



Assessment of Planning Risks and Alternative Futures for the Florida Transportation Plan

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16. Abstract The Florida Department of Transportation (FDOT) recognizes that changes in demographics, economics, technology, the environment, and global issues will create planning risks for Florida's transportation system. In preparation for the 2020 update of the Florida Transportation Plan (FTP), FDOT contracted Florida State University's Barnebey Planning & Development Lab to assess the impact these future risks could have on Florida's transportation system and how these risks should be addressed in FDOT's planning processes. Accomplishing this goal involved conducting a comprehensive literature review and stakeholder outreach process to identify hazards threatening Florida's transportation system and to assess their potential consequences to the state's transportation facilities. The hazard assessment and consequence identification was then applied to the FTP update by evaluating their impact on the FTP's five alternative futures scenarios and how the risks could affect FDOT's ability to achieve the FTP's Goals. Finally, the research team made recommendations for integrating risk management into all of FDOT's long-range planning processes. The team developed a risk assessment framework and included specific recommendations and risk assessment tools for each phase of the planning process that FDOT can use to ensure that planning efforts minimize the effects of risks on project outcomes. The findings of this report provide valuable insight for long-term transportation planning and will serve to guide the FTP update and create resilient planning and project development processes across the state to ensure that, in the face of uncertainty and change, FDOT can maintain a safe, interconnected and reliable transportation system.					
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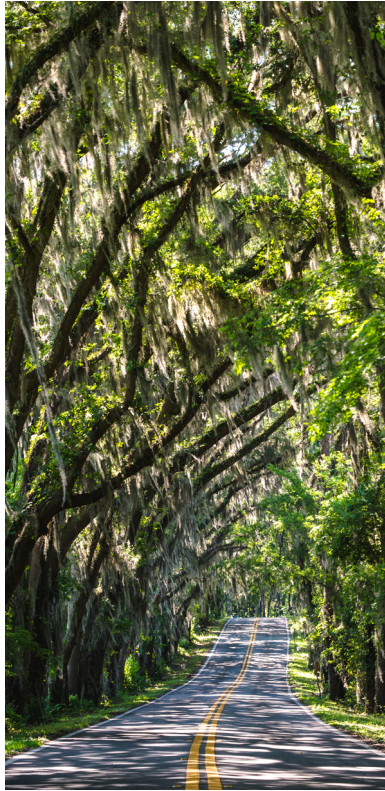


Table of Contents

Executive Summary	4
Introduction	6
Chapter 1: Literature Review & Hazard Assessment	10
Chapter 2: Consequence Identification and Management	34
Chapter 3: Planning Implications for Alternative Futures	48
Module 1: Return to Historic Growth	50
Module 2: Rural Rediscovery	66
Module 3: Global Trade Hub	84
Module 4: Innovation Hub	100
Chapter 4: Strategies for Transportation Planning	118
Conclusion	142
Appendix	
Appendix A: Risk Assessment Strategies for Long-Range Transportation Planning Whitepaper	146
Appendix B: Stakeholder Outreach	158
Bibliography	176

Executive Summary

The Florida Department of Transportation (FDOT) has acknowledged that there are changes in technology, environment, different populations in Florida, and transportation financing that have increased planning risk for Florida's transportation infrastructure network. With a goal of ensuring that the Department can maintain a safe, interconnected, and reliable transportation network, promoting economic prosperity and preserving the quality of the environment, in the face of uncertainty and change, FDOT recognizes that researching and planning for the risks associated with uncertain futures is paramount.

The Florida Transportation Plan (FTP) is the single overarching statewide plan guiding Florida's transportation future. In preparation for the next update of the FTP in 2020, FDOT contracted Mark and Marianne Barnebey Planning and Development Lab (BPDFL) of Florida State University (FSU) to augment FDOT's understanding about the influence of five different uncertainty areas (i.e. population, economic, environment, technology, global issue) on Florida's future transportation system and how these risks should be addressed in FDOT transportation planning processes from the FTP Vision, Policy, and Implementation Element updates. This project was conducted in two Phases by two Studio teams: Summer 2018 and Fall 2018 Studio Teams. This report comprises of the consolidated findings of Phase I-Identification and Assessment of Transportation Risks and Consequences, as well as the findings of Phase II- Evaluation of Alternate Futures and Strategies for Transportation Planning.

This report is structured with four chapters:

Chapter 1: Literature Review & Hazard Assessment – This chapter includes findings from the research the Studio Team conducted, gathering information from the literature review, guided by input from the stakeholder outreach process, in five areas of uncertainty.

Chapter 2: Consequence Identification & Stakeholder Outreach – This chapter presents the consequences identified in the literature review and a summary of the methods that were used to evaluate the impact of the identified risks on Florida's future transportation system.

Chapter 3: Planning Implications for Alternative Futures – The third chapter describes how the uncertainty areas lead to risks and how different regions of Florida State are likely to be impacted by the consequences of the identified risks in five alternative future scenarios (i.e. Return to Historic Growth, Rural Rediscovery, Global Trade Hub, Innovation Hub, Risks on the Horizon) outlined in the FTP Vision Element.

Chapter 4: Strategies for Long-Range Transportation Planning – The fourth chapter addresses the integration of risk management into transportation planning. A framework for risk assessment within each stage of the transportation planning process in the state of Florida was developed, and this chapter includes six specific recommendations for each phase of the transportation planning process.

Appendix A: Risk Assessment Strategies for Long-Range Transportation Planning – This white paper highlights the best practices from Florida Metropolitan Planning Organizations who planned well for risk in their long-range transportation plans and identifies gaps in risk-based long-range transportation planning so that MPOs may have an opportunity to further enhance their planning for the next cycle of LRTP updates.

Some key findings from planning implications of the non-risk based alternative future scenarios include-

- A Return to Historic Growth future scenario is most likely to affect coastal-urban followed by inland-urban Florida and be most impacted by population uncertainties
- The future of Rural Rediscovery is most likely to affect inland-rural Florida and be most impacted by both environmental and technological uncertainties
- Global Trade Hub future scenario is most likely to affect coastal-urban followed by inland-urban Florida and be most impacted by global uncertainties
- Innovation Hub future is most likely to affect inland-urban and coastal-urban Florida and be most impacted by technological uncertainties
- Achieving the goals of “Agile, Resilient, and Quality Infrastructure” and “Efficient and Reliable Mobility for People and Freight”, outlined in FTP Vision Element, would be most affected by risks in these alternative future scenarios.

The six key recommendations to address risk in various FDOT planning processes are:

1. Include resiliency in the face of risk as an overarching, guiding goal and conduct preliminary risk reviews
2. Determine if the accomplishment of the plan’s overall vision depends upon forecasted assumptions for Florida that are vulnerable to risk
3. Collaborate with stakeholders and industry partners to determine anticipated risks on the horizon

4. Evaluate comprehensiveness of risk inclusion in the plan using the Risk Assessment Tool
5. Conduct a risk-based alternatives exercise based upon the five alternative futures in the FTP Vision Element
6. Use the Risk Assessment Tool for final plan review and approval.

Overall, this report will increase FDOT’s understanding of future areas of risk that can be anticipated and the influences of those risks on Florida’s transportation network, and the contents of this report will help inform the 2020 Florida Transportation Plan update.

Introduction



Introduction

The purpose of this project is to increase FDOT's understanding of risk and the influence that risk has on Florida's transportation network with the intent of supporting the scheduled 2020 update to the Florida Transportation Plan. A second and equally important purpose of documenting future risk is to improve current planning processes to ensure that, in the face of uncertainty and change, FDOT can maintain a safe, interconnected and reliable transportation system, promoting economic prosperity and preserving the quality of the environment.

Background

The Florida Department of Transportation ("the Department") contracted with the Florida State University, Department of Urban and Regional Planning – Mark & Marianne Barnebey Planning and Development Lab ("BPDL"), the University of Florida, and the University of South Florida's Center for Urban Transportation Research to determine how risks and uncertainties should be addressed in the 2020 Florida Transportation Plan ("FTP") update. To provide the broadest and most objective input, the Department entered into the same scope of work with each of these research institutions with the caveat that they would work concurrently but without collaboration.

The BPDL approached the project in two phases, addressed sequentially by Summer and Fall 2018 sessions of the graduate capstone studio course, "Advanced Planning Problems" (the "Studio Teams"). The first phase of the project Phase I – Identification and Assessment of Transportation Risks and Consequences, & Phase II – Evaluation of Alternate Futures and Strategies for Transportation Planning.

Phase I: The Identification and Assessment of Transportation Risks and Consequences, addressed by the Summer 2018 Studio Team involved the completion of Tasks 1 and 2.

- **Task 1** – A combined Stakeholder Outreach and Literature Review context setting process and a Hazard Assessment of potential statewide planning risks in five categories: Population, Economics, Environment, Technology and Global Issues.
- **Task 2** – Consequence Identification: Documenting transportation assets at risk of impact by each type of uncertainty, the level of vulnerability of those risk implications, and overall statewide planning risks.

Phase II: The Evaluation of Alternate Futures and Strategies for Transportation Planning, addressed by the Fall 2018 Studio Team involved validating the approaches and results of Phase I, consolidating Phase I findings, and completing Tasks 3 and 4.

- **Task 3** – Evaluating Alternate Futures defined in the FTP to document their sensitivities to each of the five uncertainty areas and their risks.
- **Task 4** – Developing recommendations for incorporating risk considerations into long- and short-term planning processes.

The Florida Transportation Plan

The FTP is the overarching statewide plan guiding the development of transportation resources in Florida over a 50-year timeframe. It is a plan for all of Florida created by and providing direction to the Department and all organizations that are involved in planning and managing Florida's transportation system, including statewide, regional, and local partners. The FTP fulfills the requirements established in Chapter 339.115 of the Florida Statutes.

The FTP, which must be updated every five years, was last updated in 2015. The next official update will be due in 2020 and work to meet this deadline will begin in early 2019. This project was undertaken with the express goal of helping provide plan update stakeholders with the best available information on risk as it affects future transportation planning. The 2015 FTP is comprised of a Vision, Policy, and Implementation Element.

- The Vision Element provides the overview of major trends, uncertainties, opportunities, and desired outcomes shaping the future of Florida's transportation system over the next 50 years;
- The Policy Element defines implementable goals, objectives, and strategies for Florida's transportation future over the next 25 years;
- The Implementation Element defines the roles of state, regional and local transportation partners in implementing the Florida Transportation Plan and includes specific short and medium-term actions as well as performance measures.

Project Goals

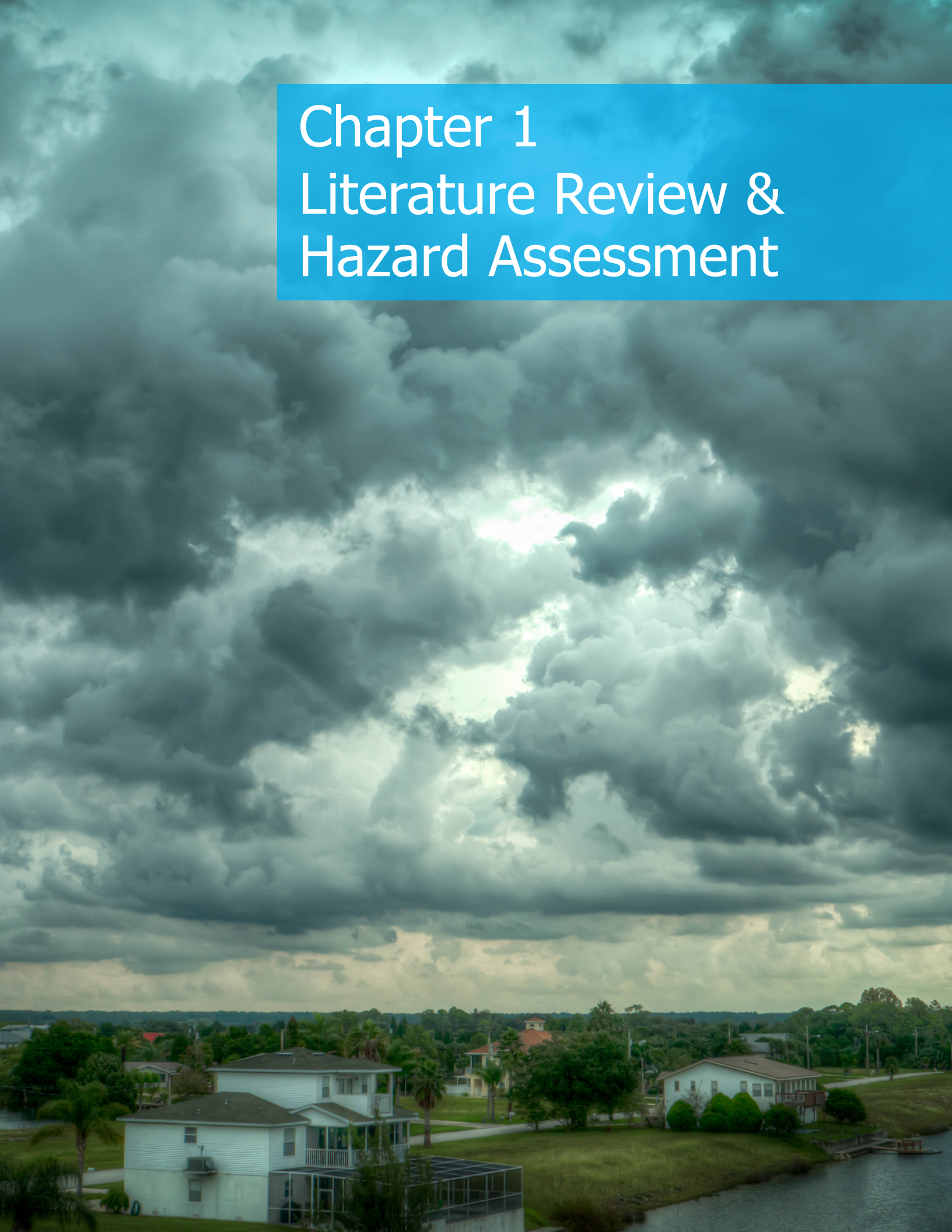
The Studio Teams focused on the 2015 Vision and Policy Elements as the starting point to conduct research efforts. The project provides insight into transformational factors that Florida may experience over the 50 year planning horizon, from 2020 through 2070. The project attempts to answer the following questions:

- How should Florida's transportation system evolve to support mobility in the future?
- How might the planning, policy-setting process, and implementation of the FTP change to accommodate risk and uncertainty?
- How might the FTP goal areas and visions of alternate futures change in response to changes in risk and uncertainty?
- How will this enhanced understanding of risk be incorporated into FDOT's day-to-day planning processes, from preliminary planning and design through project implementation?

Predicting the Future

Understanding the future is at the heart of long-range plans, including the 50-year FTP. The primary authors who helped guide the Studio Teams' approach to making future predictions were Michio Kaku, author of *The Future of Humanity* (2018) and other works of future speculation, and Philip Tetlock and Dan Gardener, the authors of *Super Forecasting* (2015). When questioned about how to feel confident in making predictions about the future, Kaku (2018) indicated that his approach is to interview as many "pioneers and trailblazers" involved in the cutting-edge research of today, and then envision a future where the results of this research and individual visions of the future come to fruition. Tetlock and Gardener (2015) offer a more concrete approach to guiding the methods of future predictions, including a "Ten Commandments for Aspiring Super forecasters." Based on these works, four guiding principles were established to help frame the project's research and analysis;

- **Divide and Conquer:** Risk is complex and multifaceted. In order to make sense of and describe risk and the impact it will have on future transportation systems and planning, risks were subdivided into five categories.
- **Expand Input:** No one person can accurately predict the future. A wide range of stakeholders representing expertise in each of the five risk areas was consulted to help guide the literature review and to offer an understanding of the primary concerns within each risk area. Further surveys and collaboration was used to help validate assumptions and findings.
- **Uncertainty Increases Over Time:** No future projection will be completely accurate. The longer the time-horizon, the more inaccurate a projection will be. Baseline conditions and trends within each risk area were identified so that prognostication could be based on a reasonable and defensible foundation of data and assumptions. Efforts also focused on developing flexible planning processes that can adapt to an uncertain future, instead of forecasting every future detail.
- **Influencers and Outcomes May be Interconnected:** In identifying risk, different risk categories and their consequences may interact or be acted upon by other external factors. The interconnections and synergies were identified and taken into consideration throughout the report.



Chapter 1

Literature Review & Hazard Assessment

Introduction

Foundational Research

All applied planning projects require foundational research to frame the study questions and inform the planning process. In structuring a research approach to inform Phase II of the project, the Studio Teams focused on five areas of risk and uncertainty for the future of Florida’s transportation systems:

1. Population
2. Economics
3. Environment
4. Technology
5. Global Issues

This section details the methodology and outreach processes used to gather information from stakeholders in these five areas as well as the literature review that was derived from the guidance and insights provided by the stakeholders. The purpose of the stakeholder outreach was to identify and validate planning risks by gaining insight from experts from a range of disciplines.

The literature review, guided by input from the stakeholder outreach process, was conducted to identify the best available documentation from academic research, planning documents, and popular media with the intent of gaining a comprehensive understanding of the vulnerabilities and risks identified in the stakeholder outreach process that Florida’s transportation system may face in the near future.

The literature review, as well as survey data from the stakeholder outreach process, are the foundations of the risk assessment portion of this project. The main question that this portion of the project seeks to answer is simple:

“What are the most significant areas of uncertainty for the future of Florida’s transportation system?”

This section will shed light on these areas of uncertainty by using Stakeholder data gathered by both Summer and Fall Studio Teams, focusing specifically on the top 3 areas of risk for each issue that were identified by survey data from experts in the field.

Methodology

Stakeholder Outreach

Both Studio Teams reached out to professionals in a variety of disciplines and organizations to gain a holistic perspective of the five areas of uncertainty that may impact Florida’s future transportation system.

The Summer Studio Team initiated the stakeholder data collection process by conducting formal interviews with experts from the private sector, government agencies, non-profits, academics, and non-governmental agencies, the distribution of which is illustrated in Figure 2.1. In addition to these interviews, the Summer Studio Team also sent out an online survey to experts to obtain further data. These survey results were used to better predict and measure the amount of impact each risk could have on Florida’s future transportation system.

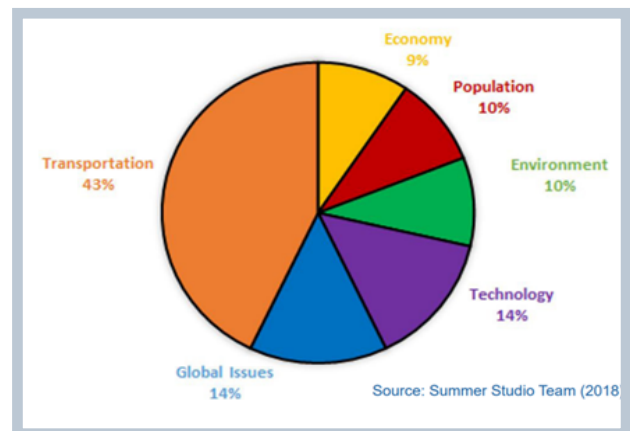


Figure 1.1: Stakeholder Organization

Source: Summer Studio Team (2018)

The Studio Team continued the outreach data collection process by resending an edited online survey to the professionals who were reached out to during Phase I as well as additional professionals with expertise in the five risk categories. The survey was modified slightly in order to better understand and validate the findings of the initial survey. The Fall Studio also sent a team to the 2018 Florida American Planning Association Conference where they deployed the survey for those attending. These survey results were used to validate the information that was gathered during Phase I.

Literature Review

Using the knowledge gained from the stakeholder outreach as a guide, the Summer Studio Team conducted a thorough literature review on the five risk areas and their three major corresponding factors. In this section of the report, the findings from the literature review are addressed in more detail than the synopsis of the stakeholder outreach findings that precede it. The literature that was analyzed consists of a combination of technical documents, academic reports, and news articles.

Geographic Contexts

Florida is a large and diverse state. The transportation risks identified in each of the five categories will have different levels of impact based on the geographic context and level of urbanization of each part of the state. For example, sea-level rise, will have greater impact on coastal cities than inland or rural areas. The Summer Studio Team defined four different geographic contexts to provide a framework to account for the differences between each context. These contexts are Inland-Urban, Inland-Rural, Coastal-Urban, and Coastal-Rural. The projected county populations for the baseline year of 2020 were used to define the urban and rural counties.

An additional refinement to the regional classification was added by defining counties as either inland or coastal, with coastal counties identified as those counties eligible for Coastal Partnership Initiative grants according to the Florida Department of Environmental Protection. Counties with the same classifications were dissolved into the four regions, Coastal-Urban, Coastal-Rural, Inland-Urban, and Inland-Rural. This compositional breakdown may have implications for management practices, because the number of assets and their perceived vulnerability will vary based on region.

Summary of Key Findings

The Summer and Fall Studio teams recorded stakeholder insights and referenced existing literature and research that helped better define risk, identify assets at risk to changing conditions, and analyze the interconnectivity between risks for Florida's transportation future. The contributing factors that these stakeholders identified included: population growth; demographic diversity; needs of limited mobility groups; generating revenue sources; income inequality; securing financing; changing landscapes; climate change; natural disasters; slow adoption of technology; user privacy; cyber security; emerging economies; geopolitical issues; and fuel dependency. The following sections will present the key findings of the stakeholder outreach and literature review processes divided by each major risk area.

Issue Area 1: Population

Florida is one of the fastest growing states in the country and is projected to experience continuous rapid growth over the next 50 years. As of 2018, Florida's growth rate was double the national average (BEBR, 2018), which may contribute to a greater demand for transportation resources. Who these new residents will be (demographic composition), where they will live, and how they will prefer to travel will shape the future of Florida's travel needs. Uncertainty surrounding each of these questions presents risks to the State's transportation network. Understanding how Florida's population will grow and change over time will enable the State to plan for these vulnerabilities.

Stakeholder Outreach Findings

During the Summer Studio outreach process, 10 percent of the survey respondents identified as population experts. In addition to the projected population growth, many stakeholders identified generational and demographics shifts as major uncertainties that will shape the future of Florida's transportation system. The Baby Boomer population is expected to send many retirees to the state, including some with mobility impairments. Additionally, migration trends are causing Florida to become a more demographically diverse state. Consequently, identifying the transportation needs of incoming populations is critical for success in Florida's future transportation system.

Through the outreach process, the top three areas of uncertainty that were identified are:

1. Population Growth
2. Demographic Changes and Shifts
3. Special Population

Literature Review Findings

Factor 1: Population Growth

Florida's growth and rate of growth will continue to increase, increasing the demand on transportation infrastructure. At the baseline year 2020, Florida is projected to reach a total population between 20.8 million and 22.6 million (BEBR, 2017). By 2045, Florida's projected population ranges from 24.5 million to 30.3 million. Figure 2.2 illustrates these forecasted population trends. The distribution of this growth may be as follows:

Inland-Urban areas are projected to have increases in population through 2070. From 2020 to 2045, these increases are expected to be between 100,000 to 200,000 permanent residents for Lake, Marion, and Sumter Counties. Orange, Osceola, and Polk Counties may have population increases exceeding 200,000.

Inland-Rural counties are expected to see a growth in population through 2070. Two of these currently rural counties are expected to develop into urban counties – Columbia County by 2045 and Putnam County by 2070.

Coastal-Urban counties are projected to grow in population through 2070. From 2020 to 2045, Santa Rosa, Sarasota, Collier, Manatee, St. Lucie, Pasco, and Brevard Counties may experience a population increase of 100,000 to 200,000. Lee, Duval, Palm Beach, Hillsborough, Broward, and Miami-Dade Counties may have population increases exceeding 200,000 permanent residents.

Coastal-Rural counties are also expected to experience population growth. Walton County, currently rural, is projected to become a Coastal-Urban County by 2040.

Furthermore, the southern and northeastern regions of Florida are expected to double their current size. Central Florida is also expected to experience a population boom.

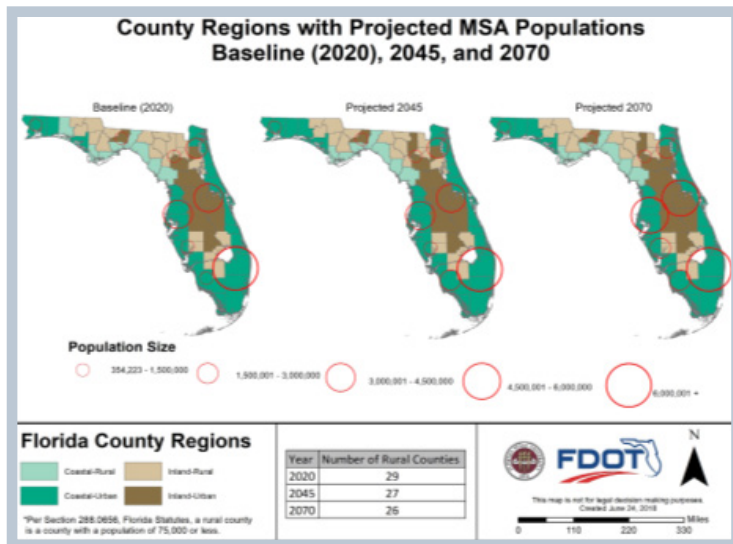


Figure 1.2: County Regions with Projected MSA Populations
Source: Summer Studio Team

Factor 2: Demographic Changes and Shifts

As the demographics of Florida’s population change, the transportation systems in Florida will need to adapt to suit the needs of the population. By 2045, it is expected that the share of Florida’s white-identifying population will decrease; conversely, racial and ethnic minority shares are generally expected to increase. Another trend is that by 2030, Generation Z (current ages 4 to 19) could increase by 13.1%, millennials (current 20-36-year old) by nearly 18.8%, Generation X (current ages 37 to 52) by 8%, and the baby boom generation (current ages 53 to 71) by 42% (Fry, 2018). Baby Boomers have constituted a large portion of Florida’s working age population in recent years; however, nearly one-third of Florida’s Baby Boomer population was entering retirement by the end of 2017 (EDR 2018).

Generational Travel Preferences

A generational analysis of transportation preferences revealed that:

- Baby Boomers prefer automobile use for leisure in early retirement, although driving eventually tapers off and they become passengers.
- Generation X also prefer driving and are more likely to possess a driver’s license than younger generations (Newbold & Scott, 2017).
- Millennials do not show the same proclivity for driving as previous generations; instead, they are more likely to utilize alternative modes of transportation.
- Generation Z may find driving to be less important (Bettendorf, 2017), but there has not been significant research yet to suggest they will choose automobiles less or more frequently than other generations.

Factor 3: Special Populations

In addition to transportation preferences varying from generation to generation, the growth of other demographic groups within Florida will result in a need to adapt to various transportation needs. The Summer Studio Team identified these groups as the elderly population, Limited English Proficiency (LEP) persons, and low-income residents.

Elderly Population

The term mobility is often used in transportation planning to denote the ease of movement through space (Levine, 2011). Urban planning recognizes that the built environment is important to allowing for mobility (Hirsch et al., 2017). This is especially true for the elderly population once they are no longer able to drive and must then rely on public transportation or walking to reach destinations. Uneven or discontinuous sidewalks, heavy traffic, and inaccessible public transportation are only a few characteristics of the built environment that can create barriers for outdoor mobility in later adulthood (Clarke, Ailshire, & Lantz, 2009).

Limited English Proficiency Persons

More than 10 million people in the United States are of Limited English Proficiency (LEP). These persons tend to rely on public transit more than English speakers (Siggerud, 2005). According to the 2015 American Community Survey (ACS, 2015) data, there is an estimated 2,167,671 persons in Florida who speak a language other than English at home and who have indicated that they speak English less than very well. Consequently, transportation planners statewide may have to ensure that infrastructure signage and marking are exemplified in a manner that is communicable to an increasing and culturally diverse population in Florida throughout urban and rural counties for the next 25 to 50 years.

Low-Income Residents

The Florida American Planning Association claims that attracting both millennials and older age cohorts involves providing affordable housing, a variety of housing types, transportation alternatives (transit, walkable, bikeable), and long-term support services such as money management and lifestyle transitioning assistance (Florida DEO, 2017). Both seniors and millennials benefit from proximity to goods and services, good connectivity, transportation options, and affordable housing options. Urban centers and transit nodes could serve this purpose, but housing is expensive. Increasing allowable density in these locations and requiring some affordable housing for seniors and millennials would be a responsive strategy.

Conclusion

The Studio Team analyzed research regarding trends in population growth, generational cohorts, and special populations. Their findings are in Phase II of this report, which determines potential consequences of these risks and what steps can be taken in response.

The **key findings** from the population section are:

- Two rural counties are projected to urbanize by 2045 and 2070 – both along transportation corridors in northern Florida.
- Growth is projected throughout most of the state. However, the southern and northeastern regions are expected to double their current size. A large population boom is expected in central Florida, as well.
- Generational living preferences may result in a higher demand to live in urbanized areas.
- Florida may have a significantly higher elderly population by 2045.
- Transportation planners will have to dedicate more resources to the needs of Limited English Proficiency Persons.

Issue Area 2: Economics

Transportation demand has always been closely linked to economic activity. How Florida's economy performs over the next fifty years will be a major determinant of the infrastructure capacity necessary to accommodate the State's transportation needs. An economic boom could worsen congestion, an economic recession could reduce the needs for capacity expansion, and the growth or decline of key industries such as tourism, innovation, or global trade could shift the location and nature of travel needs across the state. In addition, the future of Florida's economy will have a significant impact on how the State's transportation system will be funded. Florida will need to identify ways of creating additional revenue streams or figure out how to close the gap in the state's budget shortfall in other ways to fund its transportation system.

Stakeholder Outreach Findings

During the Summer Studio outreach process, 9 percent of the survey respondents identified as economics experts. The primary economics risk area that was identified in the outreach process was Florida's ability to address funding an increase in transportation demands. The availability of funding of funding sources for transportation is decreasing. Local governments contribute a majority of their economic resources to transportation, including basic maintenance and upkeep of transportation systems and assets. With Florida's increasing population, demand for transportation infrastructure may overwhelm available funding.

Additionally, gas taxes are also under pressure as people demand more fuel-efficient vehicles. In a future that relies more on public transportation and private transportation options that use alternative fuel sources, it is essential that Florida identifies more reliable and equitable methods of funding to support its transportation system.

Through the outreach process, the top three areas of uncertainty that were identified are:

1. Generating revenue sources
2. Securing financing
3. Income inequality

Literature Review Findings

Factor 1: Generating Revenue Sources

The decrease in traditional funding sources (e.g. tax revenues) for transportation due to restrictions has become a major concern for states, and Florida is no exception. It is important to have adequate revenue so that existing transportation facilities can be maintained and future projects can be funded. Federal and state revenues are the primary sources of funding for transportation projects in Florida. The federal government generates revenues from taxes on multiple items related to transportation and then distributes these funds based on discretionary allocations.

