic impact assessment practices. <i>Journal of Transport and Land Use</i> , 14(1), 47-64. https://doi.org/10.5198/jtlu.2021.1730