In a transportation context, funding can be best defined as the methods or means in which an organization can pay for transportation related services and/or expenses (NCSL, 2018). According to Akins (2015), however, it will be very difficult for the state to rely on traditional sources, such as motor vehicle fuel taxes, to fund transportation-related projects in the future due to fluctuations in fuel prices and consumption; this risk is exacerbated by the lack of political will by elected officials to raise fuel taxes. There is also the matter of the growing popularity of alternative energy sources within the transportation sector (e.g. electric vehicles). An incremental approach may be a solution in addressing the state's funding gaps due to the decreases in state and federal financing. A few options in addressing these gaps are to charge vehicles per miles traveled, raise sales tax rates, implement tolls, cut and divert funds, and raise gas taxes (Florida MPOAC Transportation Revenue Study, 2012).

Factor 2: Securing Financing

Securing financing for transportation is also an area of uncertainty. Existing transportation infrastructure requires constant maintenance. Planned projects often require extensive amounts of upfront capital to ensure that the levels of service and customer satisfaction are both being met. America 2050, an organization that focuses on future national planning, recommends that metropolitan areas implement strategies that involve expanding sources of revenue for transportation infrastructure (America 2050, 2018). It is essential for Florida to get creative in generating more funding for transportation.

Public-Private Partnerships (PPPs)

One promising solution is the use of public-private partnerships (PPPs). PPPs are very attractive for infrastructure investment because cost and risk burdens can be evenly distributed between the public and private entities. PPPs can also be attractive as an alternative funding source because of the prospect of limited federal funding. PPPs will help enable the FDOT to meet its goal for efficiency and reliability within its infrastructure, as stated in its FTP (Mallet, 2017). One example in which PPPs can be helpful in transportation is for contributing to the funding of building sustainable, low-carbon transport infrastructure and services for the future (Konrad Adenauer Foundation, 2015).

Additionally, private partners in PPP relationships can provide specialized expertise in low carbon transport as well as access to their highly efficient, market-refined systems. According to the World Bank Private Participation in Infrastructure (PPI) Database, the number of PPP infrastructure projects increased from 36 in 1990 to a peak of 121 in 2006. While the quantity of PPP projects has fluctuated over the last thirty years, the total investment in transportation infrastructure PPPs has increased from \$7.6 billion to \$55.3 billion between 1990 and 2014. The Summer Studio Team expects to see this trend increase, given the trends of limited and decreasing federal funding availability.

Tolls

Toll facilities in the 21st century are often operated by PPPs to generate revenue because of the decrease in public funding and limitations in financial equity. According to Kirk & Mallet (2018), highway toll revenue reached \$14.025 billion in FY2015. On an average, facility owners collected \$2.38 million per mile of toll road or bridge in FY2015 (Kirk & Mallet, 2018). All revenue from the toll facilities goes either to state and local agencies or to the private entities that run the facilities; the federal government collects no revenue from the tolls.

While vehicle use in Florida has increased since 2014, demographic trends and social changes could lead to slower growth in personal motor vehicle use; these trends would constrain any increases in toll revenues on existing or newly-tolled roads. If the number of users of toll roads were to decrease as personal motor vehicle use decreases, toll roads (new or existing) may not generate the necessary traffic and revenue to support their infrastructure. With this fact in mind, increasing toll roads may prove to be an ineffective strategy if personal motor vehicle use declines.

Additionally, increasing the average toll per mile may be a challenge because that can conflict with trucking interests as vehicles can be charged tolls by each axle. If the increases are too large, it could encourage motorists (particularly truckers) to use competing non-tolled routes. In short, tolls might yield limited success in generating revenue for transportation expenditures. Tolls, however, may be most successful in financing specific facilities such as major roads, bridges, or tunnels that may have heavy traffic and are located where avoiding the toll is difficult (Kirk & Mallet, 2018).

Value Capture

Value capture is an attempt to cover part or all of the cost of transportation improvements from landowners or developers that benefit from the resulting increase of value in real property. Examples of value capture are tax increment financing, special assessments, development impact fees, negotiated exactions, and joint development (Zhao et al., 2012). One entity where value capture is being used more extensively is with public transit, especially with joint development. An example of this type of development is a real estate project at or near a transit station that is pursued cooperatively between the public and private sectors (Government Accountability Office, 2010). Special assessment districts generate funding for specific projects for local governments. In these districts, properties within the boundaries are assessed a special tax for a specific purpose (Zhao et al., 2012). These mechanisms may serve to mitigate the risks of an economic recession or decreased transportation funding.

Factor 3: Income Inequality

Income inequality is also a significant source of uncertainty. There are concerns over trends in labor force participation, household income inequality, and transportation congestion challenges.

Labor Force Participation

At the national level, there are 41 states that have a higher Labor Force Participation Rate (LFPR) than Florida (Florida Employment Report, 2017). The LFPR is the percentage of the population age 16 and older who are employed or actively looking for work (Kromer & Howard, 2013). In Florida, the large number of Baby Boomers retiring has influenced the state's LFPR; age cohorts 65 years and older will make up 37 percent of the state's population from 2010 to 2020 (Florida TaxWatch, 2016). Another factor in influencing

the state's LFPR is the delay of younger generations getting into the workforce. A decrease in the LFPR may result in decreased demand on Florida's transportation networks, specifically during peak commuting hours.

Household Income Inequality

Low-income populations tend to have less access to a vehicle and are more reliant on alternative modes of transportation (Fletcher, Garasky, & Nielsen, 2005). With this in mind, prioritizing efficiency and reliability among all modes is important because of the social implications for low-income households. The average wages have not been keeping up with the increased cost of living (Asset Limited, Income Constrained, Employed [ALICE] Report, 2017). According to the Florida Chambers Jobs 2030 Report, a family of four would need to earn \$47,848 to afford basic needs (e.g. housing, childcare, food, health care, and transportation) (Florida Jobs 2030, 2017). As the quantity of low-income households increases, it is anticipated that Florida can expect to see an increase in demand for public transit and bikeable/pedestrian facilities.

Conclusion

The Studio Team researched and analyzed trends that pertained to revenue sources, securing financing, and income inequality. Phase II of this report further analyzes the potential consequences pertaining to these risks and the steps that need to be taken for mitigation.

The key findings from the economics section are:

- Florida should consider identifying alternative revenue mechanisms and further prioritize funding decisions to maximize existing available funds in order to fund its transportation infrastructure.
- Increases in fuel economy standards may pose a great threat to the collection of fuel taxes due to the decrease in fuel consumption.
- More public-private partnerships for financing transportation projects in Florida must be established.
- Florida should continue to take an incremental approach to directing solutions in order to increase revenues.
- Accessibility should be a priority for planners in making decisions that accommodate all people, with specific attention paid to addressing income inequality.

Issue Area 3: Environment

The natural environment in Florida is one of its most attractive features. Florida relies on tourism and natural assets to boost the state's economy and attract visitors. Planning sustainable transportation networks that conserve Florida's natural assets aligns with the 2015 FTP Vision element of developing solutions that will enhance the state's environment. Planning for a transportation network that conserves the environment and is prepared for environmental uncertainties is vital. Overall, the state is highly vulnerable to volatile weather events linked to climate change, resulting in a need for the Department's consideration of practices in design and mitigation to reduce the impacts of extreme weather events and natural disasters when planning Florida's transportation systems.

Stakeholder Engagement Findings

During the Studio team's outreach efforts, 10 percent of the survey respondents identified as environmental experts. The stakeholders agreed that the natural environment in Florida is one of its most attractive features. Florida relies on tourism and natural assets to boost the state's economy and attract visitors. However, the growing threat of natural hazards puts much of Florida's transportation infrastructure at risk. Consequently, the stakeholders confirmed that planning sustainable transportation networks that conserve Florida's natural assets and are prepared for environmental uncertainties is vital to Florida's future.

Through the outreach process, the top three areas of uncertainty that were identified are:

1. Changing landscapes
2. Climate change
3. Natural disasters

Literature Review Findings

Factor 1: Changing Landscapes

Today, Florida is seeing population growth which in the next 25 and 50 years will increase development trends of sprawl in rural areas and compact development in urban areas. The 1000 Friends of Florida (FOF, 2017), in collaboration with Florida Department of Agriculture and Consumer Services and the University of Florida's Geoplan Center, produced a report on Florida's expected development and growth patterns through 2070. This report found that if Florida's current development trends continue, more than a third of Florida's land is projected to be developed by 2070. This uncertainty of changing landscapes could detrimentally affect the environment and increase the risks to the transportation system if not planned correctly. The main risks associated with urbanization and sprawl are air pollution and flooding.

Sprawl is typically followed by an increased demand in transportation infrastructure (Parker, 2017). This can lead to more vehicle miles traveled, thus consuming more fuel and generating air pollution (Parker, 2017). Additionally, most transportation infrastructure operates at a low permeability rate; this means that water does not infiltrate the infrastructure. Sprawl and urbanization therefore could increase the risk of flooding. In a report published by United States Geological Survey, urban areas are more likely to suffer from flooding due to impervious surfaces replacing permeable soil (Konrad, 2003). The EPA also reports flooding risk is expected to increase with time due to factors of climate change (EPA, 2018). Flooding not only affects residents' mobility but also degrades the quality of transportation infrastructure, such as road erosion. Additionally, the Florida 2070 report from the 1000 Friends of Florida, found that development is expected to continue increasing along coastal areas and floodplains

(Carr & Zwick, 2016). If current land use patterns continue, Florida 2070 expects to see more development in high-risk flooding zones. An illustration of flood hazard risks in the state of Florida is included in Figure 1.3 below.

FDOT and other planning agencies need to prepare by planning their infrastructure strategically and by being ready to react to the risks of air pollution and flooding impeding people’s mobility. Emphasis should be placed on determining which transportation assets such as roads, public transit, and populations are most vulnerable to these risks. Transportation planners should seek mitigation efforts for flooding, such as implementing green infrastructure into transportation networks. Additionally, since land-use patterns affect the demand for transportation resources, a reduction in sprawl and an efficient use of transportation may help to reduce future transportation infrastructure costs and mitigate damage that is caused to the environment and air quality. To combat the risks of flooding and air pollution, the 1000 Friends of Florida (2017) suggests retaining open spaces by providing incentives to landowners, designing communities for multiple nodes of transportation, supporting funding for greenways and corridors, and lessening the impact of new development on open land. Additionally, the Florida 2070 report recommends compact development that is built away from floodplains. Looking towards the future, FDOT needs to be aware of the uncertainties of urbanization, sprawl, and the environmental risks that they may pose to Florida’s transportation system.

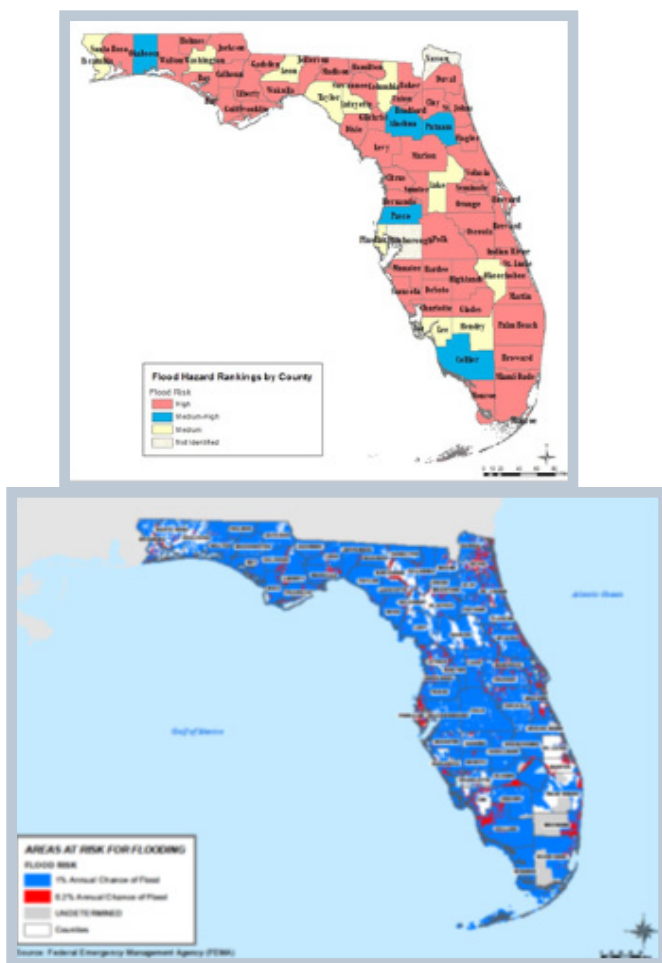


Figure 1.3: Flood Hazard Risks in Florida

Source: [FDEM, 2018 Hazard Mitigation Plan (both)]

Factor 2: Climate Change

Climate change is a global phenomenon, influencing the change in typical weather experienced in a region, thereby creating environmental concerns and hazards. Florida, being surrounded by the Atlantic Ocean and the Gulf of Mexico, is more susceptible to the impacts of climate change and sea level rise. The main threats identified as potential risks due to the effects of climate change in the state of Florida are sea level rise, extreme temperature and storm surge (Smith et al., 2018). Energy consumption in the transportation sector significantly contributes to the air pollution by emitting greenhouse gases such as CO₂, CH₄ and N₂O.

This in turn poses long-term impacts on society by degrading the air quality, adversely affecting public health, and negatively influencing agricultural production. Dependency on non-renewable energy consumption in different sectors is increasing greenhouse gas emissions, which will intensify the mean global temperature over the next twenty years (National Intelligence Council, 2017). A report by Kirschbaum (2018) noted that each degree Celsius of temperature increase could cause 2.3 meters of sea level rise and accelerate the rate of storm surge. **Figure 1.4** illustrates the impact of high sea level rise (126.3 cm ~ 1.26 meter) on the state of Florida, indicating that the coastal areas are going to be directly affected by this risk.

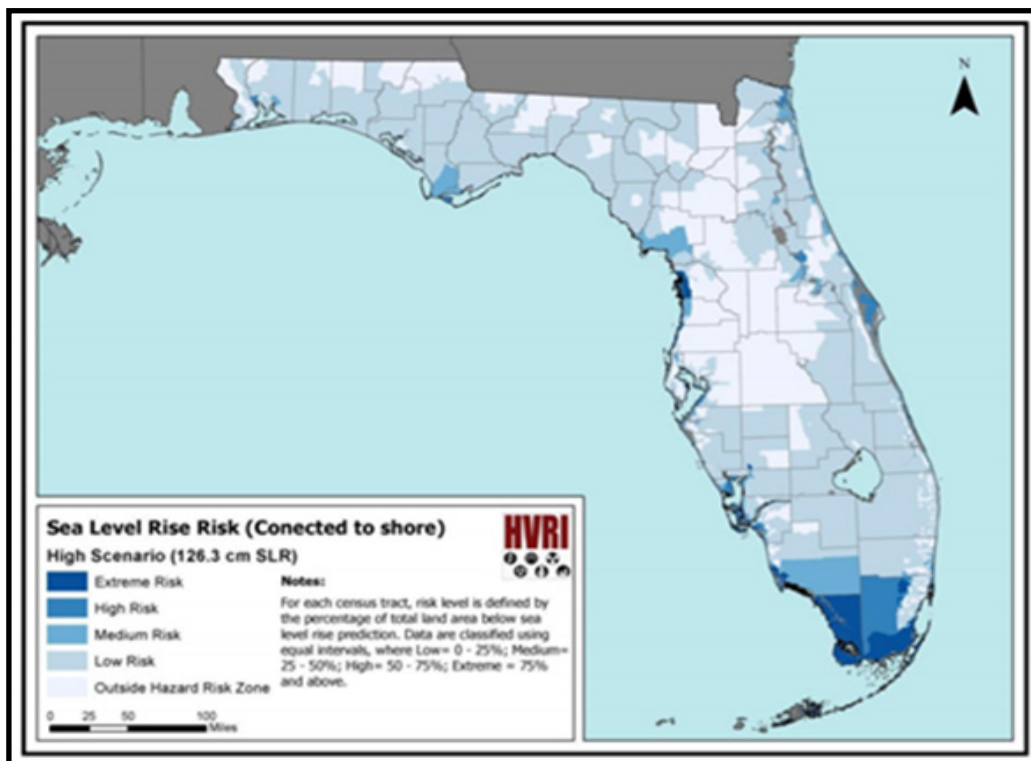


Figure 1.4: Scenario of Sea Level Rise in Florida

Source: University of South Carolina, Hazard and Vulnerability Research Institute, 2014.

These extreme weather events and sea level rise may adversely affect Florida’s urban coastal communities (Sadler et al., 2018). Comparatively, urban areas are more vulnerable to the effects of these extreme temperature events than rural areas. The higher intensity of development and asphalt-made structures in urban communities absorb and retain more heat than they reflect. This prolonged period of heat engenders the urban heat island effect, stressing critical transportation infrastructures as well as impacting the public transit riders, pedestrians and bikers. An extended period of extreme temperature can be expected to also increase wildfire occurrence, threatening surrounding transportation infrastructures and communities (National Research Council, 2008).

Another research finding identifies thirteen Florida cities among the top cities projected to observe maximum heat index days above 105°F by 2050, which clearly shows that Florida is steadily experiencing growth in temperature (Kenward et al., 2016).

If the trend of heat surge continues, then Florida is expected to face an overall increase of 1-degree Fahrenheit by 2045 and a 2- degree by 2070; the consequences of this can severely affect the State’s elderly population (Cheng, et al., 2018). Further, there is great vulnerability for widespread coastal areas to experience storm surge due to global warming reaching at least 4 feet above high tide by 2030, and 5 feet by 2050 (Strauss, n.d.). According to Wuebbles (2016), however, the impacts of climate change are likely to increase the total costs to the transportation system and their users. A wide range of adaptive actions, though, can reduce the impacts. In this sense, FDOT should create a long-range transportation plan that incorporates temperature variability and resilient infrastructures to withstand the probable environmental risks of climate change. Proper materials should be used to combat extreme heat effects, and adequate shade or cover should be provided at wait stations to mitigate heat risks to public transit riders. A graphic describing impacts of climate change on transportation infrastructures as discussed above is included below as Figure 1.5.

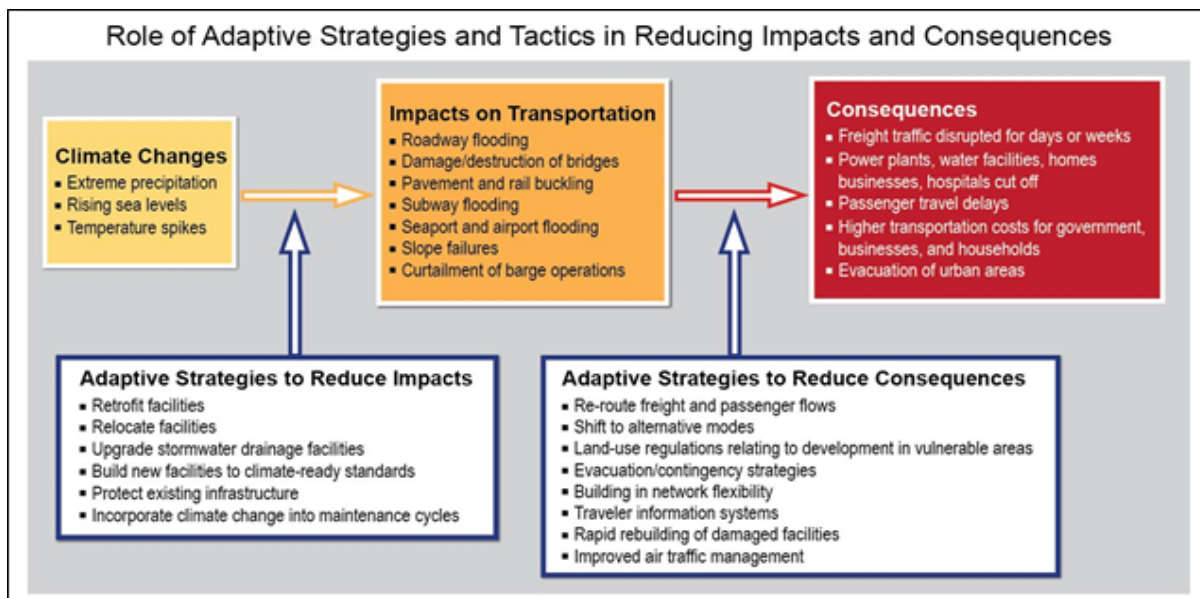


Figure 1.5: Role of Adaptive Strategies and Tactics in Reducing Impacts and Consequences

Source: Wuebbles (2016)

Factor 3: Natural Disasters

Natural disasters also contribute to the environmental area of uncertainty. Being intensified by climate change, natural disasters pose a substantial threat to Florida's transportation infrastructure with concerning issues like extreme, acute weather events, fire hazards, and sinkholes. The World Economic Forum (2018) ranked extreme weather events as the most likely risks to occur and those with the greatest impact. Using the unusually active Atlantic hurricane season of 2017 as an example, the World Economic Forum showed the possible level of disruption to critical infrastructure caused by these tropical storms. Florida is exposed to a frequent vulnerability of catastrophic hurricanes, which can leave transportation infrastructure and assets in disastrous conditions. Sinkholes, naturally occurring geological features, are also one of the predominant landforms in Florida that pose a hazard to transportation assets and the environment. The presence of sinkholes has increased since 2014 (Bodenner, 2018), impacting water quality and environmental resources by draining streams, lakes, and wetlands, and creating pathways for transmitting surface waters directly into underlying aquifers (Tihansky, 1999).

Geographical location has placed Florida more at risk than other states regarding tropical cyclones, for which vulnerable coastal areas undergo the effects of numerous hurricanes almost every year. Research by Walsh and his colleagues (2014) predicted the average intensity of tropical cyclones to increase by 2-11%, while the frequency is expected to decrease by 6-34% by 2100. Despite the possibility of lower frequency in the future, the uncertainty in the long-term prediction of tropical cyclones makes it difficult to take proper measures beforehand. Additionally, when investigating transportation vulnerabilities in Kentucky, Blandford, Schurman & Wallace (2018) found that sinkholes and flooding are likely to cause temporary road closures, roadway damage, or problems with drainage and rainwater runoff. Another study by Shenk (2018) noted three weeks of road closure in Virginia caused by sinkholes that required adjusting red-light signals

by VDOT to change traffic patterns. FDOT planners should consider in their long-range transportation planning how to overcome the negative effects, like these, of natural hazards on transportation infrastructure. Since the frequency of tropical cyclones cannot be projected to 2045 or 2070 with a degree of certainty, the annual likelihood and expected increase in overall magnitude makes them a high risk for long range transportation planning (Smith et al., 2018). Therefore, technological advances and improved methodology to forecast the frequency and expected severity of tropical cyclones can support the development of preventive infrastructure practices to withstand this natural hazard (Smith et al., 2018).

Conclusion

When planning for the resiliency of Florida's transportation system over the next 50 years, it will be important to understand the environmental uncertainties that may be faced. Through data collection it was found that changing landscapes, climate change, and natural disasters will pose risks in the future to Florida's transportation network. Each of these uncertainties and their associated risks may affect transportation infrastructure as well as people's mobility. By planning with consideration of the environment, the Department has an opportunity to lead other sectors in adopting resiliency initiatives that both support the environment and transportation networks.

The **key findings** from the environment section are:

- Florida is expected to see development trends of sprawl in rural areas and compact development in urban areas.
- Florida's environment is extremely vulnerable to impacts of climate change.
- Natural hazards are continuing to increase in intensity, creating continuous uncertainty and threaten the welfare of Florida residents.

Issue Area 4: Technology

By 2070, Florida’s modes of transportation and supporting infrastructure will have undergone significant structural changes. This is an important issue area because new technology and innovation are expected to replace existing transportation networks with which there is predictability and familiarity. Examples of new technological changes on the horizon include Autonomous Connected Electric Shared Vehicles (ACES) and increased reliance on mass transit systems such as light rail, high speed rail, and bus-rapid transit (BRT). Additionally, intelligent transportation systems (ITS) currently exist and help with traffic management, weather monitoring, crime reduction, and ridership monitoring in many urban areas.

Stakeholder Engagement Findings

During the stakeholder outreach process, fourteen percent of the survey respondents identified as technology experts. Respondents believed that it is imperative for the state of Florida to utilize innovative technological advancements to ensure that its transportation network continues to serve the needs of people and goods in the future. However, technological advancement is always accompanied by disruptions and challenges. The most common concerns among respondents were the high level of uncertainty in the ability to predict when specific technological changes may occur; how rapidly new technology or approaches could replace an existing system; the types of potential advancements in transportation technology; and the future riding capabilities that may become available. In short, the Studio Team has identified the top three contributing factors for this area of uncertainty as being:

1. Slow adoption of new technology
2. User Privacy
3. Cyber Security

Literature Review Findings

Factor 1: Slow Adoption Rate of New Technology

ACES (Automated, Connected, Electric, and Shared vehicles) are expected to revolutionize and impact all transportation modes in the next 25 to 50 years. ACES encompass technological advancements in vehicles, energy sources, adoption rates, and impacts to the natural and urbanized environment as well as transportation assets in Florida. While technology may not yet reach the age of the Jetson’s flying car, by 2070 the changes to Florida’s modes of transportation, and the infrastructure supporting them, are forecasted to undergo radical changes. The following graphic, **Figure 1.6** Levels of Autonomy in Technological Transportation Advancements, shows the increasing levels of automation beginning with no autonomy and ending with full vehicle automation that can be expected in the future.

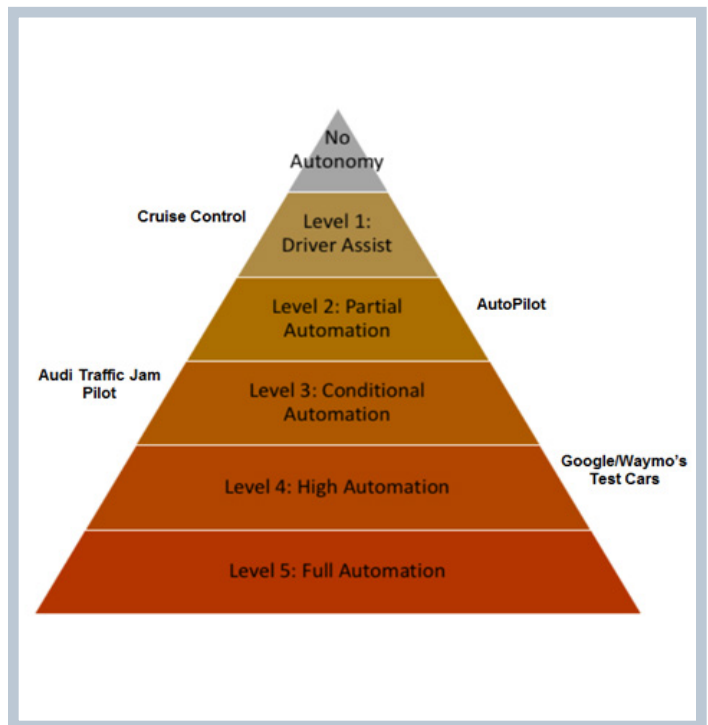


Figure 1.6: Levels of Autonomy in Technological Transportation Advancements

Source: NHTSA (2017)

Autonomous and Connected Vehicles (AV)

AVs are expected to significantly impact the built environment and urban form including the size of traveling lanes, the demand for parking and drop-off areas, and the potential of redevelopment opportunities (Chapin et al., 2016). By 2030 almost 70% of new cars on the market may have self-driving features and at least 15% of new cars are anticipated to be fully autonomous (Desjardins, 2018).

Connected and electric vehicles (EV) will be equipped with enhanced safety notification capabilities to alert passengers on upcoming traffic conditions and active routing. The level of EV adoption rate depends on regional and local regulation pushing and the level of consumer EV ownership pulling (Mckinsey, 2016).

Shared Autonomous (automotive) Vehicles (SAV) are the next evolution of ride-sharing, as individual car ownership proves to be an expensive and inefficient mode of transportation. This shift in shared mobility allows customers to find the ideal solution for each type of trip, which may create new sectors of specialized vehicles designed to address specific needs (Mckinsey, 2016). Based on the literature, slow adoption of new SAV technology was identified as a potential risk.

Factor 2: User Privacy

Control Systems

Control systems are one of the primary components of a sophisticated integrated transportation system. Smart streetlights are a form of technology infrastructure that have the possibility of providing more energy-efficient lighting, detecting weather attributes, detecting potential crimes, and monitoring real-time street traffic conditions. Spice (2017) cites that the City of Pittsburgh's adaptive traffic technology has improved traffic conditions by reducing motor idle time by 40 %, travel time

by 25% and braking by 30%. U.S. DOT (2018) fact sheet states smart traffic systems will have continuous software, communication, and hardware incompatibilities, which may need to be addressed by the Department in the future.

Monitoring and Enforcement

Integrated transportation systems planning include monitoring and enforcement strategies such as red-light cameras. Red-light cameras are a controversial form of traffic controlling technology intended to save lives. Proponents argue red light cameras hold red-light violators responsible for proceeding through a red-light intersection. Red-light cameras catch these people through video recording and captured photos, preventing fatal accidents with other motorists, pedestrians, and cyclists due to their deterrence of motorists proceeding through a non-green-light intersection.

Opponents argue that red-light cameras are a money-generating practice implemented by cash-strapped local governments and that while red-light cameras may prevent fatal head-on collisions, but they are more likely to cause more rear-end collisions from drivers slamming on their brakes in fear of receiving a red-light related citation (Bryan, 2018).

The research indicates that, within 20 to 30 years, smart transportation systems may have advanced to the point where vehicles may communicate with each other without human influence or interaction. Sensors within vehicles and embedded within the roadway may not only be designed to observe traffic conditions and transmit data to the central traffic control system, but these sensors are also expected to make vehicle travel seamless and safer.

Overall, upgraded traffic control systems as well as transportation monitoring and enforcement strategies will rely heavily on the relationship and integration of new technology the State's transportation system.

These systems will often include gathering, analyzing and implementing user information regarding photos, records, location services and other collected personal data that will improve the efficiency of a well-connected network. Although this new system will be more communicative in nature, it creates a risk of user privacy, where users of the transportation system will have less control on how their personal information will be collected, used and distributed.

Factor 3: Cyber Security

Infrastructure and other critical assets are a contributing factor to the technology area of uncertainty. Cyber security is identified as a potential planning risk to Florida's transportation system across all methods of transport, which include land, maritime (i.e. water), and aerospace.

Land Transport

Land transport is an essential component to multimodal transportation because land connects with the two other critical methods of transport: water and air. Land transport infrastructure and transportation assets are directly influenced by technological improvements.

There are indirect advances in construction technology that may influence bridges, roads, and other megastructures such as a 3-D modeling process for managing project information; increasing internet connectivity at sites; 3D laser scanning and drone-generates surveys; and adopting of machine guidance and GPS in smaller projects in the next 25 years (Construction Executive, 2017).

Maritime

Maritime transport infrastructure and transportation assets are directly influenced by technological improvements. Technological advances in water transport require attention primarily on harbors, seaports, and canals. Understanding the implications of planning risks to 2050 in maritime trade is important because of potential consequences connected to social, economic, technological and environmental developments across the globe. Technological advances may lead to shipping automation and autonomous operations at shipping ports, which may then affect the kinds of international goods and services that are typically processed.

According to the Global Maritime Technology Trends 2030 (GMTT2030, 2015), technological advances in maritime include: a) ship design and construction, and b) modifications that will improve safety, commercial, and operational performance. New materials constructed using lightweight carbon-nano technologies have the capability to increase water vessel efficiency and maximize usage (GMTT 2030, 2015). Advanced manufacturing strategies including 3-D printing capabilities can speed up construction, maintenance and repairs. Lastly, security advancements including electronic warfare and cloud-computing applications addressing product data are predicted to streamline the supply chain processes as well as imports and exports (GMTT 2030, 2015). Transportation planners and other decision-makers in the state should continue to monitor trends in supply chains and maritime travel to mitigate the risk of infringing cyber security.

Advanced materials are expected to carry many risks and uncertainties from the development of lightweight materials which are cheaper to produce and manufactured utilizing carbon-nano technology; however, carbon nano-tube reinforced composites are lighter (GMTT 2030, 2015). These materials have the capability for shape optimization that can be morphed to increase water and underwater vessel efficiency and maximize power use. Additionally, advanced manufacturing may benefit from the development of materials that address new challenges. Beneficial to advanced manufacturing are 3D printing capabilities that manufacture low-cost products and systems, which includes the transport sector (GMTT 2030, 2015). Moreover, cloud-computing applications, utilized for product data, aid with improving product mobility; further, advance manufacturing may allow on-board maintenance and repairs. Lastly, GMTT 2030 (2015) noted that cybersecurity and electronic warfare places numerous threat critical assets throughout the State over the decades to come.

Aerospace

Technological advancements in assets (i.e. aircrafts and drones) and infrastructure for air transport are critical to the multimodal network. In general, the literature supports the suggestion that air traffic forecasts are bound to increase within the next 25 years due to increasingly favorable economic conditions globally as shown in Figure 2.11 (International Aviation Civil Organization, 2016).

Technologies that may change air transport include advancements in manufacturing such as 3D/4D printing, ultra-light metal alloys, hybrid & smart materials, improved engine technologies, new wing designs, new inner designs, hybrid rocket technology to even all electrical aircraft

Space Industry

According to Buck (2010), by 2035 the space technology and operating environment may look different due to technological trends in two fundamental areas which were identified as spacecraft and space transportation; this includes space technologies, capabilities, products, and services which may become more affordable, ubiquitous, globally available, and interconnected. It is difficult to project what the aerospace industry will look like past 2045 , especially because the trends of increasing blending of aviation and information technology, are blurred; this is exacerbated if those sectors are integrated within enterprises that want to take advantage of increasing integration (National Academic Press, 2018).

Conclusion

To summarize, the identified planning risks associated with technological advancements include:

- Slow adoption of new technology
- User privacy
- Cyber security

When developing transportation services and networks that prioritize mobility in the future, FDOT should embrace the emergence of shared and automated vehicles over the next several decades in Florida. The 2015 FTP Policy element highlights that this is effectively a new goal; further exploration of the contributing factors – ACES, ITS, and infrastructure and assets in transportation – may be critical as they are interrelated in addressing the potential risks identified to be associated with technological uncertainties in statewide transportation planning.

Issue Area 5: Global Issues

Population growth, political shifts with economic implications, and urbanization are expected to impact transportation issues globally. In Florida, transportation planners must be cognizant of trade agreements, political climates, and emerging markets. These issues will contour Florida's future economy. Advocates of Florida's transportation system should engage with political and public policy actors to advance sufficient transportation policies. Failure to do so may lead to insufficient resources and development for Florida's future transportation system.

Stakeholder Engagement Findings

During the stakeholder outreach process, fourteen percent of the survey respondents identified as global experts. Respondents identified a number of global issues that could impact the performance and infrastructure of Florida's transportation network within the next several decades. Global issues may have a particularly strong impact on how Florida's economy will grow in an increasingly global market, as well as how Florida's population will grow through immigration. In these ways, respondents agreed that several factors could shape Florida's future transportation demand.

Through the outreach process, the Studio Team has identified three contributing factors for this area of uncertainty:

1. Geopolitical issues
2. Fuel dependency
3. Emerging economies

Literature Review Findings

Factor 1: Geopolitical Issues

An array of possible geopolitical issues, such as the threat of terrorism and global conflict, were identified as being possible factors impacting the future of demand on Florida's transportation network. FDOT should be aware of key indicators of impending crises, such as rising international poverty levels and volatile oil prices. This awareness can help predict the coming to fruition of the effects of these issues.

Refugee Immigration

Geopolitical issues and conflict could result in the mass in-migration of refugees, displaced peoples, or those fleeing volatile situations or epidemics/pandemics. This influx of people would increase demand on the roadways and require an increase in provision of public transportation. Furthermore, international immigrants would not necessarily be fluent in the English language or American driving practices and principles. A review of wayfinding and signage would be imperative to ensure the safety of commuters of all kinds: pedestrian, cyclist, public transit rider, and motorist.

The future displacement of citizens facing climate change is another possible risk. While Florida itself (specifically south Florida) is set to experience increased threats from climate change, those who reside in southern or international coastal areas that are prone to even greater levels of environmental consequences could view Florida (especially northern or inland) as respite either temporarily or permanently. Regardless of cause, any mass in-migration of people would exponentially increase the demand on Florida's aging transportation infrastructure (Goodell 2018).

Effects on Commodity Pricing

Additionally, effects stemming from larger events and conflicts can include the sudden and/or unsustainable change in the price of commodities; this price change could impact two of Florida's major industry sectors: tourism (national and international) and agriculture. Changes in oil prices will impact the volume of visitors to the state of Florida, thus impacting the demand on its highways, toll roads, and surface streets. As agricultural commodities pricing fluctuates due to global issues, Florida will also see a fluctuation in the usage of its highway shipping routes by freight trucks.

It is important to note that conflict is not confined to other nations. The World Economic Forum found that the increasing polarization of the U.S. and its politics could have long-term effects in the transportation industry (World Economic Forum 2018). Any conflict affecting the price of oil and its commodities, as well as the business relations between two states, could also pose as harmful (World Economic Forum 2018); this could result in shifts in demand on Florida's highway systems.

Factor 2: Fuel Dependency

The impact of oil availability and pricing is anticipated to have an effect on the demand placed on the Florida transportation system. Beyond those effects as described in the Geopolitical Issues section above, the Intergovernmental Panel on Climate Change (IPCC) estimates that there could be an increase in global urban dwellers. The IPCC also forecasts that up to 68% of the world's population will reside in urban areas, which will increase transportation demands for commuting (IPCC, 2014). This will only serve to increase consumption of resources and alter ingrained mobility patterns. While transportation technology could serve to improve energy outcomes within the next several decades, the current rate of energy consumption could outpace any significant improvements. The IPCC further asserts that there is a correlation with an increase in urbanization resulting in an increase in income, and an increase income subsequently correlating with a higher consumption of energy and greenhouse gas emissions. FDOT should maintain awareness of this trend and incorporate alternatives to independent, automotive transportation methods in its long-range planning to combat this disturbing and detrimental trend.

Factor 3: Emerging Economies and Markets

As globalization increases, the effects from emerging economies within developing areas in the world (e.g. Latin America and the Caribbean) could cause shifts in the existing chain of economies and relations between states. Florida is a gateway of commerce for many countries (Enterprise Florida, 2018a), allowing for convenient dispersal of goods via the extensive infrastructure throughout the state. This includes a number of ports (generally within urban areas), hundreds of airports, and tens of thousands of miles of road, including easily accessible highways.

Ousley (2015) highlights the extent to which Florida serves adjacent regions. Nine out of the top ten agricultural export markets in the Americas, thus Florida ports are also significant in terms of the economic relationships with the ports of the Carolinas and Georgia. Further the recently-expanded Panama Canal and the construction of the potentially forthcoming, even more robust Nicaragua Canal will impact the direction and use of shipping routes across the state of Florida. The Florida Ports Council (2018) noted that there is potentially a realignment of global trade routes as a result of international infrastructure and canal investments; thus, the state of Florida should strategically identify and plan for an increase in volumes in those identified trade routes.

Another point for consideration is how emerging economies will overtake the traditional economic partners of the U.S. As shifts in economic powers around the world occur, there will be implications for Florida in terms of shipping and logistics, trade competitiveness, and the potential access to new markets. This will all have an impact on Florida's transportation network. The economies of China, India, and Brazil (notably Florida's current top trading partner and export destination) are poised to become greater priorities for the U.S., both through increased utilization of ports and through increases in demand for air travel by their citizens (Goldin 2014). International tourism, as mentioned above, has also increased substantially within the past several years; citizens from more traditionally developing economies are experiencing shifts in their own markets. This will act both as a boon to tourism, but also as a strain on aviation, public transit, and roadway infrastructure (Buckley, et al. 2015).

Further, there is global trend of shifting industry mixes from manufacturing economics to services economies. This results in changing domestic and international demand and consumption for local and imported goods, which will have impacts on shipping patterns and thus Florida’s transportation network. **Figure 1.7** illustrates how the industry mix for three emerging economies, China, India, and Indonesia, is projected to shift over the next forty years. China, for example, is transitioning from a traditionally manufacturing and export economy to a service-oriented economy. As such, its demand for imported goods is increasing. Therefore, Florida can expect to see an increase in North American-made goods shipping through the state of Florida by freight truck or rail and exported out through its ports.

Conclusion

The literature review and stakeholder outreach findings identified a number of possible risks and influences on the transportation system of Florida, within various contexts:

- Climate change could result in the severe displacement of large amounts of people, increasing local Florida populations and thereby the demand on its roadways and public transit systems.
- The use of finite resources, and emerging technology will not only affect the greater economy at large, but also how users of Florida’s transportation system interact with it.
- Developing countries, particularly India, China, and Russia will continue to emerge as greater economic powers, thereby increasing the demand on and influencing the function of Florida’s transportation system

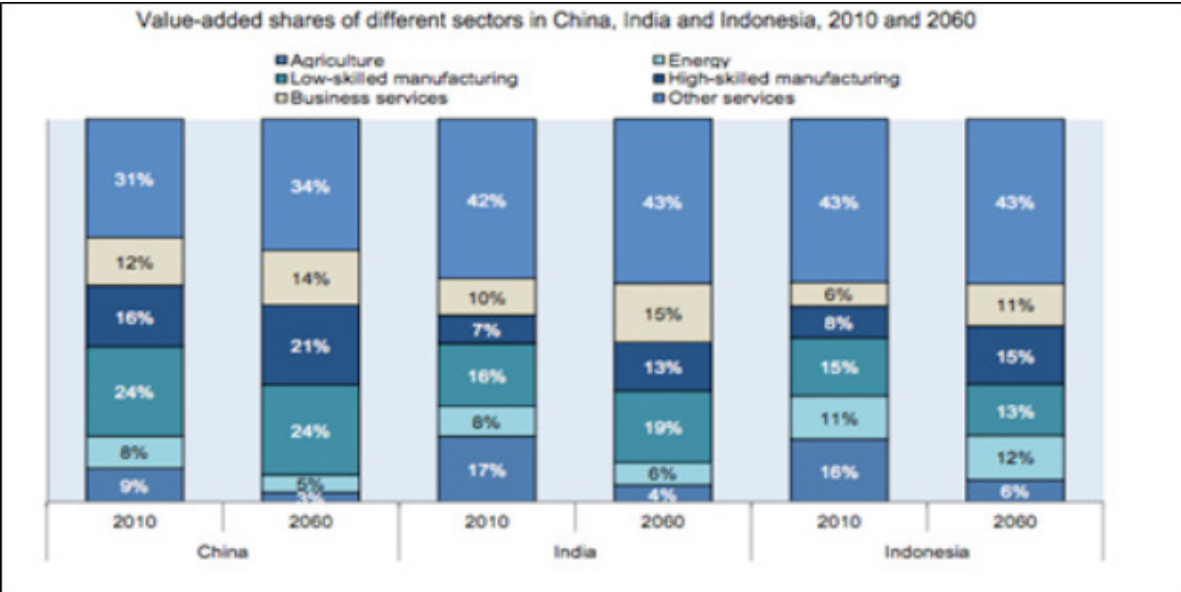
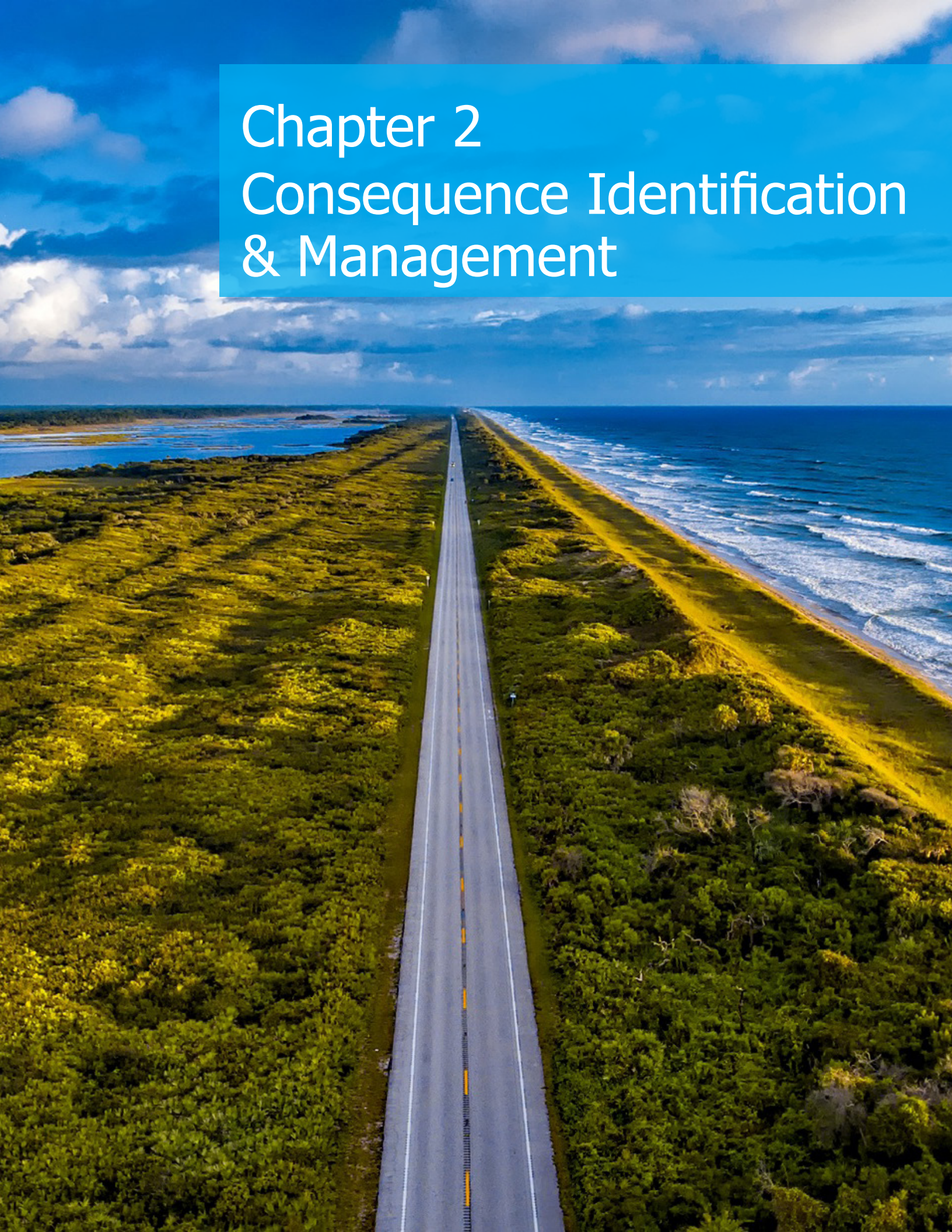


Figure 1.7: Industrial Structures Set to Change in Emerging Economies
 Source: Chateau et al. (2014)

Chapter 2

Consequence Identification & Management



Introduction

Building on the finding of Chapter 1: Literature Review and Hazard Assessment, this section provides a summary of the methods that were used to evaluate the impact each risk identified in Chapter 1 could have on the future of Florida's transportation system. This section also exhibits important findings and validation of these methods.

There are two components to this section of the report:

1. **Phase I** - Methodology and Findings
2. **Phase II** - Validation of Results

Phase I explains the methods the Summer Studio Team used to measure the risks to Florida's future transportation system, develop an asset inventory, identify assets at risk, and evaluate the relationships between the various risks and assets. Phase II then details the methods the Fall Studio Team used to review and validate the Summer Studio Team's results to ensure the data was accurate and effective for use in Tasks 3 and 4.

Methodology and Findings

The methods that were used during Phase I were broken into three components: 1) Potential Uncertainties and Assessment of Risks, 2) Assets At-Risk, and 3) Consequence Identification and Management. For the first component, the Summer Studio Team discussed the risks identified through a literature review and stakeholder outreach process, reviewed their potential synergies, and calculated a risk rating score. In the second component, the Summer Studio Team applied the risk rating score to evaluate the assets at-risk in Florida. In the final component, a total risk score was developed based on the findings from the other two components.

The first component of the methodology from Phase I is Potential Uncertainties and Assessments of Risks. During this step, the Summer Studio Team identified the potential risks under each area of uncertainty from the literature review and stakeholder interviews with over twenty stakeholders from varying field of work or research. Then, the hazards posed by each risk were classified on a five-point scale, with one being the least severe and five being the most severe. Afterwards,

a Stakeholder Risk Assessment Survey was conducted to survey professional planners. The Summer Studio Team also approached other representatives from different private and non-governmental organizations who are involved in environmental planning and hazard mitigation to participate in the risk assessment survey. They created a list of questions intending to gauge stakeholders' perceptions concerning the risks identified and contacted the stakeholders via email with an online survey link. The Studio Team also requested that the stakeholders forward the survey to their colleagues who might have important insights regarding one of the five areas of uncertainty. Overall, there were a total of 52 survey participants in the risk assessment survey, and the results were used to develop a risk rating for each risk identified.

The risk rating was calculated by taking the average potential degree of impact for the risk from the survey data and multiplying it by the average likelihood of the risk occurring. Next, a risk rating scale was developed to create a qualitative assessment of the survey results based on categories of "High" (H), "Medium" (M) and "Low" (L). Then, heat maps were created which showed the average likelihood of the risks versus the impact of the risks for each of the five uncertainty areas, as well as a map that displayed the average risk rating for all five areas of uncertainty. These findings are shown in Figure 2.1 through Figure 2.6 below.

The final part of the methodology in this component was the calculation of synergy score. The methods that were used during Phase I were broken into three components: 1) Potential Uncertainties and Assessment of Risks, 2) Assets At-Risk, and 3) Consequence Identification and Management. For the first component, the Summer Studio Team discussed the risks identified through a literature review and stakeholder outreach process, reviewed their potential synergies, and calculated a risk rating score. In the second component, the Summer Studio Team applied the risk rating score to evaluate the assets at-risk in Florida. In the final component, a total risk score was developed based on the findings from the other two components.

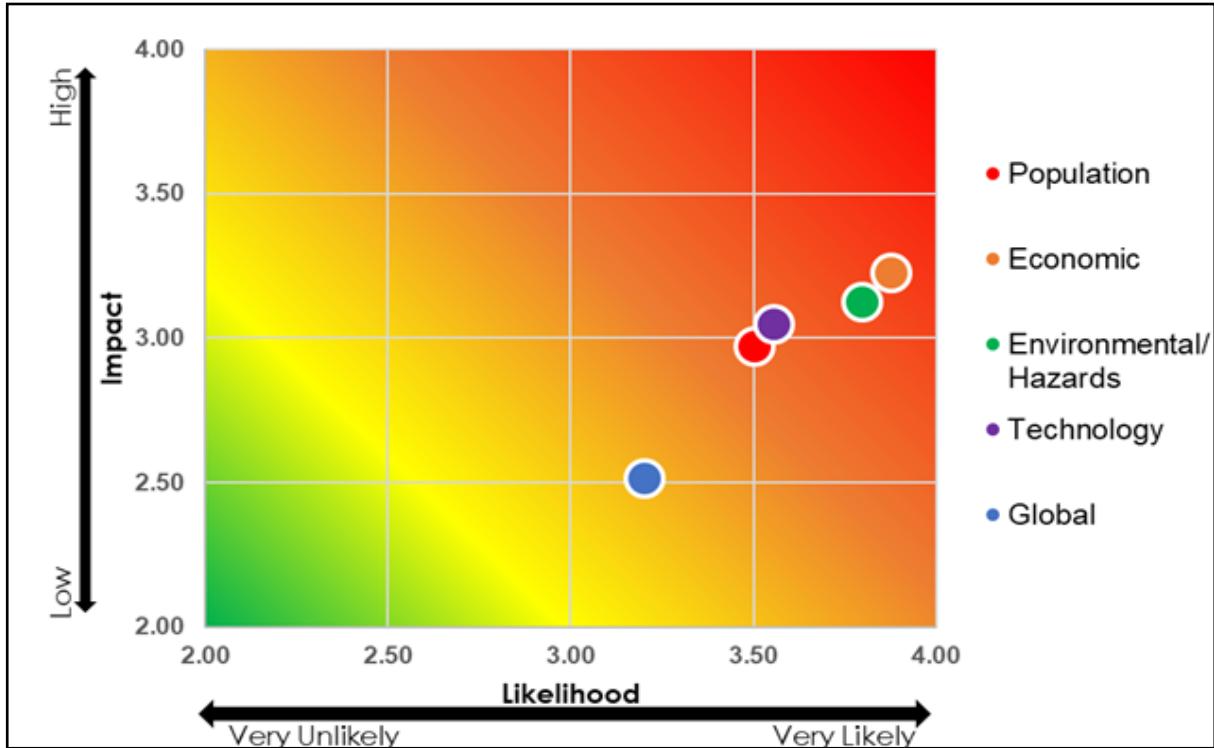


Figure 2.1 Uncertainty Area Average Heat Map

Source: Summer Studio Team, 2018

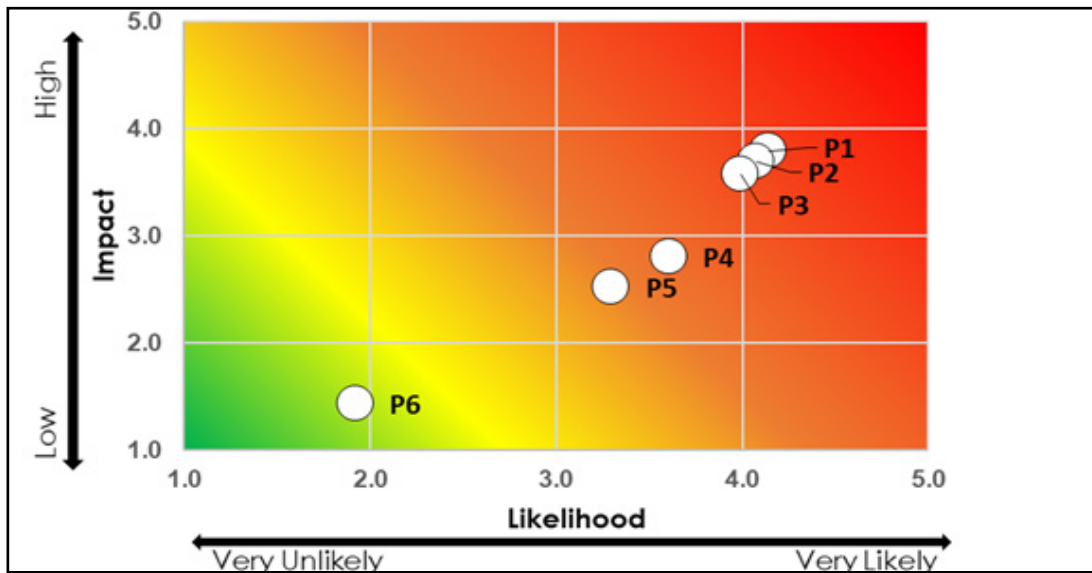


Figure 2.2 Population Risk Assessment Heat Map

Source: Summer Studio Team, 2018

P1-6 are defined in Table 2.3

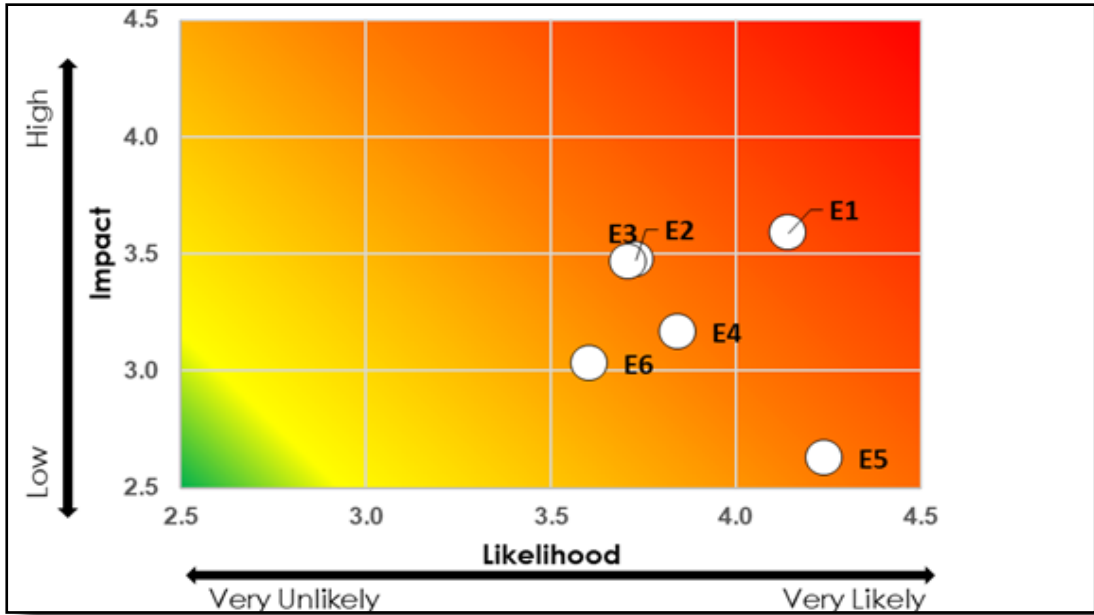


Figure 2.3 Economic Risk Assessment Heat Map

Source: Summer Studio Team, 2018

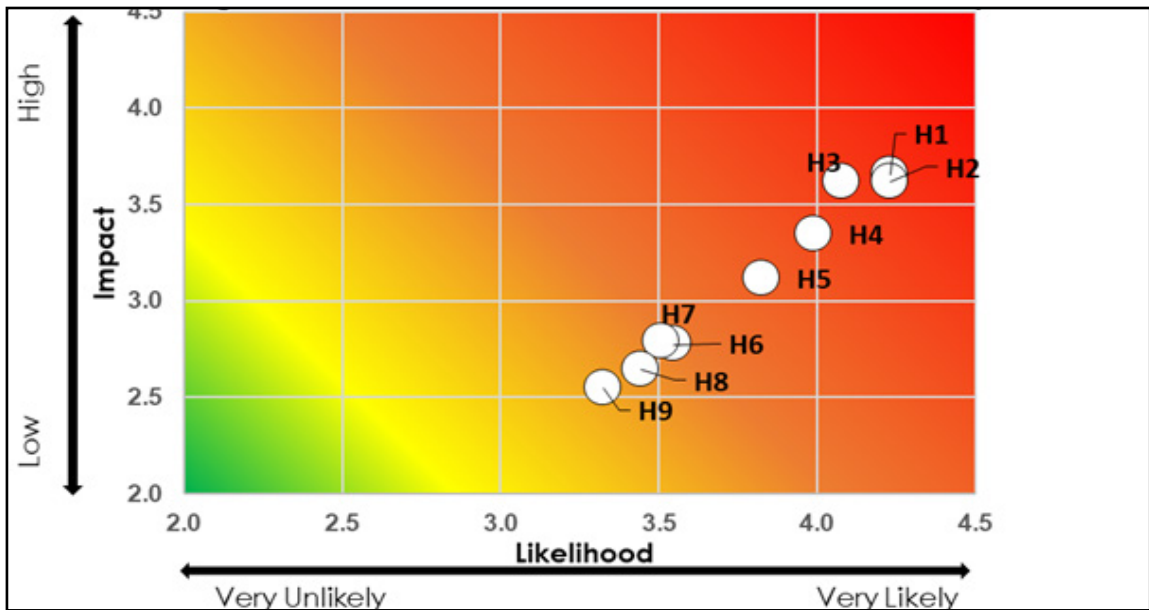


Figure 2.4 Environment/Hazards Risk Assessment Heat Map

Source: Summer Studio Team, 2018

E1-6 are defined in Table 2.3

H1-9 are defined in Table 2.3

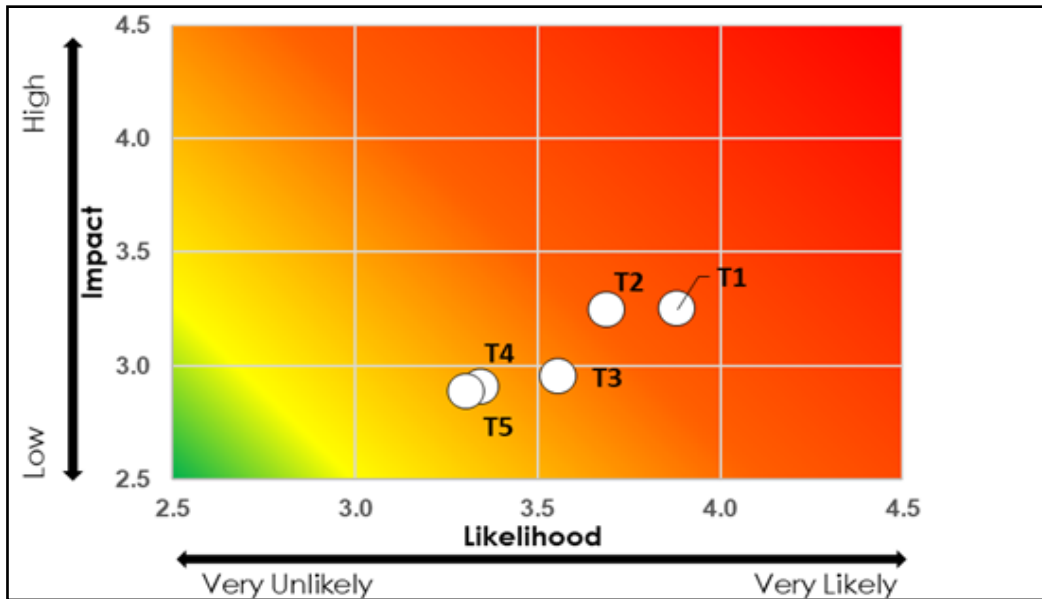


Figure 2.5 Technology Risk Assessment Heat Map

Source: Summer Studio Team, 2018

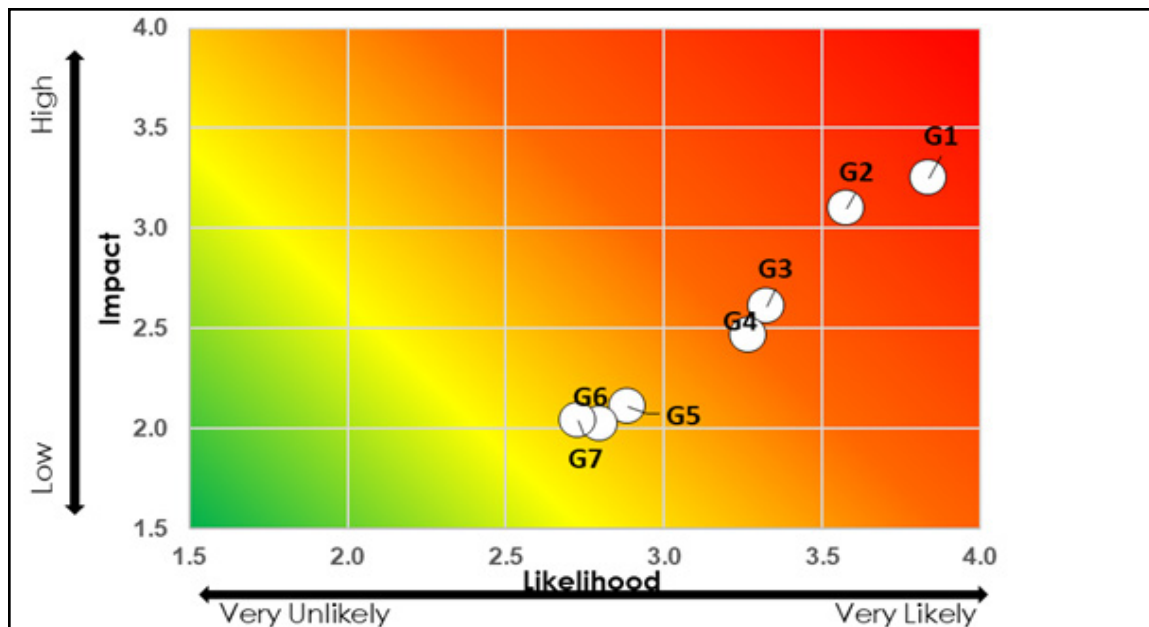


Figure 2.6 Global Risk Assessment Heat Map

Source: Summer Studio Team, 2018

T1-5 are defined in Table 2.3

G1-7 are defined in Table 2.3

The second component of the methodology from Phase I is Assets-At-Risk. In order to create an asset inventory, the Summer Studio Team reviewed the Asset Management Plans created by State DOTs and other planning agencies. Then, they developed a GIS tool for creating an asset inventory for Florida. This was an important step in developing an extensive list of assets such as transportation assets, environmental assets, and economic assets. They also created an inventory of assets by region.

These regions were broken down between coastal-urban, coastal-rural, inland-urban and inland-rural areas. The asset inventory in Table 2.2 revealed that the coastal-urban region comprises of the highest number of transportation assets, implying that this region could have a high level of vulnerability. Next, the Summer Studio Team identified the potential impact that the risks could have on each asset and assigned a degree of impact posed. This degree of impact was assessed on a scale of high, medium and low which was consistent with the risk rating categories. Following this process, the Summer Studio Team conducted an asset vulnerability assessment that determines the level of vulnerability for the different assets.

The results from this asset vulnerability exercise showed that the most vulnerable asset was transit and the least vulnerable asset was traffic signals. The entire asset vulnerability table can be found in the Appendix J of Summer Studio report. Later, a cumulative risk-to-asset score was calculated to determine the top assets at risk, from which the top 13 assets-at-risk were used to calculate the total risk score in the following section (note: initially the Studio Team intended to select the top 10 risks, but with a three-way tie between three assets the Team decided to comprehensively review the top 13 assets-at-risk).

The assets identified by this analysis as most at risk, from highest to lowest levels of vulnerability, are as follows: transit, airports, seaports, freight/rail, US highways, interstates, toll roads, bridges, state parks, national parks, state roads, county roads, and scenic highways.

The third component of the methodology from Phase I included Consequence Identification and Management. The methods of this component included creating an asset risk score. The identified risks were assigned asset risk scores that determined the impact that each risk had on each of the assets. Then a cumulative asset risk score was totaled per identified risk. Finally, a total risk score (total risk score = risk rating + (asset risk score X synergy score)) was calculated to determine the consequences of each potential type of risk on vulnerable Florida assets. These findings are shown in Table 2.3 below.

These methods and processes used in Phase I help to better measure which risks are the ones that could have the most impact on Florida's future transportation system. An important finding from these methods is that, based on the average risk rating for the areas of uncertainty, planning professionals predict economic uncertainties as having the highest risk and global issues as having the lowest risk for affecting Florida's future transportation system (Figure 2.1).

The findings from Phase I also summarized what the top three risks for each of the five areas of uncertainty are based on the total risk scores calculated (Table 2.4). The findings of the risk rating scores depict that stakeholders are concerned with demographic and environmental uncertainties, as they may have a higher likelihood of impact on and span of impact on Florida's future transportation system in 2045 and 2070; conversely they feel that global issues are less likely to have a substantial impact.

However, the total risk score implies that population, economic and environment uncertainties are create the greatest vulnerability for the transportation assets of Florida. Rapid population growth, congestion, another recession, decreasing transportation funding, sea level rise and storm surge were some of the most significant risks. Areas of technological uncertainties received somewhat moderate total risk scores, but two global issues of rising energy price and global recession received a high-risk score, indicating greater vulnerability for the transportation assets. These methods and findings from Phase I were validated and then used for Phase II tasks.

Table 2.3: Overall Risk

Category	Risk	Risk Rating	Synergy Score	Asset Risk Score	Total Risk
Population					
P1	Rapid population growth	15.70	11.0	27.0	312.7
P2	Aging populations	15.05	7.0	5.0	50.1
P3	Congestion from further suburbanization	14.27	9.0	22.0	212.3
P4	Immigration	10.12	10.0	11.0	120.1
P5	Political polarization	8.31	8.0	19.0	160.3
P6	Population decline	2.76	6.0	27.0	164.8
Economic					
E1	Another recession	14.86	7.0	33.0	245.9
E2	Increasing fuel costs	12.95	7.0	15.0	118.0
E3	Growing household income inequality	12.85	3.0	9.0	39.8
E4	Financing new infrastructure	12.17	6.0	26.0	168.2
E5	Worsening traffic congestion	11.13	6.0	23.0	149.1
E6	Decreasing transportation funding	10.92	6.0	31.0	196.9
Environmental					
H1	Storm surge	15.46	7.0	26.0	197.5
H2	Sea level rise	15.30	8.0	39.0	327.3
H3	Extreme weather (i.e. tropical cyclones)	14.74	9.0	8.0	86.7
H4	Inland flooding	13.35	5.0	11.0	68.4
H5	Reduction of open space	11.92	5.0	8.0	51.9
H6	Extreme temperatures	9.86	5.0	11.0	64.9
H7	Declining water quality	9.79	4.0	4.0	25.8
H8	Fire hazards	9.10	4.0	17.0	77.1
H9	Water scarcity	8.48	7.0	7.0	57.5
Technology					
T1	Cyber security	12.63	7.0	13.0	103.6
T2	Outdated government regulation	11.96	6.0	12.0	84.0
T3	User privacy	10.50	7.0	16.0	122.5
T4	Lack of funding for smart infrastructure	9.72	5.0	17.0	94.7
T5	Slow adoption of new technology	9.54	7.0	21.0	156.5
Global					
G1	Rising energy prices	12.47	8.0	28.0	236.5
G2	Global recession	11.07	7.0	28.0	207.1
G3	Terrorism	8.67	6.0	18.0	116.7
G4	Climate refugees	8.05	6.0	10.0	68.0
G5	Global epidemics	6.07	7.0	13.0	97.1
G6	Global conflict (war)	5.65	6.0	11.0	71.6
G7	Food crises	5.57	9.0	12.0	113.6

Table 2.4: Summary of Total Risk and Asset Risk Score Matrix

Risk	Risk Rating	Synergy Score	Transit	Airports	Seaports	Freight /Rail	US HWYs	Interstates	Toll Roads	Bridges	State Roads	County Roads	Scenic HWYs	State Parks	Nat'l Parks	Asset Risk Score	Total Risk
Population	Rapid population growth	15.70	H	M	M	M	M	M	M	M	M	M	M	M	M	27	312.7
	Congestion from suburbanization	14.27	H	L	-	M	H	M	M	M	H	H	L	-	-	22	212.3
	Population decline	2.76	H	M	M	M	M	M	M	M	M	M	M	M	M	27	164.8
Economic	Another recession	14.86	M	M	M	M	H	H	H	H	H	H	H	M	M	33	245.9
	Decreasing trans. funding	10.92	M	M	M	M	H	H	H	H	H	H	H	M	-	31	196.9
	Financing new infrastructure	12.17	H	M	M	M	M	M	M	M	M	M	M	L	L	26	168.2
Environment/Hazards	Sea level rise	15.30	H	H	H	H	H	H	H	H	H	H	H	H	H	39	327.3
	Storm surge	15.46	-	L	H	L	M	M	M	H	M	M	M	H	H	26	197.5
	Extreme weather (i.e. tropical cyclone)	14.74	L	L	-	L	-	-	-	L	-	-	-	M	M	8	86.7
Technology	Slow adoption of new technology	9.54	M	M	M	L	M	M	M	M	M	M	M	-	-	21	156.5
	User privacy	10.50	M	H	M	-	L	L	L	L	L	L	L	L	L	16	122.5
	Cyber security	12.63	H	H	H	H	-	-	L	-	-	-	-	-	-	13	103.6
Global	Rising energy prices	12.47	H	H	H	H	M	M	M	M	M	M	M	L	L	28	236.5
	Global recession	11.07	H	H	H	H	M	M	M	M	M	M	M	L	L	28	207.1
	Terrorism	8.67	M	H	H	M	L	L	L	H	-	-	-	L	L	18	116.7

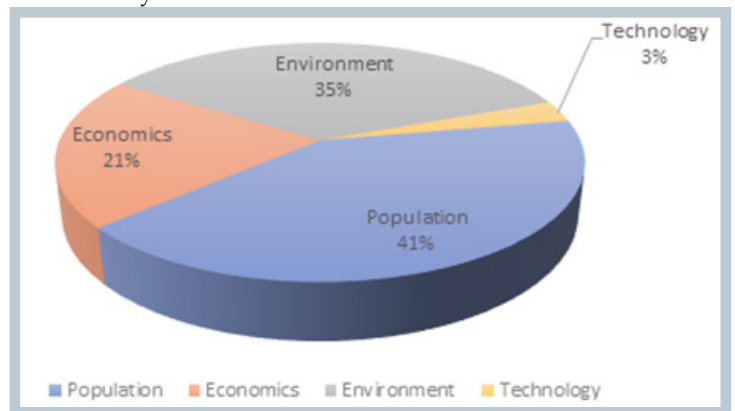
Phase II: Validation of Results

Phase II efforts began by ensuring the Summer Studio Team's findings were valid. After vetting the accuracy of Table 2.1 – Table 2.4 and gaining an in-depth knowledge of the methodology that was used during Phase I, some adjustments were made in the final top three identified risks under each area of uncertainty in Phase I results. Next to validate the findings of the Summer Studio analysis, a follow-up survey was conducted. In Phase II of this project, it was important to refocus and edit the survey questions that were used in Phase I to collect more information that could validate the total risk calculations prepared in Phase I, as well as collect responses about the impact of the identified risks on the alternative future scenarios. The Phase II survey intended to gather more expert input to ensure that the Phase I results correctly predicted which risks could cause the most vulnerability for Florida's future transportation system and capture expert insights on the likelihood of impact of those risks on the four FTP-defined alternative future scenarios.

As mentioned earlier, 52 professional planners participated in the survey during Phase I. Among these participants, 20 were respondents from the primary list of stakeholders that were listed by the Summer Studio Team as necessary to reach out to for the online survey. The other 32 participants were likely the colleagues of those stakeholders who were requested to participate in the survey. To validate the results of Phase I, those 20 known respondents from the Phase I stakeholder list who originally responded to the survey, along with other professionals and experts in the planning field were contacted via email to participate in the Phase II online survey. The validation survey was also administered at the 2018 Annual Conference for the Florida Chapter of the American Planning Association (APA) at West Palm Beach. This setting allowed for a larger respondent set and greater variety

within the planning field. The state-wide context of the conference helped in attaining responses that represented the transportation needs and concerns within a diverse set of disciplines.

The Studio Team conducted the Phase II survey from September 11, 2018 to September 16, 2018. In total, 35 professional planners responded to the survey administered during the Phase II validation process. A majority (30) of the total respondents were professionals and expertise from Florida APA Conference. Figure 2.7 illustrates the participation of stakeholders by category of self-identified expertise in the Phase II survey. It is to be noted that only one participant self-identified as an expert in technology during that survey, while none of the respondents who participated in the survey self-identified as an expert in Global Issues. Therefore, it was not possible to validate the Phase I data pertaining to global issues of uncertainty.



Note: No self-identified Global Issues respondent participation

Figure 2.7 Participation of Stakeholders by Category of Expertise in Phase II Survey

Source: Summer Studio Team, 2018

The Fall Studio Team followed the same procedure developed and used by the Summer Studio Team to calculate the total risk posed by each identified risk on the future transportation system of Florida. Comparison of the risk rating calculation and total risk score between Phase I survey respondents and Phase II survey respondents can be found in Attachment A of this report. The top three risks identified under each uncertainty area from Phase I compared to Phase II are in bold in the Total Risk columns.

The final results from Phase II survey validated the Phase I results. The data validation showed that the top three uncertainties for the Population, Economic, Environment, and Technology risk areas aligned between the two sets of survey data except for one risk, cyber security in the Technology section. This may be due to the fact that only one participant responded to the questions related to technological uncertainties. It also should be noted that the top three risks under the Global area of uncertainty could not be validated since none of the survey participants self-identified Global Issues as their expertise. Even with the lack of participation from technology and global experts, the majority (11 out of 15) of the top risks identified during Phase I were validated to be the same between the two surveys administered.

While some of the quantitative data collected and analyzed during Phase II differed slightly from that of Phase I, the overall qualitative comparison of the data allowed for a high level of confidence satisfying the results of the Summer Studio Team's research. The validation results ensured that a large number of professionals and experts envision the same risks impacting Florida's transportation system in the future. The Fall Studio Team is confident in Summer Studio Team's validation efforts regarding Phase I methodology and results that show the consequences that each potential

risk could have on vulnerable assets. It was determined that Phase I results would be used for Phase II tasks because they were backed by the best knowledge available at the time and upon the work completed throughout the validation process. The survey that was used to validate these calculations can be a model for replication by FDOT during stakeholder meetings to continue to gather the best predictions for risk impacts over time during the FTP update planning process. If FDOT should decide to continue with this research, the Fall Studio Team would recommend a multi-dimensional analysis of these findings exploring their influences in specifically coastal, inland, rural, and urban communities.

Conclusion:

- The Fall Studio Team validated the results of Phase I survey as the results of Phase II survey data matched the Phase I results.
- The region of coastal-urban area contains the highest number of transportation assets.
- Stakeholders are most concerned that demographic and environmental uncertainties may have a higher likelihood of impact on and span of impact on Florida's future transportation system in 2045 and 2070, while they feel that global issues are less likely to have a substantial impact.
- Based on total risk score, population, economic and environment uncertainties were determined to be the most pressing risks to Florida's transportation assets. Rapid population growth, congestion, another recession, decreasing transportation funding, sea level rise and storm surge were some of the most significant risks. Areas of technological uncertainties received somewhat moderate total risk scores, but two global issues of rising energy prices and global recession received a high-risk score, indicating greater vulnerability for Florida's transportation assets.

Attachment A

Comparison of Phase I (Summer Studio) and Phase II (Fall Studio) survey Results

Category	Risk	Risk Rating		Synergy Score	Asset Risk Score	Total Risk	
		Summer	Fall			Summer	Fall
Population							
	Rapid population growth	15.70	22.35	11.0	27.0	312.7	319.4
	Aging populations	15.05	19.25	7.0	5.0	50.1	54.2
	Congestion from further suburbanization	14.27	20.63	9.0	22.0	212.3	218.6
	Immigration	10.12	12.95	10.0	11.0	120.1	123.0
	Political polarization	8.31	10.53	8.0	19.0	160.3	162.5
	Population decline	2.76	6.67	6.0	27.0	164.8	168.7
Economic							
	Another recession	14.86	18.56	7.0	33.0	245.9	249.6
	Increasing fuel costs	12.95	16.50	7.0	15.0	118.0	121.5
	Growing household income inequality	12.85	20.77	3.0	9.0	39.8	47.8
	Financing new infrastructure	12.17	14.47	6.0	26.0	168.2	170.5
	Worsening traffic congestion	11.13	18.48	6.0	23.0	149.1	156.5
	Decreasing transportation funding	10.92	17.69	6.0	31.0	196.9	203.7
Environmental							
	Storm surge	15.46	19.64	7.0	26.0	197.5	201.6
	Sea level rise	15.30	22.75	8.0	39.0	327.3	334.7
	Extreme weather (i.e. tropical cyclones)	14.74	20.57	9.0	8.0	86.7	92.6
	Inland flooding	13.35	18.77	5.0	11.0	68.4	73.8
	Reduction of open space	11.92	12.71	5.0	8.0	51.9	52.7
	Extreme temperatures	9.86	18.41	5.0	11.0	64.9	73.4
	Declining water quality	9.79	11.82	4.0	4.0	25.8	27.8
	Fire hazards	9.10	14.66	4.0	17.0	77.1	82.7
	Water scarcity	8.48	11.97	7.0	7.0	57.5	61.0
Technology							
	Cyber security	12.63	10.50	7.0	13.0	103.6	101.5
	Outdated government regulation	11.96	16.00	6.0	12.0	84.0	88.0
	User privacy	10.50	2.00	7.0	16.0	122.5	114.0
	Lack of funding for smart infrastructure	9.72	20.25	5.0	17.0	94.7	105.3
	Slow adoption of new technology	9.54	18.00	7.0	21.0	156.5	165.0
Global							
	Rising energy prices	12.47	-	8.0	28.0	236.5	-
	Global recession	11.07	-	7.0	28.0	207.1	-
	Terrorism	8.67	-	6.0	18.0	116.7	-
	Climate refugees	8.05	-	6.0	10.0	68.0	-
	Global epidemics	6.07	-	7.0	13.0	97.1	-
	Global conflict (war)	5.65	-	6.0	11.0	71.6	-
	Food crises	5.57	-	9.0	12.0	113.6	-

Chapter 3

Planning Implications for Alternative Futures



Introduction

The development of a 50-year transportation plan for the state of Florida needs to consider a wide-array of variables and future-influencing factors. The diversity of the State's demographics, the rate of population growth, the effects of economic, environmental, and technological change, and the continued or new patterns of development could all pose complications to the implementation of transportation projects and policies. Given the uncertainty surrounding all of these factors, making definitive future predictions to guide planning efforts is extremely difficult. Consequently, forecasting specific scenarios for the next several decades is necessary to help determine the transportation infrastructure and development that must occur to best serve residents and visitors to the State. To make better long-range planning decisions, FDOT has identified potential future scenarios in the FTP Vision Element that could occur in Florida over the next 50 years. These futures include: A Return to Historic Growth; Rural Rediscovery; Global Trade Hub; Innovation Hub; and Risks on the Horizon.

A Return to Historic Growth future scenario predicts continuous population growth, as well as growth in the economy. The Rural Rediscovery future scenario anticipates growth within various sectors within less populated areas. The Global Trade Hub future scenario looks to expand global economic outreach and tourism. The Innovation Hub future scenario places particular emphasis on urban centers of innovation. The Risks on the Horizon future scenario outlines a number of extreme risks that Florida may face in the next several decades, including climate trends and changes, economic uncertainties, and decreased growth in population. The categorized futures allowed the Fall Studio team to expand upon the risks these futures could experience as well as review how the FTP policy element goals will be affected within the scope of the next 25 to 50 years.

In the FTP Policy Element, FDOT expands on a number of goals that they want to achieve. Despite various futures, and the risks posed to each of these futures, it is the aim of the FTP to implement policies so as to achieve these goals. These goals include, broadly: safe infrastructure and systems; resilient and responsive infrastructure; efficient mobility of both people and goods; greater choices for transportation; solutions that cater to the needs of Florida's international economic competitiveness;

life-enhancing infrastructure and solutions; and sustainable, environmentally compatible infrastructure. Achieving these goals necessitates input from a diverse selection of stakeholders, as well as data collection and analysis, and the outlining of areas of emphasis, so as to enable efficient implementation.

During Phase I uncertainties and trends that could threaten Florida's transportation system in the next 50 years were identified. Each of the future scenarios are unique in that one scenario may be more susceptible to certain risks than another. Also, multiple alternative future scenarios could occur simultaneously in different areas of the State; therefore, solutions that may suit coastal urban areas, may not be effective in inland rural communities. As such, the Fall Studio team paid careful consideration to specific regions and risks specific to each future scenario to help to determine the priority areas to address.

The Fall Studio team focused on the four non-risk-based FTP Alternative Futures, framing these as the focal points of the discussion so as to incorporate risk considerations into each of the futures instead of limiting the discussion of risk to the Risks on the Horizon scenario. The Studio team created a module for the four non-risk-based future scenarios and decided to analyze the Risks on the Horizon as a section within each of these scenarios to better explore extreme risks that could derail a scenario or could be more dangerous because of a certain scenario. These modules do not follow the same format as the rest of the written report because they are meant to act as stand-alone booklets that can be individually pulled out. The organization of each future scenario's module starts with the definition of the future from the FTP Vision Element as well as illustrative photographs to better enable readers to envision what that future may look like in Florida. The Fall Studio team structured their risk analysis by using the information and data synthesized in Phase 1 to decide which risks would most likely affect a specific scenario. The Fall Studio team's analysis expands on where and how the alternative future scenarios could lead to different risks that could potentially have consequences to achieving the FTP policy element goals. The methods and information contained in each future scenario module will better assist FDOT in planning for the future in the face of risks and uncertainties.

Methodology

For each future scenario, the Fall Studio team started by conducting a workshop using data from the FTP Vision Element, the literature review, Phase I results, and the Phase II stakeholder survey to brainstorm and identify the relevant risks that could occur in a given scenario. This included deciding which risks could pose a threat to Florida's transportation system in each scenario. As multiple alternative future scenarios could occur simultaneously in different areas of the State, it was then an important step for the Fall Studio team to identify where in Florida each scenario would most likely occur. Using the available data, the Fall Studio team analyzed how different regions (i.e. coastal-urban, coastal-rural, inland-urban, inland-rural) of the State were likely to be impacted by the identified risks in each future scenario.

During Phase I and Phase II of the project, the studio teams realized that there are different methods of risk and impact assessments. Risk assessments typically consider several components including the level of impact (consequences), level of likelihood (probability), assets at risk, vulnerability, hazards, and resistance. During Phase I, the Summer Studio team generally tried to follow the traditional methods of risk assessment. However, due to a short semester schedule and a 50-year time horizon, the Summer Studio team used a modified version of risk rating scale, which was originally developed by FDOT as a part of the Transportation Asset Management Plan (FDOT, 2015).

The Summer Studio team used the scale to create a qualitative assessment of the risks by measuring the level of impact and likelihood of impact of different risks from Phase I survey results. They assessed future risks by gathering expert opinions to assess the risks posed by the five uncertainty areas and evaluated the consequence of uncertainty by calculating a total risk score. The Summer Studio team also

considered assets at risk by using a method of rating from "Low" to "High" the amount of risk each type of asset may be vulnerable to, based on expert responses and literature review research.

Since projecting risk and vulnerability 50 years in the future is extremely difficult, the Fall Studio team during Phase II adopted a subjective way of evaluating the impact of risks on alternative future scenarios based on the methods and data used in Phase I. The Fall Studio team relied on the findings from the Phase I risk assessment that evaluated both the probability and impact of each risk. The Fall Studio team used these findings to then conduct a qualitative assessment, similar to the qualitative ranking used during the assets at risk analysis during Phase I of the project. The Fall Studio team also relied on experts' opinions gathered during the Phase II survey to determine the impacts of each identified risk on Florida's different regions. The impacts were categorized as "Extremely High" (E), "High" (H), "Medium" (M), "Low" (L), or "No Impact" (N). Where Extremely High =4, High=3, Medium=2, Low=1, and No Impact =0. This general process is one that FDOT can use at Transplex or other stakeholder engagement events to have expert participants rank the vulnerability caused by different risks under each future scenario. The Studio Team is confident that the evaluation process helps to identify where a scenario may be impacted by risk and which of those risks could cause the most vulnerability to the transportation system.

In the final step, a total vulnerability score was calculated for each uncertainty area by adding the numerical values for each risk and averaging them. The vulnerability score per area of uncertainty indicates the amount of vulnerability that an uncertainty area poses to the State's transportation system. This helped the Fall Studio team to identify which uncertainty area would cause the most impact in a future scenario. The graphics produced by the Fall Studio Team to illustrate the analysis findings, first include a pie chart that shows the percentage of where the risks within a given scenario could present the most vulnerability to the State. Graphics also include other pie charts that display the percentage of which uncertainty area poses the highest risks for each region (ex. coastal-urban). The Fall Studio team also created a map to better illustrate where a scenario would most likely have the most impact and which risks would cause the most vulnerability in those areas. These methods were a base for the Fall Studio team to better analyze why and how different risks would affect a specific future scenario. Using this tool, FDOT can generate a vulnerability matrix for different FDOT districts, based on the portion of different region areas contained in each district, and evaluate regional vulnerability by uncertainty area, and consequently take necessary measures to mitigate the impact of uncertainty areas that deemed suitable for any concerned district.

Module 1: Return to Historic Growth



Introduction

This module will explore the relevant risks that a return to historic growth future scenario could be susceptible to and could pose to Florida’s transportation system. In the FTP Vision Element, FDOT defines the return to historic growth future scenario as:

“high growth in population, visitors, and the economy, with similar development patterns and industry mix as today”

According to the FTP Vision Element, planners may expect to experience historic growth patterns and preferences under a return to historic growth scenario such as:

- 800 or more people a day move to the State,
- Florida’s economy remains focused on agriculture, construction, and tourism,
- Florida’s population and economic growth concentrates on the fringes of existing urban areas resulting in dispersed and sprawling growth,
- Gasoline prices remain low and new technologies do not catch on, which results in a continuing reliance on the motor vehicle as the primary way we travel,
- Continuous expansion of the highway system to accommodate the growing demand for moving people and freight.

Through the Studio Team’s methods, it was identified that a return to historic growth scenario would most likely affect **coastal-urban** and parts of **inland-urban** Florida (**Figure 3.1.1**). In fact, the FTP Vision Element states that 6 of the top 20 fastest growing metropolitan areas in the U.S. are cities in Florida located within these regions (**Figure 3.1.1**). Through this process it was also determined that the transportation network would be **most vulnerable to population risks** under this future scenario. This module will identify specific risks and potential consequences related to how a return to historic growth scenario could affect the achievement of the FTP’s policy goals.

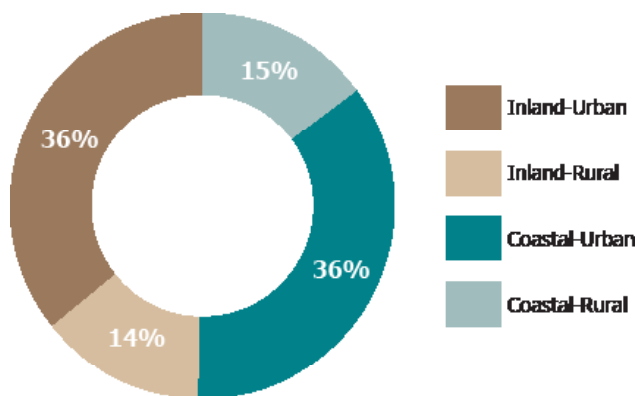


Figure 3.1.1: Impact of Risks by Region
Source: Fall Studio, 2018

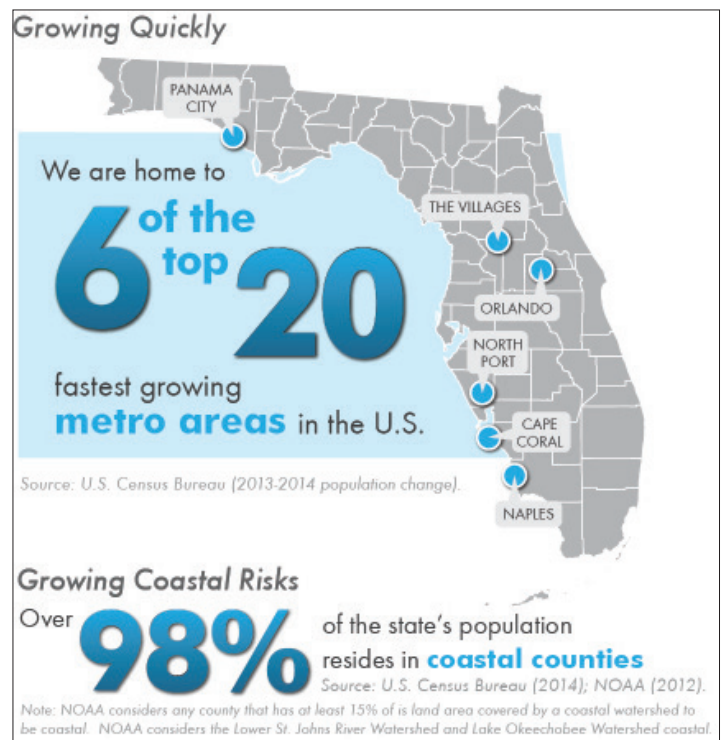


Figure 3.1.2: Areas of Major Growth in Florida
Source: FDOT FTP Vision Element, 2015

Visioning

Envisioning what a return to historic growth scenario may look like and mean for Florida’s different cities is helpful to better comprehend which risks may arise. A return to historic growth could lead to fast-growing metropolitan areas in Florida. Under this scenario, Florida’s smaller communities could grow into large metropolitan areas, just as cities like Miami have grown in the past 50 years (**Figure 3.1.3**). These growing cities may experience investment in new infrastructure as well as sprawl. For example, a city like Ocala, could experience a high growth in population and start to look similar to a larger metropolitan community resembling today’s Orlando (**Figure 3.1.4**). Although predicting the future is impossible, we could expect Florida’s smaller communities to grow similarly to Florida’s larger ones under a return to historic growth scenario.



Figure 3.1.3: Miami in 1961 Compared to Miami in 2007
 Source: AerialArchives, 2014

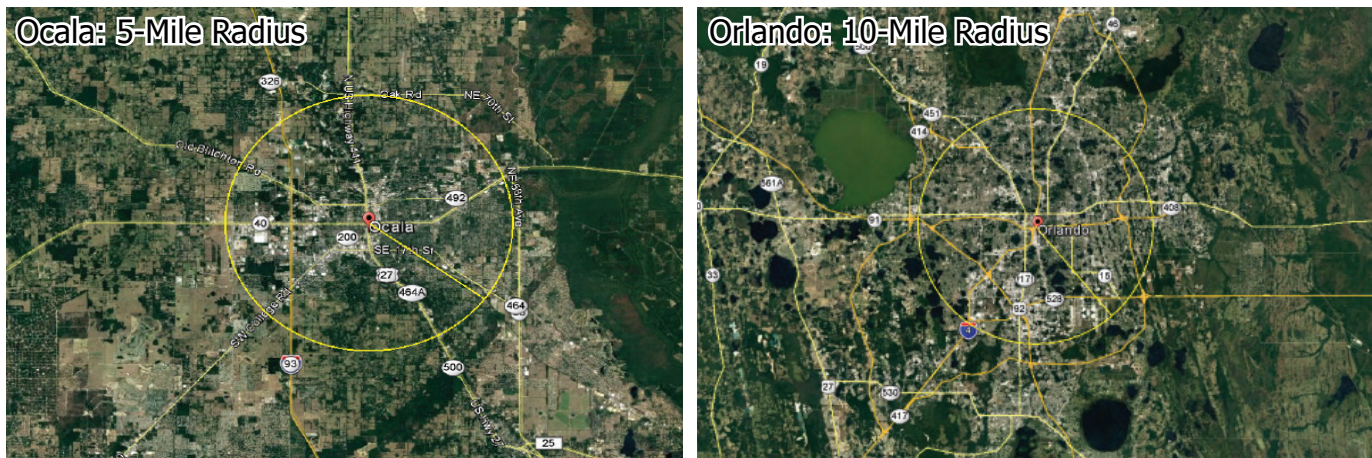


Figure 3.1.4: Visualizing A Return to Historic Growth: Ocala (Left) and Orlando (Right)
 Source: Google Earth, 2018 (left and right)

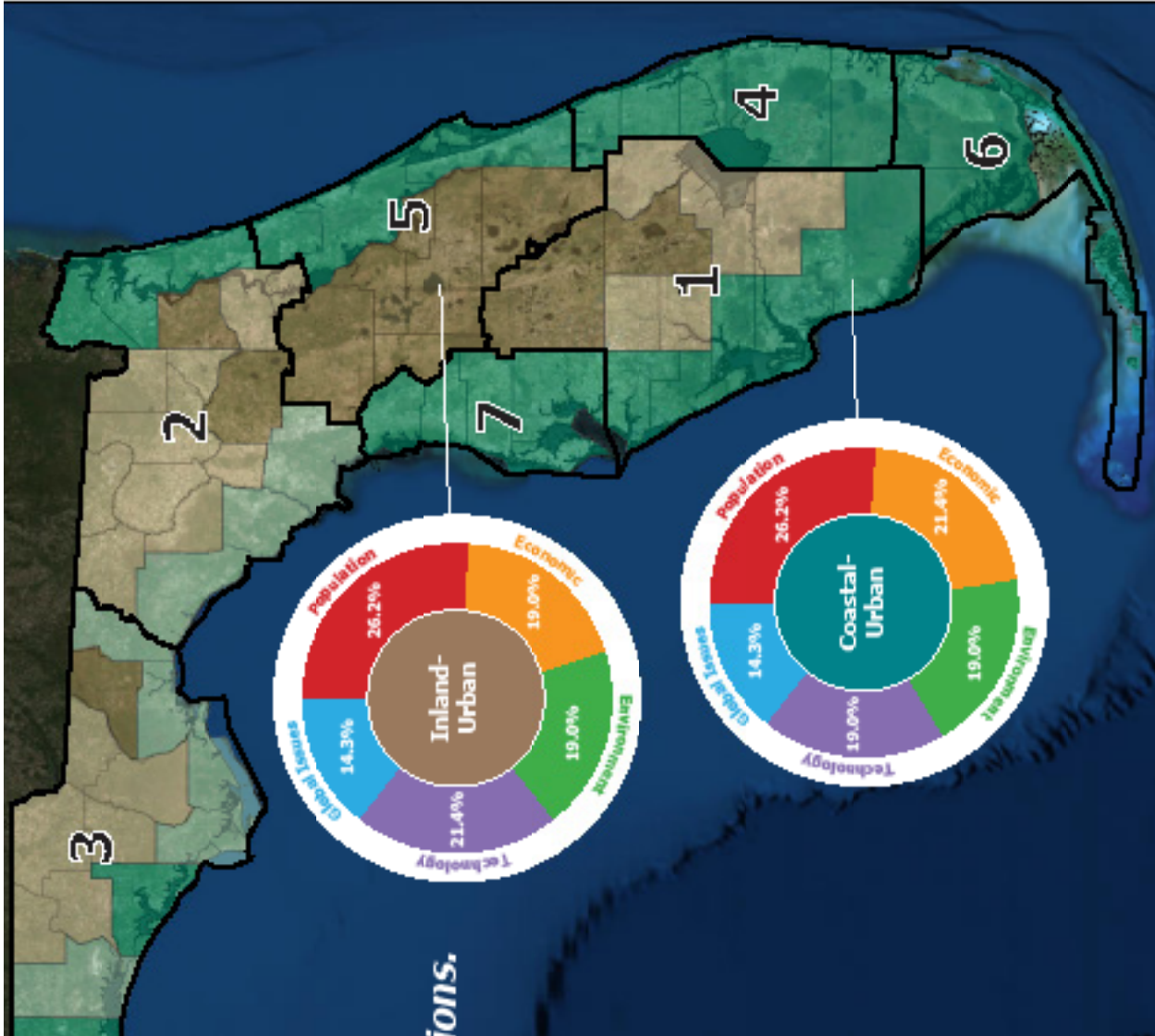
Uncertainties and Risks

The Fall Studio team used the literature review and data from survey responses to identify specific risks that could affect a return to historic growth scenario. The team also used this data to create **Table 3.1.1** which summarizes the potential consequences that the different risks could pose to four regions in Florida (i.e. coastal-rural, coastal-urban, inland-rural, and inland-urban). This process aided the team in visualizing how the most impacted areas of the State could look under a return to historic growth scenario. The level of impact for each risk was evaluated based on the average vulnerability score. This revealed that population uncertainties are likely to have the highest impacts on this future, followed by global and economic issues. This aligns with expert opinions that were gathered during the team’s surveying efforts. The team also created **Figure 3.1.6** on the opposing page which demonstrates how vulnerable the affected regions are to the anticipated risks.

Significant population growth at the fringe of urban areas could exacerbate congestion from suburbanization and limit the mobility of aging and immigrant populations. An increase in visitors could lead to shifts in economic markets and tourism, which would affect certain global markets. Although environmental and technology risks could have negative consequences, the Team’s analysis suggests they may have less impact on this future. All of these risks and their relation to this scenario are expounded upon on the following pages. For each uncertainty area, the team analyzed why the identified risks could affect this future and how the risks could affect transportation.

Table 3.1.1: Consequences of Risks on Regions under A Return to Historic Growth					
Risks under Uncertainty Area	Coastal-Rural	Coastal-Urban	Inland-Rural	Inland-Urban	Vulnerability score
Population					
Congestion from Suburbanization	L	E	L	E	10
Immigration	L	H	L	H	8
Aging Population	L	E	L	E	10
Average					9.33
Economics					
Decrease of Transportation Funding	L	H	L	H	8
Financing New Infrastructure	M	H	M	H	10
Worsening Traffic Congestion	L	H	L	M	7
Average					8.33
Environment					
Inland Flooding	L	H	L	H	8
Sea level rise & Extreme Weather	H	H	L	M	9
Extreme Temperature	L	M	L	H	7
Average					8.00
Technology					
Continued Dependence on Old Tech	L	H	M	H	9
Slow Integration of New Tech	L	M	L	H	7
Smart Infrastructure Funding Low	L	H	L	H	8
Average					8.00
Global Issues					
Shift in Economic Markets & Tourism	L	H	N	H	7
Geopolitics Affect Fuel Use & Cost	M	H	M	H	10
Average					8.50



With a return to historic growth, population-based risks pose the greatest threat to Florida's transportation system. Most of these threats are to coastal-urban and inland-urban regions.



■ Coastal-Rural
 ■ Inland-Rural
 ■ FDOT Districts
■ Coastal-Urban
 ■ Inland-Urban

Uncertainty Area	Regional Vulnerability by Uncertainty Area			
	Coastal-Rural	Coastal-Urban	Inland-Rural	Inland-Urban
Population	16.67%	26.19%	18.75%	26.10%
Economic	22.22%	21.43%	25.00%	19.05%
Environment	27.78%	19.05%	18.75%	19.05%
Technology	16.67%	19.05%	25.00%	21.43%
Global Issue	16.67%	14.29%	12.50%	14.29%
Total	100.00%	100.00%	100.00%	100.00%

Note: Specific FDOT Districts are numbered on this map.



 Fall 2018
 Studio Team

0 25 50 100 150 Miles

N

Figure 3.1.6: Risks by Region for a Return To Historic Growth
 Source: Fall Studio Team, 2018

Population Risks in a Return to Historic Growth



Congestion from Suburbanization

Why is this a risk in this future?

This future would bring 800 new residents to Florida per day and continue inefficient development patterns throughout the state. Proliferation of sprawling patterns would likely increase congestion generated by suburban communities.

How does this affect Transportation?

Increased congestion could undermine planning efforts that aim to create multimodal options, transportation solutions that create quality places, and transportation solutions that enhance Florida's natural environment and conserve energy.

Aging Population

Why is this a risk in this future?

The Baby Boomer generation comprises a large share of Florida's population and has shown a preference for driving. This preference is supported by current development patterns in many communities, which could limit current and future options.

How does this affect Transportation?

Car-centered infrastructure must adapt and accommodate other modes of travel. Transportation planning decisions should be coordinated with land use decisions to ensure the mobility of all residents, especially Florida's aging population.

Immigration

Why is this a risk in this future?

From 1990-1995 nearly 30% of Florida's growth was from legal immigration (Martin, Bouvier, & William, 1995), and there were an additional 585,000 illegal immigrants in Florida as of 2014 (Pew Research Center). A diverse population has diverse needs.

How does this affect Transportation?

Immigration could exacerbate transportation demand and a large component of the population may have a Limited English Proficiency (LEP) requiring language barriers be addressed in signage and education to ensure safe movement for all people.



Population professionals ranked population risks as the uncertainty area most likely to have an adverse impact on the return to historic growth scenario. Further congestion from increased suburbanization could result in decreased choices and mobility. Aging and immigrant populations have unique transportation needs; however, their needs may not be met by transportation systems under this future.

Figure 3.1.7: Congestion on Florida Highway

Source: Miami Herald

Economic Risks in a Return to Historic Growth



Transportation Funding Decreases

Why is this a risk in this future?

Infrastructure investments are necessary to meet capacity needs, but a reliance on automobiles could result in a “funding gap” and local governments may be forced to use more of their budget to cover basic maintenance of existing transportation infrastructure.

How does this affect Transportation?

Decreases in transportation funding make it difficult to maintain existing infrastructure and fund new projects. Several industries could be affected if fewer funds are allocated to road maintenance and alternate routes would have to be used.

Financing New Infrastructure

Why is this a risk in this future?

Due to high economic growth, Florida may attract new industries; this would require expanded infrastructure investments. Though economic development is generally positive, this could lead to limited secured funding for other transportation projects.

How does this affect Transportation?

Decreases in secured financing for new projects would make it difficult to complete other projects that could meet increased capacity needs. Necessary highway expansion might not be met if secured investments are transferred to new industries.

Worsening Traffic Congestion

Why is this a risk in this future?

Sprawling growth and reliance on automobiles make it difficult for disadvantaged persons travel efficiently. This can adversely affect the ability of these people to obtain employment and maintain healthy lifestyles.

How does this affect Transportation?

All modes of travel could be less reliable due to traffic congestion. Traffic congestion could limit mobility and accessibility of people who are unable to afford an automobile if the travel costs of using non-auto modes are too high.



Economic professionals surveyed ranked the economic uncertainty area as having a greater impact on this future than it would on other alternate future scenarios. Traffic congestion, financing new infrastructure, and decreases in transportation funding are the main economic risks that are associated with a return to historic growth and which could cause the transportation network to be vulnerable.

Figure 3.1.8: Construction Crew

Source: Luke Dow Law Firm

Environmental Risks in a Return to Historic Growth



Inland Flooding

Why is this a risk in this future?

To accommodate future population demand, expansion of the existing highway system and the construction of new roads could lead to increased impervious surfaces; this would result in inland flooding if these impacts were to remain unmitigated.

How does this affect Transportation?

Inland flooding may impact the coastal-urban transportation services and inland-urban areas by disrupting transportation assets (e.g. bridge, pavement, rail line) and damaging storm water management services, which would hinder mobility.

Sea Level Rise and Extreme Weather

Why is this a risk in this future?

Reliance on gasoline may increase air pollution and Florida's overall carbon footprint. This could hasten and intensify mechanisms affecting climate change, resulting in extreme weather events (e.g. major hurricanes) and sea level rise.

How does this affect Transportation?

Tropical weather events followed by storm surge and land fall can cutoff the power supply, water facilities, and uproot trees; this could disrupt the communication network and block the evacuation routes.

Extreme Temperature

Why is this a risk in this future?

Expansion of the highway system and reliance on motor vehicles would increase vehicle miles traveled (VMT). This would capture more heat in the road and accelerate heat generation in the nearby areas, causing the urban heat island effect.

How does this affect Transportation?

Prolonged periods of heat can cause strain on transportation infrastructure (i.e. highway surface, railway line) inducing higher transportation cost for operation and maintenance of the existing system.



Environmental professionals ranked environmental risks as second most likely to have an impact on the return to historic growth scenario in the Phase II survey. The identified risks are likely to impact the future transportation services by affecting the non-resilient transportation infrastructures, disrupting evacuation routes near coastal areas, and rendering higher transportation costs in the capital budget for operation and maintenance.

Figure 3.1.9: Coastal Road Gives Way to Evulsion

Source: Jabin Botsford, Charleston Gazette

Technology Risks in a Return to Historic Growth



Dependence on Old Technology

Why is this a risk in this future?

Low gasoline prices could deter people and industries from adopting new transportation technologies. Furthermore, the adoption of new technologies may be accompanied by a learning curve for all generations, but especially older generations.

How does this affect Transportation?

Slow adoption of new technologies could affect industries that are directly influenced by technological advancements. Users relying on old technology slow the overall adoption of new technologies, which could make transportation systems less safe.

Slow Adoption of New Technology

Why is this a risk in this future?

The interoperability of transportation control systems allows for greater traffic monitoring and enforcement. Failure to integrate new technologies could result in less safe and inefficient transportation systems.

How does this affect Transportation?

Miscommunications between connected/autonomous vehicle users and technologies employed by central authorities could result in safety and efficiency concerns, which could reduce benefits to integrating these technologies.

Insufficient Funding for Smart Technology

Why is this a risk in this future?

With the expansion of the highway system, a lack of funding for smart infrastructure is a potential risk to the State. This includes issues such as failure to incorporate digital and electronic fare payments into the transportation system.

How does this affect Transportation?

To attain funds, the State needs to consider that many transportation networks are moving away from hard currency in favor of digital and electronic fare payments. Tolls may need to be retrofitted to ensure ACES vehicles can pass.



According to Phase II of the survey results, technology professionals ranked technology risks as the least likely to have an impact on the return to historic growth scenario out of all the alternative futures. The Fall Studio team identified the main technology risks as the slow adoption of technology by users, the lack of integration to new technologies, and the lack of funding for smart infrastructure. These risks could cause the State's transportation systems to be vulnerable in this scenario.

Global Risks in a Return to Historic Growth



Economic Markets and Tourism Shift

Why is this a risk in this future?

A burden will be placed upon infrastructure, as well as possible losses due to heightened competition from other regions, as markets in developing and formerly developing countries continue to expand and movement of people increases.

How does this affect Transportation?

Florida could struggle to keep pace with the development and upkeep of new infrastructure. Technology, such as that for ports and toll roads, must also keep pace with shifting markets.

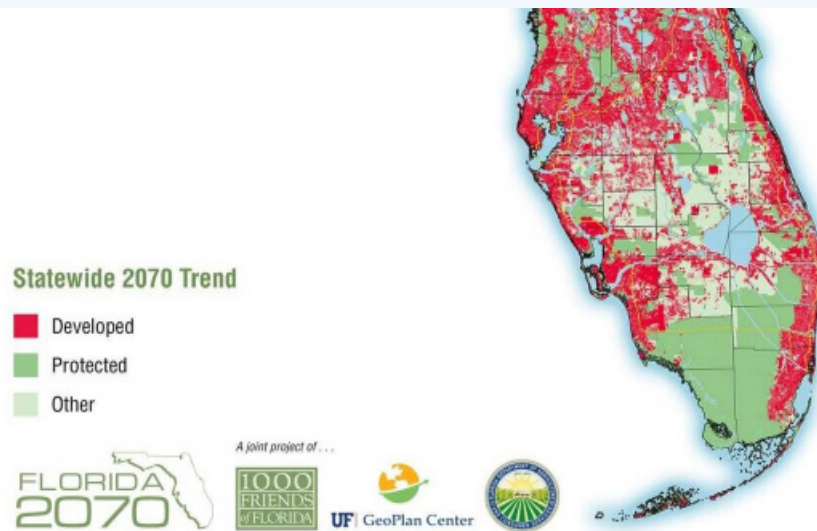
Geopolitics Affect Fuel Use and Cost

Why is this a risk in this future?

America’s dependence on external sources for fuel could be burdensome. Even if there is an increase in use of alternative fuel methods, such as electronic vehicles, the rate at which populations are growing will only increase the use of finite resources.

How does this affect Transportation?

The State currently lacks appropriate wide-spread public transportation, necessitating the use of a car for most trips. As the population grows, so will the number of trips; this would strain auto-oriented infrastructure and resources.





















As Florida continues to experience the effects of global events, as well as urbanization, the transportation system will need to adapt in kind, so as to meet the needs of Florida’s diverse citizens. .

Potential Disruptions to FTP Policy Element Goals

Included in the FTP are seven policy element goals. Each of these encompass a number of objectives and suggestions to implement practical and efficient transportation solutions. Of these seven goals, four are relate to the statewide transportation system and the remaining three outline how transportation supports the overall priorities of the State. The risks identified in this subsection could affect implementation of these goals under a return to historic growth.

Population changes are most likely to impede achievement of Florida’s transportation goals under this scenario. Congestion from further suburbanization could cause the most disruptions to FDOT’s implementation efforts. Regarding economic-based risks, traffic congestion and decreased funding could affect achieving these goals and threaten Florida’s thriving economy. Environmental risks, such as inland flooding and extreme weather, may adversely affect the quality of transportation infrastructure. Technology-based risks include lack of funding and slow adoption of new technologies which could affect public safety. Although forecasting the effects of geopolitics on Florida is limited, these issues could severely impact personal and commercial transportation. **Table 3.1.2** below summarizes the disruptions that the uncertainty areas could have to the FTP Policy Element goals. As seen below, “Safety and Security for Residents, Visitors, and Businesses” and “Agile, Resilient, and Quality Infrastructure” are most at-risk under this scenario. On the following pages are specific ways in which risks related to the uncertainty areas could interfere with these goals.

Goals	Population	Economic	Environment	Technology	Global
Safety and Security for Residents, Visitors, and Businesses					-
Agile, Resilient, and Quality Infrastructure	-				
Efficient and Reliable Mobility for People and Freight			-	-	-
More Transportation Choices for People and Freight			-	-	
Transportation Solutions that Support Florida’s Global Economic Competitiveness	-	-	-	-	
Transportation Solutions that Support Quality Places to Live, Learn, Work, and Play		-	-	-	
Transportation Solutions that Enhance Florida’s Environment and Conserve Energy		-		-	-

Safety and Security for Residents, Visitors, and Businesses



- An aging population may be more at-risk for unsafe driving due to impairments resulting from physical and mental changes.
- Further congestion from suburbanization could detrimentally affect evacuation routes.
- Those with Limited English Proficiency (LEP) could pose a threat to safety for various modes of travel if measures are not taken to assist these Floridians with understanding laws and signage.
- Traffic congestion may prevent people and first responders from arriving at destinations in a timely manner, which puts people’s physical and financial well-being at-risk.
- The risks of sea level rise and tropical cyclones may impact emergency evacuation of coastal regions due to energy blackouts and evacuation route blockages.
- Lack of alternative modes for evacuation and disruption of existing evacuation routes may adversely affect transportation security and emergency response.
- Dearth of integration to new technologies may jeopardize safety and security for residents, visitors, and businesses due to inadequate control systems to communicate vital information to individuals and central authorities.

Agile, Resilient, and Quality Transportation Infrastructure



- Decreases in funding may cause roads to go into disrepair, making them less resilient and agile.
- Traffic congestion may cause infrastructure to wear down quicker, which would expedite the need for repairs; consequently, this would require an increase in funds.
- Extreme temperatures and inland flooding may strain transportation assets by damaging existing highways, rail lines, bridges, and other transportation systems and facilities.
- Retrofitting critical infrastructure to withstand hazards can be difficult, making critical infrastructure vulnerable to impairment from sea level rise and extreme weather events.
- The lack of funding for quality smart infrastructure could result if the State does not promptly incorporate new technologies in its transportation systems, particularly in digital and electronic fare payments.
- If tourism shifts from other countries increases the movement of people to Florida, this could cause a risk if there is a lack of infrastructure to accommodate a greater number of users. Infrastructure needs to be compatible with changing global climate conditions.

Efficient and Reliable Mobility for People and Freight



- Further congestion from suburbanization could increase person-hours of delays on state roads caused by bottlenecks, gaps, and crashes.
- The reliability of all modes of Florida’s transportation system and efficiency of supply chain for freight moving to, from, and through Florida, could be affected by further congestion from suburbanization.
- Lack of secured financing for new infrastructure projects, as well as decrease in funding for current ones, may jeopardize optimal movement of people and freight; consequently, this could adversely affect Florida’s economy.
- Traffic congestion slowing people and freight can lead to losses in revenue.

More Transportation Choices for People and Freight



- Dense development trends may slow while suburbanization increases resulting in more congestion and furthering reliance on automobiles. This could limit mobility and planning efforts such as FDOT’s Safe Mobility for Life program.
- Balancing infrastructure investments that promote multiple modes of travel may prove difficult with increased suburbanization and reliance on automobiles.
- Decreases in funding could limit alternate mode choices for the disadvantaged due to the lack of public transit routes available.
- Due to traffic congestion, the disadvantaged would also have limited transportation choices due to the continued growth in sprawling areas.
- Due to geopolitics affecting low fuel prices and more usage, there may be a slow implementation of multi-modal transportation, such as bike paths and Bus Rapid Transit.

Transportation Supports to a Globally Competitive Economy



- Economic market shifts could cause a risk if there is a failure to ensure efficient cooperation between county transportation systems and modes, such as ports, to enable economic success

Transportation Solutions that Support Quality Places to Live, Learn, Work, and Play



- Further congestion from suburbanization could increase roadway capacity needs, furthering reliance on automobiles and undermining efforts to create quality places.
- Increased immigration to communities may reflect acceptance of values that have resulted in historic growth patterns, calling into question a desire for change.
- Tourism shifts and increasingly diverse communities, facing issues such as climate change, would call for a change in infrastructure needs that are better compatible.

Transportation Solutions That Enhance Florida’s Environment and Conserve Energy



- Sprawling development patterns would undermine environmental and energy conservation efforts by consuming more land, generating more traffic, and furthering reliance on fossil fuels.
- Increases in temperature may further incline people towards using automobiles even to traverse short distances.
- Gasoline combustion contributes to green-house gas emissions and deteriorates regional air quality, resulting in short- and long-term consequences.

Risks on the Horizon

Risks on the horizon are important for FDOT to be aware of to be prepared to plan for the extreme events that could derail current trends in the future. The FTP Vision Element outlines a few examples of extreme scenarios that could disrupt the future which are listed below. Although each future scenario will be susceptible to extreme or unknown risks occurring, this section will look at a worst-case scenario that would detrimentally disrupt a return to historic growth.

Potential **Risks on the Horizon** outlined in the FTP Vision Element include:

- Migration to Florida from other states slows dramatically.
- A global crisis stalls Florida's tourism industry.
- Florida's economy enters a period of prolonged stagnation.
- Multiple hurricanes hit Florida in a single year.

Worst case scenario:

The main theme in the return to historic growth scenario is that population and economic growth is projected to be high. A major recession with the economy entering a period of prolonged stagnation is a risk on the horizon that could detrimentally disrupt this scenario and could cause the State to see rapid population and economic decline. For this future scenario, FDOT should plan for population and economic trends but also be prepared for if an extreme circumstance occurs that could majorly disrupt the assumptions and expectations associated with a return to historic growth.

How this risk could disrupt this future:

There would be a decrease in jobs, decrease in population, and a decrease in tax revenue. This would result in not having the adequate funding to cover current and future transportation projects. If roads are not built strategically or if projects cannot be finished, then this lack of funding could be detrimental for parts of the State's population in being able to get from place to place. A major recession would also influence the State's labor force because jobs would be available in limited areas. This could further contribute to unemployment because people may not be able to obtain employment without access to an automobile. This could also be juxtaposed with the fact that there may not be enough funding for adequate public transit services (e.g. enough routes).

It could get worse:

If multiple hurricanes in a year occur in conjunction with a major recession then this would further threaten infrastructure, the safety of residents, and may discourage migration to urban-coastal areas because a lot of growth would be concentrated in coastal areas.

A major recession could be on the horizon and may occur in conjunction with another extreme event such as multiple hurricanes which would result in rapid population and economic decline. Risks on the horizon could affect FDOT in being able to achieve its FTP policy goals, especially if they are not prepared to be resilient against extreme events. Being aware of the extreme disruptions that could affect and derail this future scenario will help FDOT to be more strategic in deciding how much new infrastructure should be constructed and how to protect the most strategic assets.

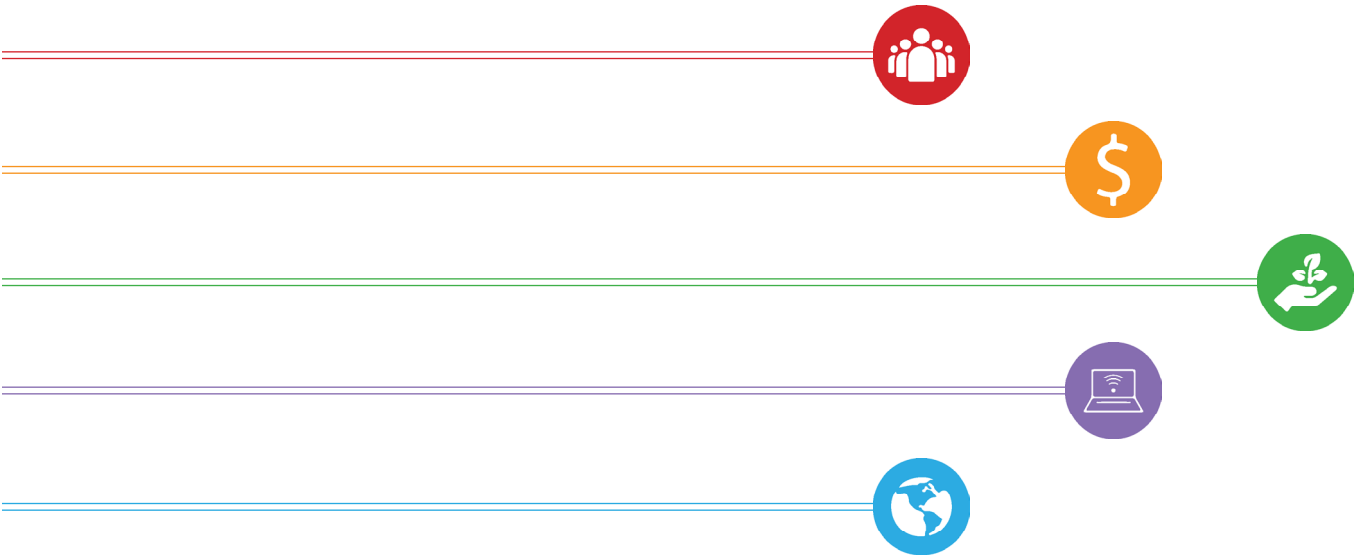
Moving Forward

Based on the Studio team’s analysis and findings, population uncertainties will pose the greatest threat under a return to historic growth scenario in Florida. It was also found that the uncertainties in this future would mostly impact Florida’s coastal-urban and inland-urban areas. FDOT’s policy goals of achieving “Safety and Security for Residents, Visitors, and Businesses” and “Agile, Resilient, and Quality Infrastructure” were found to be most at-risk under this scenario. If a return to historic growth scenario occurs in the next 50 years in Florida, being aware of the risks that may affect transportation planning is necessary for FDOT to determine which recommendations to implement.

The FTP Vision Element lays out some solutions that could be considered in a return to historic growth scenario such as:

- Continuing to expand our highway system to accommodate continuously growing demand for moving people and freight,
- Using technology and information to better manage our existing highway system, and
- Developing alternatives to highway transportation where there is sufficient demand.

The methods used to create this module and the information contained within it will aid in the creation of new solutions that will better mitigate against risks when FDOT updates the FTP Vision and Policy Elements.



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Module 2: Rural Rediscovery



Introduction

This module will explore the relevant risks to Florida’s transportation system under the “rural rediscovery” future scenario. In the FTP Vision Element, FDOT defines the rural rediscovery scenario as:

“Focus on rural areas and small towns, including traditional industries such as agriculture and eco-tourism, as well as new sectors”

According to the FTP Vision Element, planners may expect to experience the following under a rural rediscovery scenario:

- The agriculture sector expanding to meet demand for local and export markets,
- Specialized manufactured goods could be produced anywhere in Florida due to rapid expansion in broadband and 3-D printing,
- Retirees, families, visitors spend more time visiting environmental recreational areas,
- Rising costs and concerns about coastal flooding encourage more residents to move inland.

Through the studio team’s methods, it was identified that a rural rediscovery scenario would most likely affect **inland-rural** Florida (Figure 3.2.1). Figure 3.2.2 displays areas where growth has started to effect rural areas in the State. Some examples of Florida rural towns that may experience this future include Century, Fort Meade, and Sebring. It was also determined, through this process, that the transportation network would be **most vulnerable to environmental and technological risks** under this future scenario. This module will identify specific risks and potential consequences related to how a rural rediscovery scenario could affect the achievement of FDOT’s FTP policy goals.

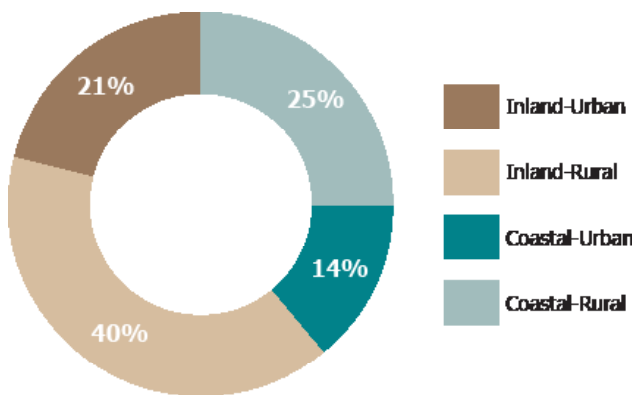


Figure 3.2.1: Impact of Risks by Region
Source: Fall Studio, 2018

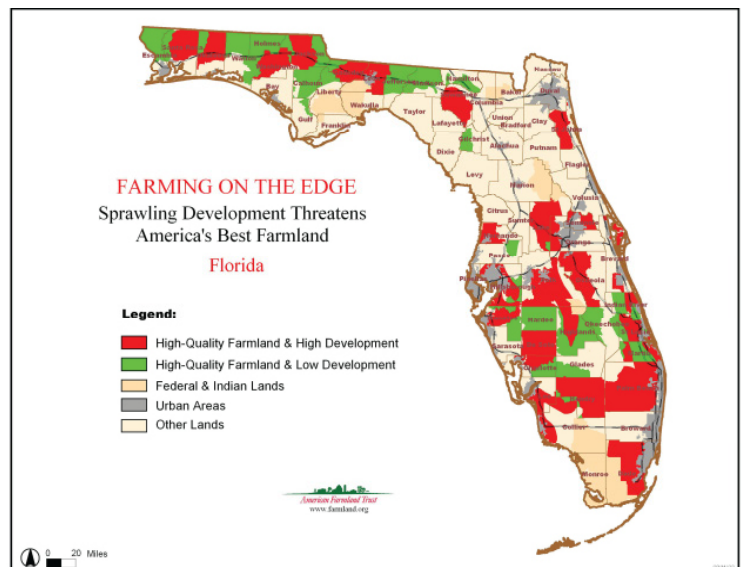
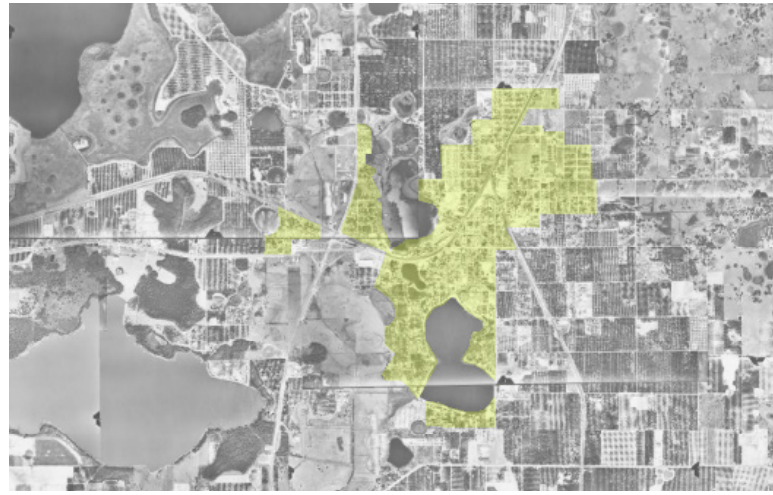


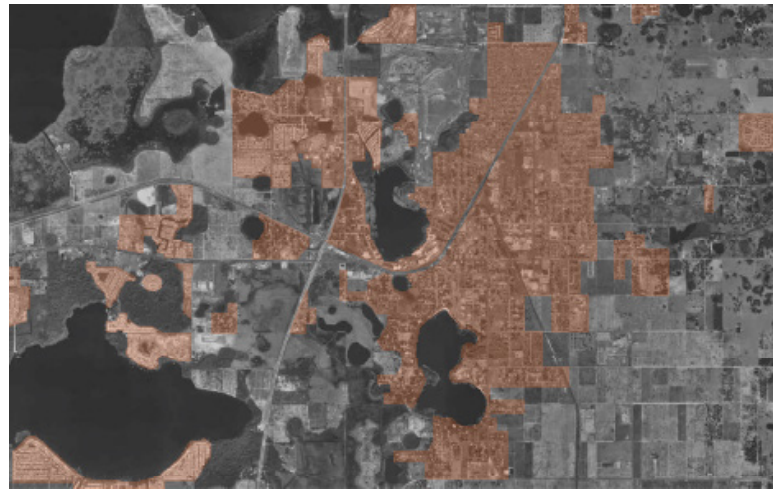
Figure 3.2.2: Encroachment on Florida’s Farmland
Source: America’s Farmland Trust, 2002

Visioning

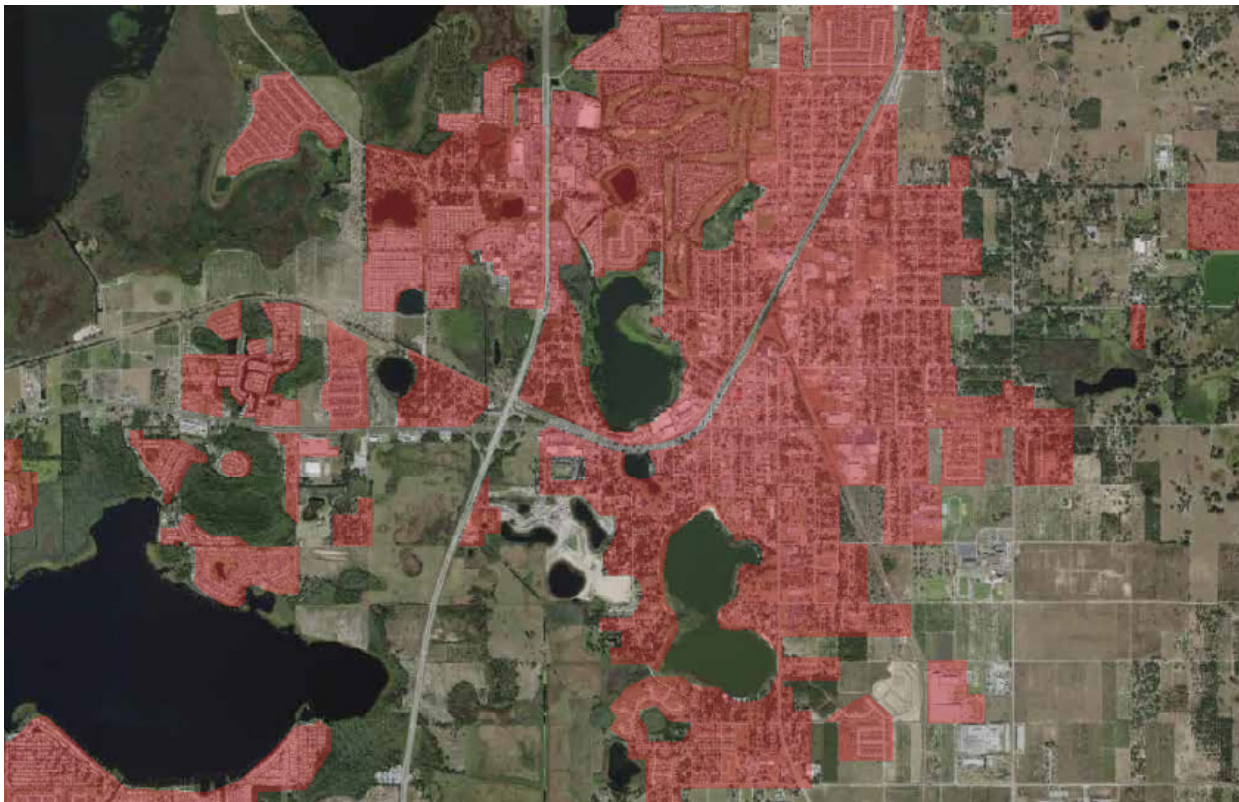
Rural areas, such as Haines City, could be affected by the rural rediscovery future scenario. This scenario could lead to reductions in agricultural and open spaces; increases in lakefront and strip development; and encroachment on environmental buffers and sensitive lands. The urban expansion in these pictures is not as drastic as development could be under this future; however, these depictions show some aspects of development patterns that could present in areas where this future occurs. **Figures 3.2.2 to 3.2.4** show that development located along major roads, which highlights how transportation decisions affect land development patterns and our environment. Rural rediscovery in Florida would require careful consideration of how transportation improvements affect our environment.



1968



1995



2017

Fig. 3.2.3 Haines City 1968 (top); Fig. 3.2.4 Haines City 1995 (mid); Fig. 3.2.5 Haines City 2017 (bottom)
Imagery Sources: Polk County GIS Interactive Map, 2018 (top, bottom); Google Earth, 2018 (Middle).

Uncertainties and Risks

The Fall Studio team used the literature review and data from survey responses to identify specific risks that could affect a rural rediscovery scenario. The team also used this data to create **Table 3.2.1** which summarizes the potential consequences that the different risks could pose to four regions in Florida (i.e. coastal-rural, coastal-urban, inland-rural, and inland-urban). This process aided the team in visualizing how the most impacted areas of the State could look under a rural rediscovery scenario. The level of impact for each risk was evaluated based on the average vulnerability score. This revealed that environmental and technological uncertainties are most likely to have the highest impact on this future in inland-rural areas. The team also created **Figure 3.2.5** on the opposing page which demonstrates how vulnerable the affected region is to the anticipated risks.

Environmental risks were determined to have the highest overall risk for this future since rural regions tend to have more environmentally sensitive areas. Experts rated technology risks as threatening to a rural rediscovery scenario due to the role of technology in supporting the agricultural industry. Funding and expanding the transportation network for new growth and development patterns may also pose risks in inland-rural regions in Florida. The State may also be more involved in global trade and face global risks in this future. Each of the identified risks and their relation to this scenario are expounded upon on the following pages. For each uncertainty area, the team analyzed why the identified risks could affect this future and how the risks could affect transportation.

Table 3.2.1: Consequences of Risks on Regions under Rural Rediscovery					
Risks under Uncertainty Area	Coastal-Rural	Coastal-Urban	Inland-Rural	Inland-Urban	Vulnerability score
Population					
Rapid Population Growth	M	L	H	L	7
Aging Population	M	L	M	L	6
Congestion from Suburbanization	M	L	H	L	7
Average					6.67
Economics					
Income Inequality	M	L	H	L	7
Allocation of Funding	M	L	M	L	6
Lack of Financing for New Projects	M	L	M	L	6
Average					6.33
Environment					
Inland Flooding	L	L	E	M	8
Reduction of Open Space	L	L	E	H	9
Extreme Temp & Water Scarcity	L	L	E	E	10
Average					9.00
Technology					
Slow Adoption of new technology	H	L	H	M	9
Cyber Security	H	L	H	M	9
Average					9.00
Global Issues					
Global Economic Events and Crisis	M	L	H	L	7
Geopolitical Effects	M	L	H	L	7
Influx of Migrant Workers	L	L	H	L	6
Average					6.67

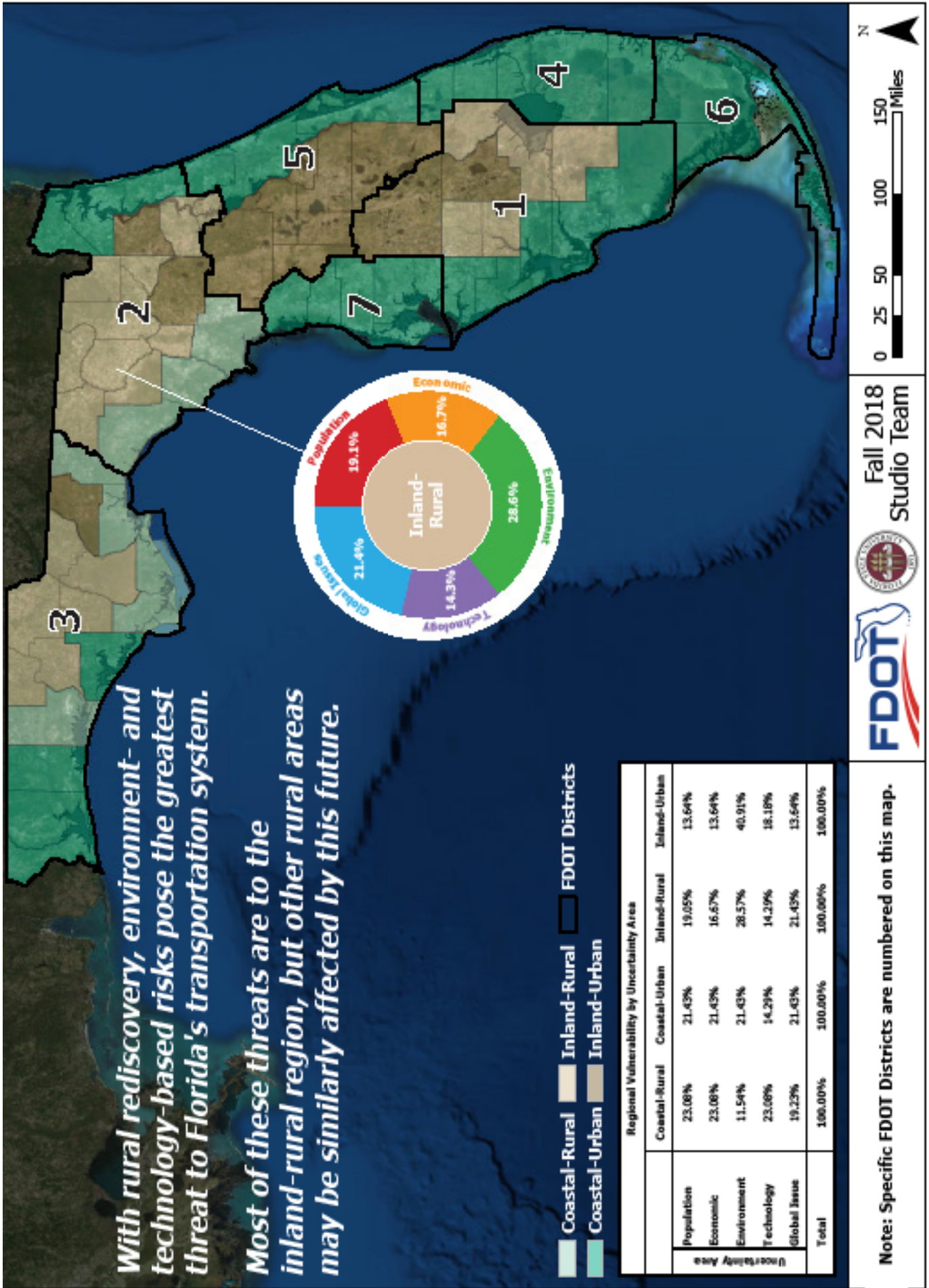


Figure 3.2.6: Risks by Region for Rural Rediscovery
 Source: Fall Studio Team, 2018

Population Risks in Rural Rediscovery



Rapid Population Growth

Why is this a risk in this future?

Florida could see intra-state population shifts should coastal areas experience more frequent or severe inundation from sea level rise. Small towns in inland-rural counties may experience rapid population growth from climate migration.

How does this affect Transportation?

Rapid population growth in inland-rural counties could increase capacity needs on state roadways to accommodate the movement of more people and freight. The rail network may require extensions to areas with rapid growth to offer alternatives for movement of people and freight.

Aging Population

Why is this a risk in this future?

Rural Rediscovery could result in rapid population growth and increased visitors to rural recreational areas. Due to fewer transportation options in these areas, the aging population may need to drive more often than they would in densely populated urban areas.

How does this affect Transportation?

Rural roads can be challenging for aging drivers. Certain aspects of these roads and intersections may need improvements (e.g. clear road paint, reflectors, rumble strips, multi-phased signalization at intersections) to compensate for age related losses in visual acuity and spatial functioning.

Congestion from Suburbanization

Why is this a risk in this future?

If small towns in inland-rural counties become desirable places to live, they may be susceptible to sprawling development patterns and excessive greenfield development if there are inadequate provisions for limiting growth in their comprehensive plans and land development regulations.

How does this affect Transportation?

Sprawling development patterns are widely considered inefficient and burdensome for transportation systems. Suburbanization of rural areas may not make practical the development of pedestrian and bike facilities or the establishment of public transit.



Rapid population growth and congestion from suburbanization could go hand-in-hand under this future. Specifically, rapid population growth may result in greenfield development that would precipitate land patterns burdensome to transportation planning. Additionally, increases in the overall population may lead to increases in aging populations, which would make certain improvements to rural roads and intersections necessary.

Figure 3.2.7: Congestion on Florida Highway

Source: National Association of Realtors, 2018

Economic Risks in Rural Rediscovery



Income Inequality

Why is this a risk in this future?

Rural rediscovery would result in many people moving into rural communities. The influx of people moving into these communities would result in expansion of certain industry sectors and more competition for jobs.

How does this affect Transportation?

The competition for jobs in these communities causes people that possess the prerequisite job skills to be unable to obtain employment due to the lack of non-auto routes in the rural communities. FDOT would need to provide public transportation systems for those that are disadvantaged.

Allocation of funding

Why is this a risk in this future?

Rural communities may not be getting adequate funding because the increase in population is not matched by an increase of funding due to competition with urban areas. The non-rural urban areas may still receive the majority of funding.

How does this affect Transportation?

Transportation infrastructure projects in rural areas may not receive the funding they need to meet demands for the increases in population. This could result in roads that do not meet level of service standards or certain safety criteria.

Lack of Financing for New Projects

Why is this a risk in this future?

Growth of manufacturing businesses and agriculture production within rural Florida are not able to secure financing for projects that can improve the community's infrastructure due to a new industry in a neighboring state or urban areas.

How does this affect Transportation?

Owing to lack of financing, projects such as new farm to market routes, improved connections from rural areas to major freight and passenger hubs in urban areas, freight terminals, and airports cannot be realized.



According to the Phase II survey, economic risks were the least likely to have an impact under the Rural Rediscovery scenario. The Fall Studio team identified the main economic risks that were likely to impact Florida's transportation network as income inequality, allocation of funding, and lack of financing for new projects.

Figure 3.2.8: Florida Oranges

Source: Lesile Atcheson, n.d.

Environmental Risks in Rural Rediscovery



Inland Flooding

Why is this a risk in this future?

More residents in Florida's inland areas due to rising costs and concerns about coastal flooding could require expansion of transportation systems and facilities in rural areas resulting in increases in impervious surfaces. Surface runoff from this could lead to inland flooding if left unmitigated.

How does this affect Transportation?

Inland flooding can cause damage to transportation infrastructure and impair storm sewer systems. Disruption of the road network due to flooding may lead to road closures and car accidents that would affect the mobility of residents and freight.

Reduction of Open Space

Why is this a risk in this future?

Expansion of the agricultural sector could lead to the consumption of lands with recreational purposes and/or high water retention capabilities. These changes in open space could result in shortages of quality recreational areas and lands that retain overflows from storm events.

How does this affect Transportation?

Conversion of rural areas in Florida with significant water retention capabilities could impede drainage and exacerbate flooding, which could disrupt transportation systems. Reduced open space may also result in higher costs to mitigate air and noise pollution caused by traffic.

Extreme Temperature & Water Scarcity

Why is this a risk in this future?

More impervious surfaces in Florida's rural areas could increase temperatures and reduce groundwater recharge. Excessive use of groundwater resources to meet agricultural demand could lead to water scarcity and saltwater intrusion. This would have long-term negative effects on agricultural production and export markets.

How does this affect Transportation?

Failure to meet the local food demand will increase the demand for freight transportation systems and extreme temperature will augment that demand.



Environmental uncertainties are deemed to pose the greatest threat to the rural rediscovery scenario. The futuristic depiction of this alternative scenario may lead to the environmental risks of inland flooding, reduction of open space, and water scarcity. These risks have the potential to impair transportation and storm sewer systems, negatively impact agricultural production, and increase the demand for freight transportation systems.

Figure 3.2.9: Flooding in Jacksonville Submerges Transportation Infrastructure

Source: James Cannon, Jacksonville Business Journal, 2018

Technology Risks in Rural Rediscovery



Slow Adoption of New Technology

Why is this a risk in this future?

Technological growth could require updates to Florida's transportation infrastructure to support more modes of travel. Rural communities and industries within them would be directly influenced by technological improvements (e.g. ITS, ACES) in land transport infrastructure and assets.

How does this affect Transportation?

Florida must be prepared to adopt new technologies to support its industries in a competitive global economy. The adoption of these technologies could also assist into expansion of certain industries and other growth opportunities for transportation.

Cyber Security

Why is this a risk in this future?

To defend and recover from cyber attacks, the State will need strong security policies and procedures in addition to experienced personnel. Otherwise, rural area's signaling and control systems may be vulnerable to malicious attacks, unauthorized access, and disruption to transportation system performance that could have severe consequences, especially if these areas experience increased migration and growth.

How does this affect Transportation?

Integrated transportation systems and technologies that would be adopted by rural communities are increasingly connected and more complex than traditional transportation systems. These systems exchange more data and have more operational system functions, such as control systems to monitor weather and traffic conditions; these functions could make systems vulnerable to cyber security threats by central authorities and could result in safety and efficiency concerns that could reduce benefits to integrating these technologies.



As Florida's transportation system grows increasingly connected and more complex, its modes of transportation and infrastructure are likely to influence rural communities and industries. As a result, the rural rediscovery alternative future is at risk of more frequent cyber security threats and slow adoption of new technologies in transportation to support the mobility of people and freight, as well as its global economic competitiveness.

Figure 3.2.10: Artist Rendition of Freight and Globe

Source: Higher Ground, Inc., 2018

Global Risks in Rural Rediscovery



Global Economic Events and Crises

Why is this a risk in this future?

Numerous global economic events or crises could affect the export of goods (e.g. agricultural goods) in rural communities, in addition to the use of multi-modal transportation infrastructure near metropolitan areas.

How does this affect Transportation?

Depending on the economic event or crisis, shifts in spending habits could result in decreases in the export of goods, which could hinder community growth. Specifically, this would result in fewer funds for transportation related projects in Florida communities.

Geopolitical Effects

Why is this a risk in this future?

Geopolitical events that increase immigration to Florida could impact development of transportation infrastructure, its utilization, and overall growth patterns, especially in terms of density of populations and available transportation resources.

How does this affect Transportation?

A geopolitical event (e.g. political disruption, reaction to a natural disaster) could affect rural transportation patterns. Ripple effects from global climate events, and a mass migration as a result of said events, could inhibit introduction of sustainable transportation systems.

Influx of Migrant Workers

Why is this a risk in this future?

A sudden influx of migrant workers could simultaneously increase productivity and financial activity, while also heightening logistical problems concerning transit that already exist in many rural communities.

How does this affect Transportation?

Increased workers would result in both increases in personal vehicle and transit use, as well as the need for work-related transportation. Lack of political support by some interests could inhibit development of equitable options and might affect supply chain modes of transportation.



The effects from global and geopolitical events have not always had profound impacts on Florida's rural communities; however, these communities are becoming more vulnerable to global risks as Florida's economy becomes more interconnected and populations in these areas increase. These risks include population strain on limited transportation infrastructure, economic repercussions from an influx of migrant workers, and a recession brought about by global economic activity.






















Figure 3.2.11: Farmworkers Picking Tomatos

Source: Joe Raedle, Getty Images

Potential Disruptions to FTP Policy Element Goals

Included in the FTP are seven policy element goals. Each of these encompass a number of objectives and suggestions to implement practical and efficient transportation solutions. Of these seven goals, four are related to the statewide transportation system and the remaining three outline how transportation supports the overall priorities of the State. The risks identified in this subsection could affect implementation of these goals under a rural rediscovery scenario.

Environmental issues are most likely to impede achievement of Florida’s transportation goals under this scenario. Extreme temperatures, water scarcity, inland flooding, and open space reductions are potential issues that could affect implementation of Florida’s Transportation Plan. Slow adoption of new technology and cyber security threats could also have negative implications for Florida’s transportation system under this future. Other factors related to population growth, economic issues, and global issues could also thwart Florida’s efforts to achieving transportation-related goals. **Table 3.2.2** below summarizes the disruptions that the uncertainty areas could have to the FTP Policy Element goals. As seen below, “Agile, Resilient, and Quality Infrastructure”, “Efficient and Reliable Mobility for People and Freight”, and “More Transportation Choices for People and Freight” are most at-risk under this scenario. On the following pages are specific ways in which risks related to the uncertainty areas could interfere with these goals.

Goals	Population	Economic	Environment	Technology	Global
Safety and Security for Residents, Visitors, and Businesses		-			-
Agile, Resilient, and Quality Infrastructure	-				
Efficient and Reliable Mobility for People and Freight				-	
More Transportation Choices for People and Freight					
Transportation Solutions that Support Florida’s Global Economic Competitiveness			-	-	
Transportation Solutions that Support Quality Places to Live, Learn, Work, and Play		-	-	-	-
Transportation Solutions that Enhance Florida’s Environment and Conserve Energy	-	-		-	-

Safety and Security for Residents, Visitors, and Businesses



- Aging drivers have more crashes on high-speed, low-volume roads and difficulty gauging distances of oncoming traffic at rural intersections lacking multi-phase signalization (Brewer and Bedsole, 2015), which could result in certain safety concerns on rural state roads if rural areas have population increases.
- Rural rediscovery could result in sprawling development patterns, which would potentially increase traffic and pedestrian fatalities (Ewing, 2003) in the areas.
- Road closure and accidents owing to inland flooding will hamper the security of residents, visitors and business.
- Reduction of open space and conversion of water retention areas may heighten flooding and put the safety of residents at jeopardy.
- Increasing connectivity and more complex transportation systems between the urban and rural areas could be more vulnerable to cyber attacks that could disrupt digital and physical transportation networks, as well as physical transportation assets.

Agile, Resilient, and Quality Transportation Infrastructure



- A lack of adequate funding for transportation projects in Florida's rural communities could result in poor quality infrastructure making roads and other modes less agile and resilient.
- Inland flooding, stormwater runoff, and rising temperatures may damage transportation infrastructure and increase operation and maintenance costs.
- Slow adoption of new technologies for transportation infrastructure, which would support rural communities and industries, could impact the transportation system's user satisfaction, quality, resiliency, and performance.
- Lack of proper transportation infrastructure could impede overall community growth, and development of equitable and efficient systems for movement of goods and people, especially within the context of increases in migrant workers and more vulnerable populations.

Efficient and Reliable Mobility for People and Freight



- Rural rediscovery could result in sprawling development patterns that would increase person- and freight-hours of delay related to bottlenecks, gaps, and crashes. This would prevent people from arriving to their destinations in a timely manner and reduce the reliability of supply chain movement to, from, and through Florida.
- Inadequate funding for transportation projects could make individuals' travel less efficient and reliable. Specifically, this lack of funding could result in poor transit, which could increase reliance on automobiles.
- Disruption of transportation infrastructure (e.g. road and sidewalk inundation, traffic signal malfunction, road closure) due to flooding and extreme heat may cause delays and slow traffic flow for people and freight.
- Widespread expansion of agriculture may reduce the amount of land available to increase the capacity of Florida's major airports, seaports, and other freight terminals at suitable location.
- A lack of funds to support sudden increases in population could impede efficient mobility, both in terms of those who rely on limited rural transit options such as migrant workers, as well as larger-scale auto-oriented infrastructure.

More Transportation Choices for People and Freight



- Rural rediscovery could further the aging population's reliance on automobiles due to fewer transportation choices in rural areas. This could also undermine efforts to establish reliable transit, pedestrian, and bike facilities in these areas.
- Rural rediscovery could limit the choices of moving people or freight due to the lack of adequate funding for transportation projects, as well as many of these rural communities being in low-density areas.
- Temperature increment may incline people towards the use of automobile, declining the potential of using other transportation choices (e.g. bicycle) for people.
- Reduced open space may make it difficult to provide buffered bike lanes and recreational trails within walking distance of trip destination.
- Slow adoption of new transportation technologies supportive of rural industries could also result in fewer transportation choices, which would limit the mobility of people and freight. This could also affect Florida's global economic competitiveness.
- Certain existing residents could be opposed to implementing new infrastructure that could allow for more equitable transportation for newly arrived immigrants, such as more bus routes, and bike-pedestrian infrastructure.

Transportation Supports to a Globally Competitive Economy



- Rapid population growth and greenfield development in rural areas could reduce the number of agricultural activities and require modifications to transportation systems that meets the needs of new predominant uses.
- Lack of adequate funding for transportation projects in rural areas could have an adverse effect on Florida's ability to meet the local demand for its agricultural goods.
- Shifts in development patterns within rural and more sparsely populated ex-urban communities, due to global and geopolitical events, could disrupt the exporting of goods.

Transportation Solutions that Support Quality Places to Live, Learn, Work, and Play



- Rapid population growth and greenfield development could lead to sprawling land development patterns that result in congestion. This could perpetuate the need for cars in urbanizing areas and undermine efforts to create quality places including historical areas.

Transportation Solutions That Enhance Florida's Environment and Conserve Energy



- Open space reductions and disruptions in sensitive areas may place wildlife habitat at risk. FDOT considers environmental implications of transportation developments through the Project Development and Environmental (PD&E) process, which could be elongated for development in sensitive areas. This could also increase study costs.
- Water retention and high recharge areas may be subject to stricter development regulations (e.g. increased groundwater thresholds, more mitigative measures for development), which could increase costs to provide transportation infrastructure.

Risks on the Horizon

Risks on the horizon are important for FDOT to be aware of to be prepared to plan for the extreme and events that could derail trends in the future. The FTP Vision Element outlines a few examples of extreme scenarios that could disrupt the future which are listed below. While each future scenario will be susceptible to extreme or unknown risks occurring, this section will look at a worst-case scenario risk that could detrimentally disrupt a rural rediscovery scenario in Florida.

Potential **Risks on the Horizon** outlined in the FTP Vision Element include:

- Migration to Florida from other states slows dramatically.
- A global crisis stalls Florida's tourism industry.
- Florida's economy enters a period of prolonged stagnation.
- Multiple hurricanes hit Florida in a single year.

Worst case scenario:

The main theme in the rural rediscovery future scenario is that people are moving back into rural areas that have open land and are supported by agriculture as the main economic sector. Although Florida is usually known for hurricanes, in terms of weather, drought is also one of the extreme weather events affecting the State. The US Drought Monitor reported an exceptional category of drought (D4), affecting 39.08% of Florida's land in 2001; recognized as the most intense period of drought to occur in Florida. Today, however, owing to an ongoing lack of rainfall, parts of the State's central communities are now enduring "extreme" drought as demonstrated in **Figure 3.2.11**, the second-worst level (Rice, 2017).

A decade-long drought is a risk on the horizon that could detrimentally disrupt this rural rediscovery future scenario. For this future, FDOT should plan the transportation system to better accommodate agriculturally focused areas but also be prepared for if an extreme circumstance such as a drought occurs that could disrupt the assumptions and expectations associated with a rural rediscovery scenario.

How this risk could disrupt this future:

A decade-long drought would negatively affect the agriculture production levels in rural areas, due to widespread water shortages followed by an increased risk of wildfire. If FDOT invests in a lot of new infrastructure projects to export agricultural products these investments may become useless if the agriculture sector is dwindling due to a prolonged drought. Furthermore, if new transportation projects are being constructed, this would mean a decrease in open space and natural areas. If there is a drought this would negatively affect many natural habitats especially if those systems are already under stress from fragmentation due to the transportation system. A decade long drought that destroys the agriculture sector in Florida and worsens the condition of the environment may cause people to leave rural areas of the State.

It could get worse:

Florida's economy could enter a period of prolonged stagnation due to a recession which would cause a loss of jobs in the manufacturing sector and lead to further population decline from rural areas.

A decade-long drought could be on the horizon and may occur in conjunction with another extreme event such as a major recession which would result in the collapse of the agriculture sector, a decline in jobs, a decline of the natural environment, and a decrease in population in rural areas. Risks on the horizon could negatively affect FDOT in being able to achieve its FTP policy goals, especially if they are not prepared to be resilient against extreme events. Being aware of the extreme disruptions that could affect and derail this future scenario will help FDOT to be more strategic in deciding how much new infrastructure should be constructed and how to protect its most strategic assets.

U.S. Drought Monitor Florida

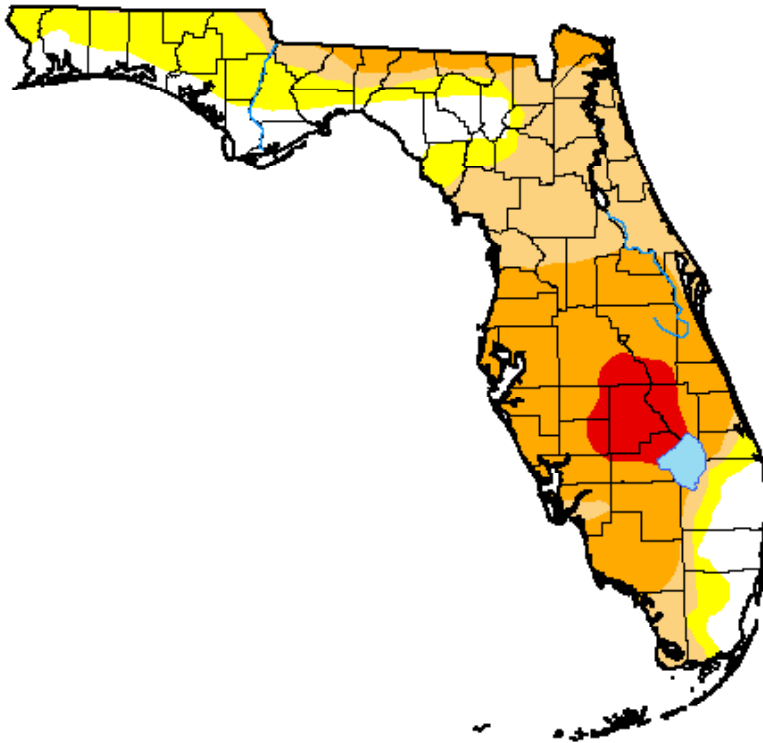
May 2, 2017

(Released Thursday, May 4, 2017)

Valid 8 a.m. EDT

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	15.97	84.03	00.00	38.42	5.59	0.00
Last Week 04-26-2017	23.50	76.50	57.43	33.45	0.00	0.00
3 Months Ago 01-31-2017	37.90	62.10	0.00	0.00	0.00	0.00
Start of Calendar Year 01-01-2017	14.17	85.83	6.07	0.00	0.00	0.00
Start of Water Year 08-27-2016	82.99	7.01	0.00	0.00	0.00	0.00
One Year Ago 05-03-2016	83.53	6.47	0.00	0.00	0.00	0.00



Intensity:

- D0 Abnormally Dry
- D1 Moderate Drought
- D2 Severe Drought
- D3 Extreme Drought
- D4 Exceptional Drought

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

Author:

Brian Fuchs
National Drought Mitigation Center



<http://droughtmonitor.unl.edu/>

Figure 3.2.12: Drought Impacts on Florida

Source: NOAA NCEI Climate, 2017

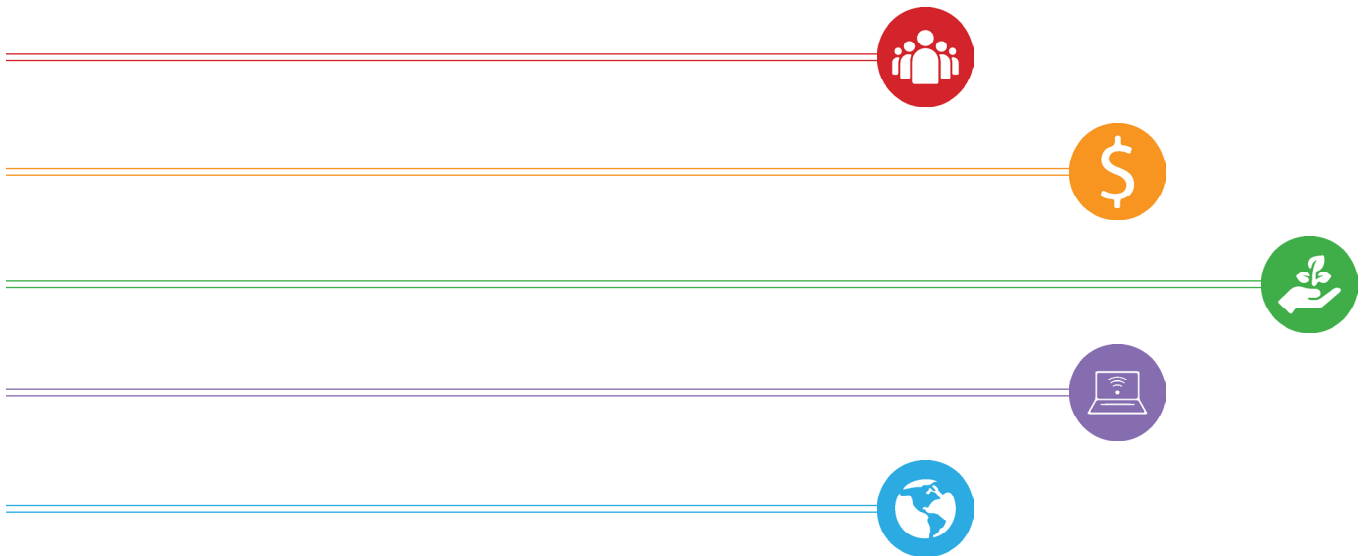
Moving Forward

Based on the Studio team’s analysis and findings, environmental and technological uncertainties will pose the greatest threat under a rural rediscovery scenario in Florida. It was also found that the uncertainties in this future would mostly impact Florida’s inland-rural areas. FDOT’s policy goals of achieving “Agile, Resilient, and Quality Infrastructure”, “Efficient and Reliable Mobility for People and Freight”, and “More Transportation Choices for People and Freight” were found to be most at-risk under this scenario. If a rural rediscovery scenario occurs in the next 50 years in Florida, being aware of the risks that may affect transportation planning is necessary for FDOT to determine which recommendations to implement.

The current FTP Vision Element lays out some solutions that could be considered in a rural rediscovery scenario such as:

- Revitalize historic communities while preserving rural lifestyle,
- Increase investment in farm-to-market freight routes, freight terminals, airports, and other infrastructure in rural and inland areas,
- Improve connections from rural areas to major freight and passenger hubs in urban areas,
- Expand recreational trails and access to natural places.

The methods used to create this module and the information contained within it will aid in the creation of new solutions that will better mitigate against risks when FDOT updates the FTP Vision and Policy Elements.



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Module 3: Global Trade Hub



Introduction

This module will explore the relevant risks to Florida’s transportation system under the “global trade hub” future scenario. In the FTP Vision Element, FDOT defines the global trade hub scenario as:

“Significant expansion in global trade, tourism, and investment”

According to the FTP Vision Element, the trends that planners may expect to experience under a global trade hub scenario include:

- Florida’s seaports and airports become the leading gateways for exports and imports serving Florida and the United States,
- The value of Florida agricultural and manufactured products sold in global markets increases exponentially,
- More than 150 million visitors travel to Florida each year – one third from overseas, and
- Florida becomes the premier location for multinational companies doing business in the United States, the Caribbean, and Latin America.

Through the studio team’s methods, it was identified that a global trade hub scenario would most likely impact urban areas in Florida and that multi-model development patterns could result in this scenario due to current preferences as well as the need to support trade and tourism. As seen in **Figure 3.3.1**, coastal-urban areas could be highly impacted by uncertainties, followed by inland-urban areas. Some examples of Florida cities that may experience a global trade hub scenario due to the presence of ports and airports are shown in **Figure 3.3.2** below. It was also determined through the Studio team’s process that the transportation network would be **most vulnerable to global risks** under this future. This module will identify specific risks and potential consequences related to how a global trade hub scenario could affect the achievement of FDOT’s FTP policy goals.

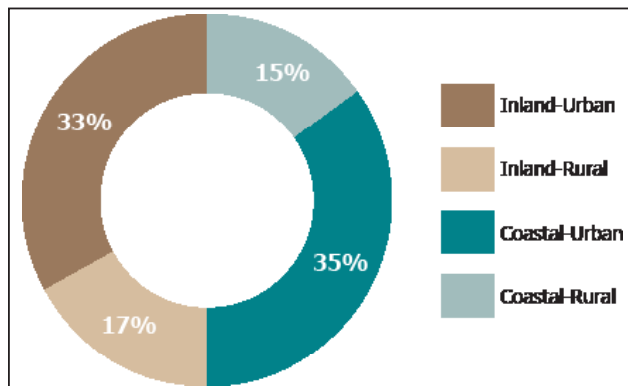


Figure 3.3.1: Impact of Risks by Region
Source: Fall Studio, 2018



Figure 3.3.2: Florida’s Port Facilities
Source: Florida Trend, 2010

Visioning

There are a wide variety of potential global risks to be aware of in a global trade hub future scenario. This scenario could lead to cyber attacks, changing global demands and supply patterns, extreme natural hazards, and a lack of expansion of existing port facilities. The ports displayed in these images shows how intermodal freight transport and terminal patterns in regional cargo gateway ports, such as Port of Palm Beach, could enter a new phase of development and resemble major cargo gateway ports such as those in Jacksonville and Miami. Although development patterns depend on improvements to each port, these figures highlight major changes to current leading gateways for exports and imports, future mobility of people and freight, and potential economic growth.



Port of Palm Beach
•••••



Port of Jacksonville
•••••



Port of Miami
•••••

Fig. 3.3.3 Port of Palm Beach (top); Fig. 3.3.4 Port of Jacksonville (mid); Fig. 3.3.5 Port of Miami (bottom)
Imagery Sources: Port of Palm Beach, 2018 (top); Jaxport, 2018 (mid); Fort Schuyler Maritime Alumni Association, 2018 (bottom)

Uncertainties and Risks

The Fall Studio team used the literature review and data from survey responses to identify specific risks that could affect a global trade hub scenario in Florida. The team also used this data to create **Table 3.3.1**, which summarizes the potential consequences that the different risks could pose to four Florida regions (i.e. coastal-rural, coastal-urban, inland-rural, and inland-urban). This process aided the team in visualizing how the most impacted areas of the State could look under a global trade hub scenario. The level of impact for each uncertainty area was evaluated based on the average vulnerability score. This revealed that global uncertainties are most likely to have the highest impact on this future in coastal-urban and inland-urban areas. The team also created **Figure 3.3.6** on the opposing page, which demonstrates how vulnerable the affected regions are to the anticipated risks.

Global risks were deemed to have the highest impact in this future scenario due to the significant expansion in global trade, tourism, and investment that would occur in Florida. Experts that were surveyed also rated technology risks as having a high impact in a global trade hub future scenario due to the importance of efficiently supporting industries and tourists in urban areas. Environmental uncertainties also pose a threat to the success of future global trade hubs if these risks disrupt the functionality of the transportation system. Acquiring the funding to expand the transportation network for new development patters to support growth may also pose risks in urban regions of the State. Each of the identified risks and their relation to this scenario are expounded upon on the following pages. For each uncertainty area, the team analyzed why the identified risks could affect this future and how the risks could affect transportation.

Table 3.3.1: Consequences of Risks on Regions in a Global Trade Hub					
Risks under Uncertainty Area	Coastal-Rural	Coastal-Urban	Inland-Rural	Inland-Urban	Vulnerability score
Population					
Rapid Population Growth	N	M	N	M	4
Population Decline	L	M	L	M	6
Average					5.00
Economics					
Decreasing Transportation Funding	L	M	L	M	6
Worsening Traffic Congestion	L	M	L	M	6
Average					6.00
Environment					
Extreme Weather & Storm Surge	L	H	L	M	7
Flooding	L	M	L	M	6
Average					6.50
Technology					
User Privacy	L	H	L	H	8
Low Smart Infrastructure Funding	L	H	M	H	9
Outdated Government Regulation	L	H	M	H	9
Average					8.67
Global Issues					
Lack of Adaptable Regulation	M	E	M	H	11
Geopolitical Events & Funding	L	E	L	H	9
Increase in Energy Prices	H	H	H	E	13
Average					11.00

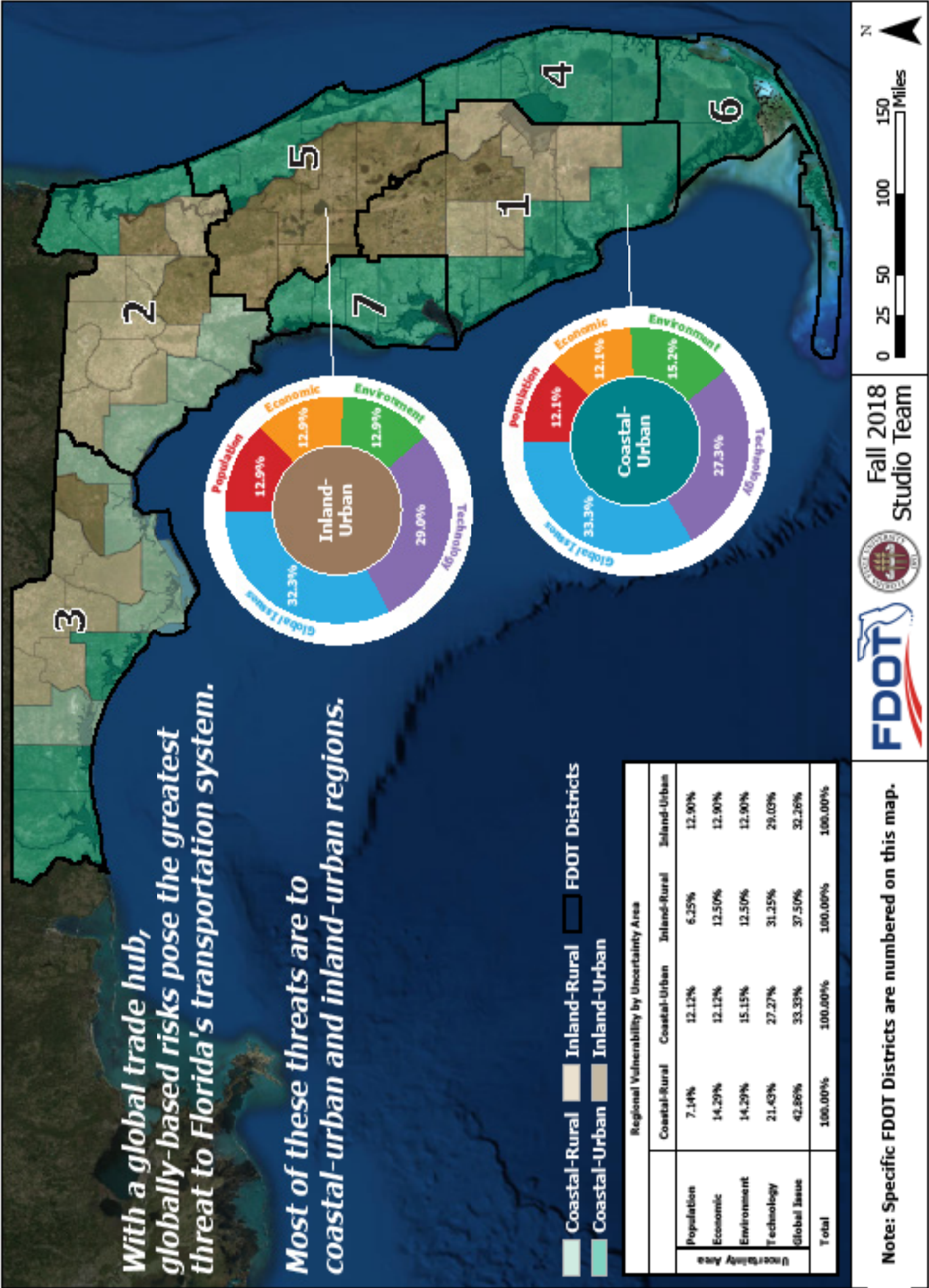


Figure 3.3.6: Risks by Region for a Global Trade Hub
 Source: Fall Studio Team, 2018

Population Risks in a Global Trade Hub



Rapid Population Growth

Why is this a risk in this future?

Rapid population growth could thwart efforts to develop transportation infrastructure concurrently. Furthermore, unforeseen increases in subpopulations could lead to unpredictable development patterns.

How does this affect Transportation?

Transportation improvements must occur concurrently with development for Florida to thrive in global trade. Rapid population growth or unforeseen subpopulation increases could make planning for this difficult (e.g. planning for generational preferences). Florida’s transportation network could be further strained in peak seasons if there are more than 150 million visitors per year.

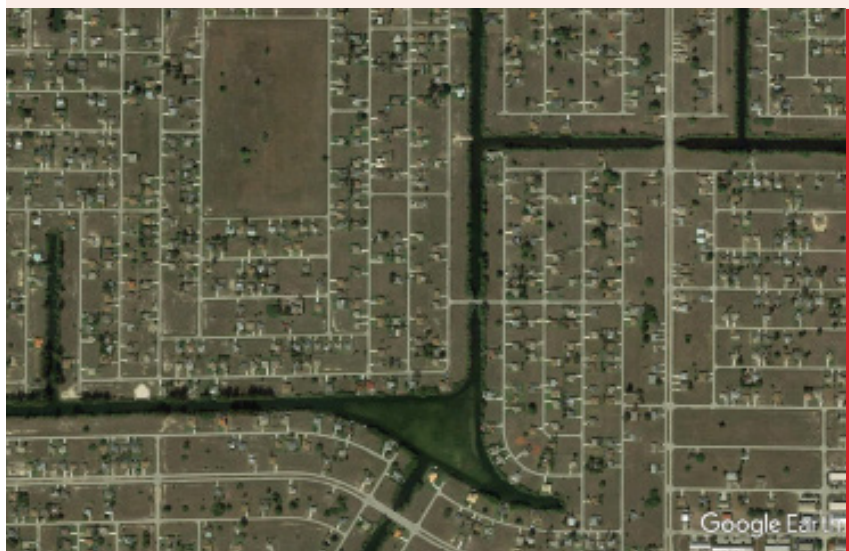
Population Decline

Why is this a risk in this future?

A decline in population could lead to declines in import and export markets in Florida. Furthermore, a population decline could result in Florida’s transportation network having fewer users.

How does this affect Transportation?

If Florida’s population were to decline, then certain transportation systems may be under capacity. Decreases in ridership or use of other modes (e.g. auto/freight use on toll roads) could result in funding gaps that would need to be filled by taxpayer dollars.



Population-based risks are not expected to be as potent as other risks under this future; however, extreme growth or a decline in growth would make it difficult for the Florida Department of Transportation to optimize infrastructure improvements. A failure to optimize improvements could result in funding gaps that affect taxpayers.

Figure 3.3.7: Suburban Subdivision Not Built-Out
Source: Google Earth, 2018

Economic Risks in a Global Trade Hub



Decreasing Transportation Funding

Why is this a risk in this future?

There is projected to be an increase in the use of seaports, airports, and rail terminals under this scenario. This would result in a need for better connections to seaports and airports in addition to improvements along intrastate and interstate corridors. All of these transportation solutions require increases in funding.

How does this affect Transportation?

Decreases in transportation funding could cause a substantial “gap” between the demand for funding for these transportation improvements and the amount of available funding. If funding and transportation investment does not keep pace with growing demand for freight and trade industries, it could stifle economic growth.

Worsening Traffic Congestion

Why is this a risk in this future?

The increase in user demand for airports, seaports, and rail terminals could cause an increase in traffic congestion on Florida’s roads. The increase in visitors and multinational companies within the state could also cause increases in congestion as well.

How does this affect Transportation?

This risk could require more frequent transportation infrastructure improvements. Specifically, upgrades to highways, harbors, airports, and rail corridors in order to accommodate the increase in traffic.



According to the forecasted result of this scenario, the economic demand for improved transportation infrastructure would be greatest in the coastal-urban and inland-urban areas. Traffic congestion would also increase the most in these two areas as well.

Figure 3.3.8: Northeast Florida Freight Mobility Study

Source: RS&H, 2018

Environmental Risks in a Global Trade Hub



Extreme Weather Event & Storm Surge

Why is this a risk in this future?

Increased import-export business at Florida's seaports and airports, followed by increased freight activity may augment the concentration of air pollutants from the transport sector; hence, this would induce climate change near the port areas. Absence of inadequate measures to ensure effective environmental policy implementation in those areas may engender extreme weather events (i.e. tropical cyclone) with a subsequent effect of storm surge in the coastal areas.

How does this affect Transportation?

As instances of extreme weather and storm surge, residents may migrate from Florida's coastal to inland areas and result in overburdened transportation system in the receiving areas. These environmental risks also have the potential to inundate seaports and airports, located near the coastal areas, and thereby hamper the export-import business adversely. This may create evacuation congestion as well, raising demand for emergency resource management.

Flooding

Why is this a risk in this future?

Millions of visitors travelling in Florida and housing multi-national companies in the State will intensify the need of expanded transportation routes. These developments would interrupt natural permeability of land, leading to inland flooding. Moreover, the low-lying topography and extensive shoreline also make the coastal communities of the state of Florida more susceptible to inundation by flood waters.

How does this affect Transportation?

Flooding would disrupt the transportation network for weeks, impacting the transportation infrastructures and creating safety hazard for visitors. This would also affect freight transportation activity and cause supply chain breakdown.



Although environmental uncertainty may not cause the greatest impact to the Global Trade Hub scenario, this alternative scenario may lead to significant environmental risks of extreme weather events, storm surge and inland flooding. These risks are likely to impede the export-import business by disrupting the freight transportation services, create evacuation congestion and thus increase demand for emergency resource management.

Figure 3.3.9: Approaching Storm in Ormond Beach, Florida

Source: Jason Weingart, NASA, 2012

Technology Risks in a Global Trade Hub



User Privacy

Why is this a risk in this future?

Integration of new technologies into Florida's transportation network could threaten user privacy. As the number of visitors traveling to Florida increases, rights to privacy could be violated at the cost of access to the free flow of data that supports smart transportation solutions.

How does this affect Transportation?

Insufficient funding sources to be invested into smart projects in transportation networks are a risk for Florida because adequate sources are essential for the state to remain a global leader in world trade.

Lack of Funding for New Infrastructure

Why is this a risk in this future?

Lack of funding for smart infrastructure that is not acquired through an electronic fare collection system and other State revenue sources could result in challenges to the performance of transportation networks and infrastructure.

How does this affect Transportation?

Insufficient funding sources to be invested into smart projects in transportation networks is a risk for Florida because adequate sources are essential for the state to remain a global leader in world trade.

Outdated Government Regulation

Why is this a risk in this future?

State and local laws and regulations need to be updated to emerging technologies in transportation systems and infrastructure in order to ensure projected economic and safety benefits.

How does this affect Transportation?

If state and local governments do not modernize or eliminate laws and regulations, it may cause confusion, introduce barriers, and other challenges in the deployment of new technologies in multimodal transportation networks.



Technology risks to the global trade hub future scenario could affect benefits of new technologies in transportation by threatening user privacy with potential cyber attacks, lack of funding for smart infrastructure obtained through electronic fare collection, and outdated government regulated not incorporated into future transportation networks.

Figure 3.3.10: Smart City Graphic

Source: Zhudifeng, BizJournals, 2018

Global Risks in a Global Trade Hub



Lack of Adaptable Regulations

Why is this a risk in this future?

Lack of global regulations, such as inconsistent vehicle and emissions regulations, could contribute to worsening and wide-scale climate disasters, which could have both direct and indirect effects on Florida.

How does this affect Transportation?

Lack of regulation in Florida could have implications on adaptability of infrastructure, which could worsen environmental conditions. Increased population will increase vehicle miles traveled, which will create difficulties in implementing modern vehicle/structural technology.

Geopolitical Events & Funding Mechanisms

Why is this a risk in this future?

Geopolitical events, such as warfare and terror, could result in increased migration and difficulties maintaining the state's transportation infrastructure; these events could also result in the state's ability to compete economically, both internationally and domestically, with other regions.

How does this affect Transportation?

Increases in population could prevent proper and efficient funding of necessary transportation systems. It could also detract from the continued success of commercial procedures, such as supply chain efficiency, depending on the externalities wrought on the state by international events.

Influx of Migrant Workers

Why is this a risk in this future?

Increases in energy prices could have rippled effects on the economy of Florida, both in terms of production of traditional agricultural products and shipment to more urban areas, as well as the general willingness of people to utilize personal vehicles for transportation.

How does this affect Transportation?

Increases in energy prices could increase the cost of shipping products, which could reduce profits and overall economic development of the state. Personal automobile use could lessen as well, resulting in problems related to the lack of infrastructure for alternate modes of transportation.






















As globalization continues to increase, the status of Florida's transportation system is at risk from multiple influencing events and variables. Both broader externalities and acute consequences need to be considered when planning for the greater transportation system. This includes protection of technological systems, ensuring future funding mechanisms, and how best to attain sustainable economic success through a functioning supply chain and distribution of commodities.

Figure 3.3.11: City Center

Potential Disruptions to FTP Policy Element Goals

Florida’s position as a dominant force within domestic and international economic markets offers a future of continued economic success and adaptation; considering all possible risks, however, a future in which the state fails to create a sustainable climate for success could also be possible. Providing for a future that entails large-scale global economic production, tourism, and resilient transportation infrastructure, requires a number of practical policies and goal-oriented strategies. The seven goals outlined in the Florida Transportation Plan include several focused on the transportation system and others supporting statewide priorities. As the demographics of Florida’s residents shift over the next several decades, it is important to consider how various risks will affect the implementation of these goals and how these goals affect Florida’s residents and visitors. The following subsection describes how different risks under the five uncertainty areas could materialize into disruptions that prevent FDOT from achieving certain goals under this future scenario.

Table 3.3.2 below summarizes the disruptions that the uncertainty areas could have to the FTP Policy Element goals. Ensuring a global trade hub means efficient implementation of several of the goals in particular. As seen below, “Transportation Solutions that Support Florida’s Global Economic Competitiveness”, “Agile, Resilient, and Quality Infrastructure”, and “Efficient and Reliable Mobility for People and Freight” are most at-risk under this scenario.

Table 3.3.2: Disruptions to FTP Policy Element Goals by Uncertainty Area					
Goals	Population	Economic	Environment	Technology	Global
Safety and Security for Residents, Visitors, and Businesses	-	-			
Agile, Resilient, and Quality Infrastructure	-				
Efficient and Reliable Mobility for People and Freight				-	
More Transportation Choices for People and Freight	-		-	-	
Transportation Solutions that Support Florida’s Global Economic Competitiveness			-		
Transportation Solutions that Support Quality Places to Live, Learn, Work, and Play		-	-	-	-
Transportation Solutions that Enhance Florida’s Environment and Conserve Energy	-	-		-	-

Safety and Security for Residents, Visitors, and Businesses



- Extreme weather events and storm surge may block evacuation routes, hindering evacuation of residents and visitors, and obstruct emergency medical supplies to distressed communities.
- Free flow of data in integrated transportation systems could lead to vicious cyber attacks on users' privacy and rights, which hinders the safety and security for residents, visitors, and businesses.
- Ensuring safety for visitors and residents within varying contexts of travel could prove difficult, depending on the consistency of regulations and safety guidelines implemented. This includes emissions regulations, as well as signage.

Agile, Resilient, and Quality Transportation Infrastructure



- Decreases in transportation funding may compromise the agility, resiliency, and quality of Florida's transportation infrastructure so it does not keep pace with user demand.
- Worsening traffic congestion may cause the agility, resiliency, and quality of Florida's infrastructure to deteriorate at a shorter time span.
- Flooding may cause transportation infrastructure to deteriorate at a faster rate, making them more vulnerable to the extreme weather events and storm surge.
- Lack of funding for smart infrastructure obtained through electronic payment fares and other funding sources thwart Florida's goal to develop agile, resilient, and quality infrastructure.
- Creating safe and quality systems for all residents and visitors could prove a cumbersome and costly process, especially when considering a large-scale and/or sudden influx of migrants and visitors.
- Lack of multi-modal infrastructure could hinder overall development of the state transportation infrastructure, as new residents and visitors become less willing, or are unable to use personal automobiles.

Efficient and Reliable Mobility for People and Freight



- Rapid population growth or population decline could make it difficult for the Florida Department of Transportation to optimize transportation improvements, leading to a transportation network that is under or over capacity.
- Mobility of people and freight within Florida's transportation network may be compromised due to a shortage in funding for ongoing maintenance, as well as expansion projects.
- The increase in visitors and multinational businesses to Florida could result in an increase in traffic congestion within the state.
- Disruption of transportation network, due to flooding, would cause passenger travel delay and hamper the efficiency of supply chain for freight movement through the State of Florida.
- Tropical cyclones with a subsequent effect of storm surge would cause severe damage to seaports and airports near coastal areas, which may impede the road and rail connections to the port areas.
- Threats to an efficient supply chain and commercial system of transportation could include lack of consistent funding, particularly if funds are shifted to defense-related functions and adaptations in the event of increased geopolitical event.

More Transportation Choices for People and Freight



- Decrease in transportation funding may result in fewer mode choices, routes, and available capacity for people and freight.
- An influx of migrants and refugees could overburden transportation systems, depending on the pace at which they arrive, if the available multi-modal transportation system is unable to support them.

Transportation Supports to a Globally Competitive Economy



- Rapid population growth could lead to a transportation system that is over capacity and unable to keep pace with improvements. Inefficient transportation networks could slow movement of freight and make Florida a less desirable destination for visitors.
- Decrease in transportation funding may have an adverse effect on Florida's ability to provide transportation infrastructure that can enable the state to meet the demand of being a global trade hub, as well as a preferred destination for visitors.
- Insufficient funding and financing for the deployment of new technologies related to multimodal transportation could deter transportation solutions that improve the State's goal of being a global leader in the world's economy.
- State and local government laws and regulations need updated to ensure the performance of the multimodal transportation systems that support Florida's global competitiveness.
- Competition from other countries could reduce Florida's overall economic dominance within the region, if Florida decreased adequate funding to modern, innovative transportation solutions (for example, ports) for commercial activities.

Transportation Solutions that Support Quality Places to Live, Learn, Work, and Play



- Many initiatives related to establishing quality places require development of multimodal transportation networks; if Florida's population declines, however, there may be less tax revenue for developing this infrastructure and too few users to make its development practical.

Transportation Solutions That Enhance Florida's Environment and Conserve Energy



- Expansion of runways, harbors and terminals to flourish export and import business, would increase the footprint of Florida's transportation system; this would thereby increase greenhouse gas emission from the transportation sector.

Risks on the Horizon

Risks on the horizon are important for FDOT to be aware of to be prepared to plan for the extreme and events that could derail trends in the future. The FTP Vision Element outlines a few examples of extreme scenarios that could disrupt the future, which are listed below. While each future scenario will be susceptible to extreme or unknown risks occurring, this section will look at a worst-case scenario risk that could detrimentally disrupt a global trade hub scenario in Florida.

Potential **Risks on the Horizon** outlined in the FTP Vision Element include:

- Migration to Florida from other states slows dramatically.
- A global crisis stalls Florida's tourism industry.
- Florida's economy enters a period of prolonged stagnation.
- Multiple hurricanes hit Florida in a single year.

Worst case scenario:

The main theme in a global trade hub scenario is that there is a significant expansion in global trade, tourism, and investment. As Florida is becoming more prominent in global activities, its global trade hubs may be more of a target for terrorism. The State may not be prepared to prevent the ability of terror groups to hack into communications systems, placing infrastructure and systems more at risk. Terrorism is a risk on the horizon that could detrimentally disrupt this future scenario in Florida. For this future, FDOT should plan the transportation system to better accommodate trade hub focused areas. FDOT should also be prepared in the event an extreme circumstance such as terrorism occurs that could disrupt the assumptions and expectations associated with this scenario.

How this risk could disrupt this future:

Terrorism would threaten the safety of residents and tourists if the transportation system were not resilient against attacks. Terrorism threats could also place restrictions on travel for commercial airlines and supply chains, which would impede economic functions in these cities. Terrorism attacks may also cause a shift of funds from needed basic transit/transportation infrastructure to defense mechanisms and strategies. This may affect the utilization of infrastructure, and the ability of new residents to integrate themselves within and utilize the transportation system.

It could get worse:

If there were a disease outbreak in Florida this would further threaten the safety of residents and may stall global trade activities as well as discourage tourists from coming into the State.

Terrorism could be on the horizon and may occur in conjunction with another extreme event, such as a statewide disease outbreak; this would result in threats to the transportation network and the economic success of Florida's trade hubs. Risks on the horizon could negatively affect FDOT in being able to achieve its FTP policy goals, especially if they are not prepared to be resilient against these extreme events. Being aware of the extreme disruptions that could affect and derail this future scenario will help FDOT to be more strategic in deciding how much new infrastructure should be constructed and how to protect its most strategic assets.

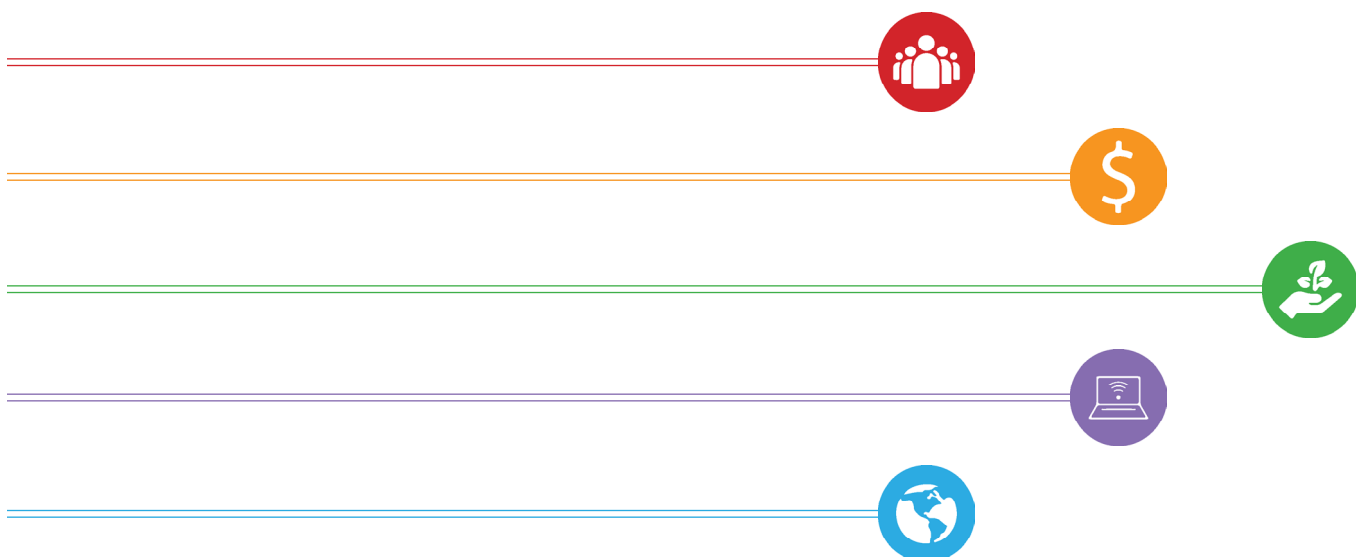
Moving Forward

Based on the Studio team’s analysis and findings, global uncertainties will pose the greatest threat under a global trade hub scenario in Florida. It was also found that the uncertainties in this future would mostly impact Florida’s coastal-urban and inland-urban areas. FDOT being able to achieve its policy goals of “Transportation Solutions that Support Florida’s Global Economic Competitiveness”, “Agile, Resilient, and Quality Infrastructure”, and “Efficient and Reliable Mobility for People and Freight” were found to be most at-risk under this scenario. If a global trade hub scenario occurs in the next 50 years in Florida, being aware of the risks that may affect transportation planning is necessary for FDOT to determine which recommendations to implement.

The current FTP Vision Element lays out some solutions that could be considered in a global trade hub scenario such as:

- Continue to deepen harbors, extend runways, and expand terminals to handle larger ships and planes
- Improve road and rail connections to major seaports and airports
- Improve long-distance truck and rail corridors to other states
- Develop a major truck/rail corridor in inland Florida to shift freight activity away from congested coastal regions and support planned intermodal hubs and facilities
- Use new technologies to improve the efficiency of the supply chain
- Create more options for visitors to easily move from airports and seaports to urban centers and major attractions

The methods used to create this module and the information contained within it will aid in the creation of new solutions that mitigate against risks when FDOT updates the FTP Vision and Policy Elements.



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Module 4: Innovation Hub



Introduction

This module will explore the relevant risks to Florida’s transportation system under the “innovation hub” future scenario. In the FTP Vision Element, FDOT defines the innovation hub scenario as:

“Emphasis on technology and innovation, particularly in urban centers.”

According to the FTP Vision Element, under a rural rediscovery scenario, planners may expect to experience:

- Younger, skilled workers choose to establish their careers in Florida because of the state’s high quality of life and growing economy
- Florida becomes a global leader in life sciences, information technology, aerospace, and other innovation industries
- People choose to live in urban neighborhoods where they can live, learn, work, and play in close proximity

Through the studio team’s methods, it was identified that an innovation hub scenario would most likely impact urban areas in Florida and multi-model development patterns that could result in this scenario due to current preferences. As seen in **Figure 3.4.1**, **coastal urban and inland urban areas** were determined to be highly impacted by uncertainties under this scenario. One example of a Florida city that may experience an innovation hub scenario, due to the presence of innovation industries, is Lake Nona (**Figure 3.4.2**). It was also determined, through the Studio team’s process, that the transportation network would be **most vulnerable to technological risks** under this future. This module will identify specific risks and potential consequences related to how an innovation hub scenario could affect the achievement of FDOT’s FTP policy goals.

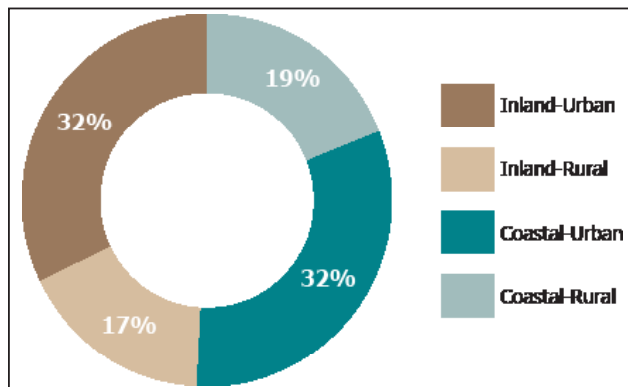


Figure 3.4.1: Impact of Risks by Region
Source: Fall Studio, 2018



Figure 3.4.2: Lake Nona
Source: Tavistock Group, 2017

Visioning

The Innovation Hub alternative future risks, due to emergence of new technologies in transportation, are inextricably connected and increasingly complex. These technologies do hold the potential to ameliorate inefficient transportation networks and enhance driver safety; however, critical smart infrastructure should not be deployed if it cannot be controlled and protected. This scenario is susceptible to a major cyber-attack, rapid technology advancement, and other risk in upgrading existing state transportation networks. The Fall Studio team has provided several visuals below to better understand how different cities may evolve over the next 50 years within this scenario.

Many of today’s refueling stations look like a Circle K gas station. Changes in markets and the number consumers could lead to mixed use refueling stations that provide alternative fuels, such as hydrogen, liquefied natural gas and electric, and stations are powered with traditional and new power sources (e.g. solar panels). Fully energy-efficient refueling stations, like Shell stations, have become more common. This refueling will have solar panels to help power the station, a restaurant and collection spot for online shoppers, chargers and fueling point for electric and hydrogen vehicles, as well as a few gas pumps.



Gas Station
.....



Mixed Refueling Station
.....



Energy Efficient Station
.....

Fig. 3.4.3 Gas Station (top); Fig. 3.4.4 Mixed Refueling (mid); Fig. 3.4.5 Energy Efficient Station (bottom)
Imagery Sources: Wikipedia, 2016 (top); Fred Lambert, 2016, (mid); Shell Oil, n.d. (bottom)

Uncertainties and Risks

The Fall Studio team used the literature review and data from survey responses to identify specific risks that could affect an innovation hub scenario in Florida. The team also used this data to create Table 3.4.1, which summarizes the potential consequences that the different risks could pose to four Florida regions. This process aided the team in visualizing how the most impacted areas of the State could look under an innovation hub scenario. The level of impact for each uncertainty area was evaluated based on the average vulnerability score. This revealed that technology uncertainties are most likely to have the highest impact. The team also created Figure 3.4.6 on the opposing page, which demonstrates how vulnerable the affected regions are to the anticipated risks.

Technology risks were deemed to have the highest impact in this future scenario due to an increase in information technology, aerospace, and other innovation industries in Florida. Global risks could also have a large effect on this scenario with the State becoming a global leader in innovation. Environmental uncertainties pose a threat to the success of future innovation hubs if these risks disrupt the infrastructure and industries that support these cities. Economic and population risks also may pose risks to the success of innovation hubs in the State as well as pose challenges to creating efficient transportation systems. Each of the identified risks and their relation to this scenario are expounded upon on the following pages. For each uncertainty area, the team analyzed why the identified risks could affect this future and how the risks could affect transportation.

Table 3.4.1: Consequences of Risks on Regions under Innovation Hub					
Risks under Uncertainty Area	Coastal- Rural	Coastal- Urban	Inland- Rural	Inland- Urban	Vulnerability score
Population					
Population Decline	L	H	L	H	8
Aging Population	L	M	L	M	6
Average					7.00
Economics					
Decreasing Transportation Funding	L	M	L	M	6
Worsening Traffic Congestion	L	M	L	M	6
Growing HH Income Inequality	L	H	L	H	8
Average					6.67
Environment					
Extreme Temperature	L	M	L	H	7
Inland Flooding	N	M	L	H	6
Extreme Weather Events	L	E	L	H	9
Average					7.33
Technology					
Fast Adoption of New Technology	H	E	H	E	14
Cyber Security	H	E	H	E	14
Outdated Government Regulation	H	E	H	E	14
Average					14.00
Global Issues					
Rising Energy Prices	H	H	H	H	12
Global Recession	H	H	L	H	10
Geopolitical Events	M	H	L	M	8
Average					10.00

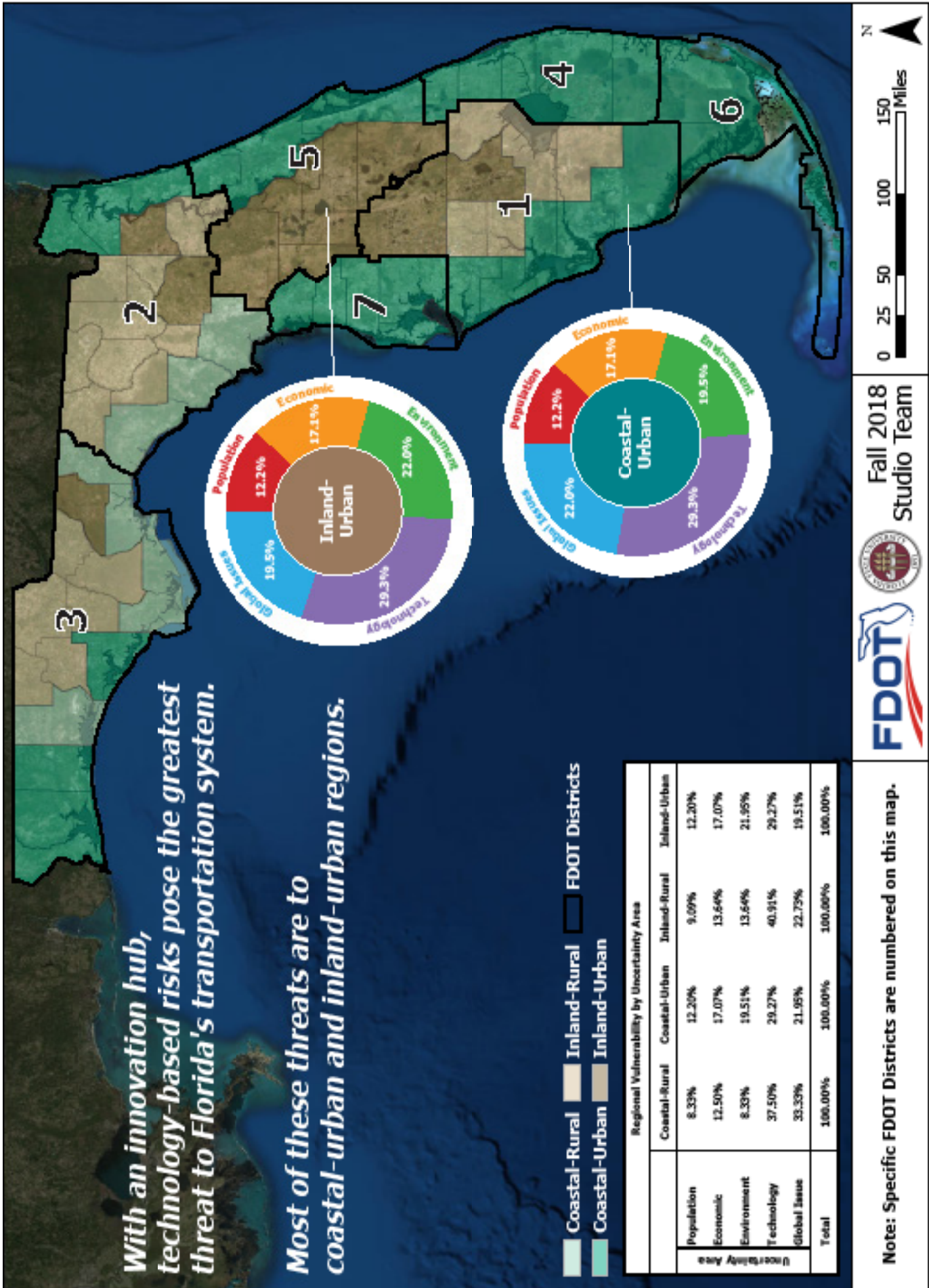


Figure 3.4.6: Risks by Region for an Innovation Hub
 Source: Fall Studio Team, 2018

Population Risks in an Innovation Hub



Population Decline

Why is this a risk in this future?

Florida's currently available housing stock consists primarily of urban and suburban neighborhoods. If the population were to decline, then there may not be demand for new homes despite changes in generational preferences.

How does this affect Transportation?

Incorporating smart technologies into Florida's transportation system may be more difficult without adding population to high dense urban centers. Furthermore, decreases in population may spread tax dollars thin for maintenance projects and reduce flexibility in budgets for allocations to smart infrastructure projects.

Aging Population

Why is this a risk in this future?

The Florida Transportation Plan's Vision Element envisions innovation hubs occurring in urban centers with younger, skilled workers and people locating in urban neighborhoods where they can live, learn, work, and play. Generational preferences of an aging population do not currently align with this vision.

How does this affect Transportation?

The addition of smart infrastructure to the transportation system will be less transformative if the population remains dispersed. Increasingly inefficient development patterns would require more money be allocated to smart infrastructure to provide similar services to all residents.



The Innovation Hub future relies on urban centers with a budding younger population. A decline in population or a disproportionate increase in the aging population could thwart materialization of this future. This could result in unchanged or increasingly inefficient development patterns, which would make it more difficult to provide smart infrastructure improvements to urban centers.

Figure 3.4.7: Woman and Man Arm Wrestle

Source: Kevin White, n.d.

Economic Risks in an Innovation Hub



Decreasing Transportation Funding

Why is this a risk in this future?

Urban areas in Florida experience a rapid increase in population due to the growth in innovative jobs. This results in an increase in commercial and residential areas that have high population density, which would require more transportation investment in current and planned infrastructure.

How does this affect Transportation?

A decrease in transportation funding and an increase in demand for transportation infrastructure investment would result in a funding gap. As a result, people could be limited to mode choices and routes to use in Florida's urban areas due to the shortfall in funds.

Worsening Traffic Congestion

Why is this a risk in this future?

The influx of new residents in Florida's innovation-laden urban areas could cause an increase in user demand and decrease the effectiveness of state's transportation networks.

How does this affect Transportation?

The increase in transportation user demand could lengthen the travel time for transportation users to get from their origin to their destination. As a result, the transportation systems in Florida's innovation-laden urban areas could become less reliable and inefficient for people to travel from place to place on time.

Growing Household Income Inequality

Why is this a risk in this future?

The increase in high-skilled innovative jobs in Florida could result in a decrease in non-innovative jobs. This would make it more difficult for people that do not have the prerequisite skills for the high-skilled jobs to obtain employment.

How does this affect Transportation?

Unskilled workers would have less disposable income, which could hinder their access to contemporary transportation networks. As a result, the mobility of the unskilled would be adversely affected.

Innovation Hub areas rely on a highly-skilled workforce. Within an economically uncertain future, these areas are most vulnerable to the risk of growing household income inequality, because not everyone that lives in these areas possess these new job skills. Decreasing transportation funding and worsening traffic congestion are other risks that could adversely affect these areas due to their increased need for a highly-reliable and efficient transportation infrastructure.



Figure 3.4.8: Innovation Hub - Retail and Entertainment

Source: Retail Innovation Hub, 2018
Assessment of Planning Risks and Alternative Futures for the Florida Transportation Plan | Final Report

Environmental Risks in an Innovation Hub



Extreme Temperature

Why is this a risk in this future?

Florida's growing economy, attracting mass population towards urban neighborhoods, will intensify development in the urban centers. This changed landscape pattern, due to over construction in the urban centers, may reduce the amount of green space and increase temperature.

How does this affect Transportation?

Extreme temperature will cause strain to the transportation infrastructures and affect rail transit facility through rail line buckling. Besides, expanding transportation choice in urban centers (i.e. walking, bicycling) may not be effective under increased temperature condition.

Inland Flooding

Why is this a risk in this future?

The construction of high-speed travel systems to facilitate the growing demand of incoming population will reduce the water permeability rate of the surface. This may expand the reach of inland flooding.

How does this affect Transportation?

Flooding would impede the drainage facility and inundate transportation infrastructures causing severe disruption to the mobility pattern. This may also hamper the delivery facility of the innovation industries.

Extreme Weather Events

Why is this a risk in this future?

In this future scenario, all high technology industries are envisioned to be established in the major urban centers of Florida. Continued period of extreme heat will lead to climate change, which may further pose environmental threat in the form of natural disasters.

How does this affect Transportation?

Extreme weather would result in power outage and uproot trees, which may disrupt the automated transportation service and obstruct the activity of innovation industries. Moreover, such natural disasters may also devastate evacuation routes, causing distress to emergency service system.



As the future scenario of Innovation Hub relies on the establishment of high-speed and automated transportation systems, this alternative future is more vulnerable towards the environmental risks of extreme temperature, inland flooding and extreme weather events; these events can damage the transportation infrastructures, affect the mobility pattern and disrupt the emergency evacuation service.

Figure 3.4.9: Boating as transportation during a natural disaster

Technology Risks in an Innovation Hub



Cyber Security

Why is this a risk in this future?

Increasing integration of new technologies, such as autonomous and connected vehicles, exchange information with other modes of transportation and infrastructure in urban areas. These technologies are threatened by malicious cyber attacks and other disruptions.

How does this affect Transportation?

Integrated transportation systems are becoming more connected in the state's transportation system. Deployment of these technologies requires measures that ensure security and privacy of people and businesses wanting to take advantage of them.

Fast adoption to new technology

Why is this a risk in this future?

Cities rapidly adopting new technologies and innovations in increasingly dense urban areas could lead to several challenges that threaten urban sustainability and the effectiveness of smart transportation systems.

How does this affect Transportation?

Statewide transportation plans to adopt new intelligent technologies too quickly could reduce the mobility of people and freight traveling safely and efficiently. These measures must be upgraded realistically to prevent potential disruptions to transportation solutions in urban areas.

Outdated government regulation

Why is this a risk in this future?

Outdated regulations that unnecessarily interfere with the development of new technologies and innovations in transportation associated with urban areas could lead to major risks that challenge the success of the state's transportation system.

How does this affect Transportation?

State and local government are unprepared for future multimodal transportation improvements and technologies. Today's urban areas' smart transportation systems are uneven and inconsistent across the state.



The Innovation Hub alternative future is likely to face several major risks. This includes the fast adoption of new technologies, modernization or elimination of outdated government regulations, and protections against potential massive cyber attacks in the deployment of new technologies and innovations to support mobility of people and freight in urban areas.

Figure 3.4.10: Innovation Hub

Source: CTGTrader, 2018

Global Risks in an Innovation Hub



Outdated Government Regulation

Why is this a risk in this future?

Outdated government regulation could hinder innovative and adaptable transportation infrastructure and systems. As Florida positions itself to become a center of global economics and activity, the lack of proper transportation facilities could slow overall progress.

How does this affect Transportation?

Necessary transportation infrastructure updates could be stalled in favor of the provision of funds and resources to limited and outdated infrastructure that is not conducive to progress on a worldwide scale. Fewer people could be receptive in taking part in Florida's economy at large.

Global Recession

Why is this a risk in this future?

A global recession could delay the overall flow of funds to the state of Florida, including transportation-focused initiatives. If other regions suffer economically, on a greater level as compared to the U.S. and Florida, the state could experience a sudden influx of new residents.

How does this affect Transportation?

Lack of funds due to an economic downturn could limit the upkeep of basic infrastructure and retrofitting and construction of modern transportation facilities. An increase in the number of residents would also place greater strain on infrastructure.

Geopolitical Events

Why is this a risk in this future?

Geopolitical events, whether it be violent coups, combative governments, or the after-effects of a natural disaster or food crisis, could adversely affect the overall success of Florida's continued transition to an attractive, innovative economy. This applies to both rural and urban areas.

How does this affect Transportation?

Negative effects could be wide-ranging, including lack of proper transportation support systems for newly arrived and vulnerable residents, to struggling economic rural to urban supply chains; this could create a chain reaction of a failing transportation system.



The connection between the success of Florida as an innovation hub, and the success of Florida's transportation systems and infrastructure, relies on the ability to adapt to wide-ranging and capricious global events. Maintaining innovative practices, a stable economy, and sustainable goals is necessary in ensuring long-term success for the state's transportation system.





















Figure 3.4.11: Automated Bus

Source: NTU Singapore, 2017
Module 4: Innovation Hub | Final Report

Potential Disruptions to FTP Policy Element Goals

As Florida’s population is projected to grow, the necessity of adaptable and innovative solutions is becoming more imperative; this necessity is important both on an economic scale, and transportation-system level, as well as the interactions between the two. Growing economic competition, especially from international regions such as Latin America and various geopolitical events, could pose as risks to the implementation of modern infrastructure. Achieving a sustainable and modern transportation system is the overarching goal; within that, it is necessary to produce and maintain a number of other deliverables on municipal and statewide levels. This includes creating accessible and equitable public transportation for all, multi-modal modes of transportation and transit, and technologically efficient supply systems.

Ensuring adaptable transportation for the changing demographics and needs of Florida will require malleable approaches and adaptable solutions that take into account the various risks that could arise. **Table 3.4.2** below summarizes the disruptions that the uncertainty areas could have to the FTP Policy Element goals. As seen below, “Safety and Security for Residents, Visitors, and Businesses”, “Agile, Resilient, and Quality Infrastructure”, and “Efficient and Reliable Mobility for People and Freight” are most at-risk under this scenario. On the following pages are specific ways in which risks related to the uncertainty areas could interfere with these goals.

Goals	Population	Economic	Environment	Technology	Global
Safety and Security for Residents, Visitors, and Businesses		-			
Agile, Resilient, and Quality Infrastructure			-		
Efficient and Reliable Mobility for People and Freight	-				
More Transportation Choices for People and Freight			-	-	
Transportation Solutions that Support Florida’s Global Economic Competitiveness	-	-	-		-
Transportation Solutions that Support Quality Places to Live, Learn, Work, and Play			-		-
Transportation Solutions that Enhance Florida’s Environment and Conserve Energy	-	-		-	-

Safety and Security for Residents, Visitors, and Businesses



- Population decline or an aging population would interrupt efforts to incorporate smart city technologies, which are often oriented towards improving safety issues, into Florida's transportation system.
- Environmental risks such as flooding and natural disaster may impede the safety and security of the residents by disrupting the transportation network and evacuation route.
- Rapid adoption of new technology associated with urbanization expose the state to challenges for ensuring the safety and security of transportation users.
- Lack of consistent regulations could hinder the adoption of necessary system improvements and infrastructure, which could be particularly problematic if the rate of growth of visitors and residents continues to increase.

Agile, Resilient, and Quality Transportation Infrastructure



- Fewer residents in urban centers would likely result in fewer smart infrastructure improvements, making Florida's transportation system less agile and resilient.
- Decreases in transportation funding would put the transportation infrastructure (e.g. streetcars, shared vehicles, and light rail) in Florida's innovative urban areas at risk of falling into disrepair at a faster rate.
- Emerging technologies in urban areas are not accompanied by up to date government regulations. As a result, Florida's infrastructure is likely to become ineffective in addressing conditions for all modes of transportation and other measures of quality.
- Lack of adaptable and multimodal transportation systems could be problematic, especially for urban areas with a large proportion of foreign and/or vulnerable populations who may lack personal vehicles, or the ability to easily navigate an outmoded system.

Efficient and Reliable Mobility for People and Freight



- Decreases in transportation funding would adversely impact the ability of transportation systems in innovative urban areas to move people efficiently.
- Worsening traffic congestion could cause the transportation networks in Florida's innovative urban areas to become less reliable because of the increase in travel time for people from origin to destination.
- Increased temperature is likely to impact mobility of the elderly and vulnerable population.
- Mobility of people using automated vehicles and high-speed rail would be severely disrupted due to the risks of flooding and extreme weather events.
- The lack of government regulations related to multimodal transportation could result in extreme congestion, increase travel time and delay the entire transportation system.
- Economic global risks could hinder the connective infrastructure between urban and rural centers, especially in terms of supply chains and labor opportunities.

More Transportation Choices for People and Freight



- Population decline or an aging population could result in unchanged or increasingly inefficient development patterns, which would reduce the likelihood that smart infrastructure could increase transportation choices for Floridians.
- Decreases in transportation funding makes it more likely that there will be less mode choices for people in innovation urban areas in Florida.
- Unskilled people living in innovation urban areas will likely have less choice in transportation modes due to having less disposable income.
- A lack of funds (due to various global economic and geopolitical events) for improvements and retrofitting of older transportation systems, could hinder overall economic and global dominance by the state, due to outmoded methods of travel.

Transportation Supports to a Globally Competitive Economy



- A major attack on computer networks that support multimodal transportation facilities, such as seaports, could cause serious disruptions to state's transportation system and Florida's global competitiveness.

Transportation Solutions that Support Quality Places to Live, Learn, Work, and Play



- Urban centers with inefficient development patterns may not support smart infrastructure improvements that could improve enhance live-learn-work-play environments and the overall quality of life of Floridians.
- The increased cost of living, due to the influx of highly-skilled workers and innovative jobs in urban innovative areas, could cause an increase in household income equality due to the unskilled being unable to keep up with the increase costs to obtain basic needs (e.g. transportation, housing, food).
- Rapid adoption to new technologies could lead to risk (e.g. unplanned urbanization) within transportation solutions that support different types of transportation modes for the needs of transportation customers.

Transportation Solutions That Enhance Florida's Environment and Conserve Energy



- The continued increase in temperature will heighten auto-based trip and consequently increase vehicle miles traveled. This will reduce the efficiency of adopting sustainable transportation systems that encourages the use of pedestrian walkways and bicycles.

Risks on the Horizon

Risks on the horizon are important for FDOT to be aware of to better be prepared to plan for the extreme and events that could derail trends in the future. The FTP Vision Element outlines a few examples of extreme scenarios that could disrupt the future, which are listed below. While each future scenario will be susceptible to extreme or unknown risks occurring, this section will look at a worst-case scenario risk that could detrimentally disrupt an innovation hub scenario in Florida.

Potential **Risks on the Horizon** outlined in the FTP Vision Element include:

- Migration to Florida from other states slows dramatically.
- A global crisis stalls Florida's tourism industry.
- Florida's economy enters a period of prolonged stagnation.
- Multiple hurricanes hit Florida in a single year.

Worst case scenario:

The main theme in an innovation hub scenario is that there is a significant expansion in in life sciences, information technology, aerospace, and other innovation industries in large cities. As Florida is becoming more prominent in technological activities, its technology trade hubs may be extremely disrupted by ransomware attacks. Stories of ransomware attacks are becoming more common and are increasingly important considerations for local, state, and federal agencies. One noteworthy example of a ransomware attack on a transportation system includes the shutdown of the San Francisco Municipal Transit Agency Attack in 2016. The ransomware attacker's efforts were thwarted, but this case highlighted the importance of not only planning for the physical aspects of smart infrastructure, but also the technological aspects. For this future, FDOT should plan the transportation system not only to better accommodate innovation hub focused areas, but also be prepared for if an extreme circumstance such as ransomware attacks occur; these attacks could majorly disrupt the assumptions and expectations associated with this scenario.

How this risk could disrupt this future:

Ransomware attacks are becoming more common especially in centers of innovation and technology. These attacks hack into technology and could lead to mass computer crashes and the complete shutdown of entire networks. This could disrupt companies and transportation systems in Florida's innovation hubs. Security measures may need to be put in place so that ransomware attacks do not lead to large economic losses and so that the safety of residents in these hubs is not threatened.

It could get worse:

If different terrorist measures evolve to hack into stoplights, control systems, or driver's cars, this could further affect the safety and efficiency of innovation hubs.

Ransomware attacks could be on the horizon and may occur in conjunction with another extreme event, such as evolving terrorist techniques; these events would result in threats to the transportation network and the economic success of Florida's innovation hubs. Risks on the horizon could negatively affect FDOT in being able to achieve its FTP policy goals, especially if they are not prepared to be resilient against these extreme events. Being aware of the extreme disruptions that could affect and derail this future scenario will help FDOT to be more strategic in deciding how much new infrastructure should be constructed and how to protect its most strategic assets.

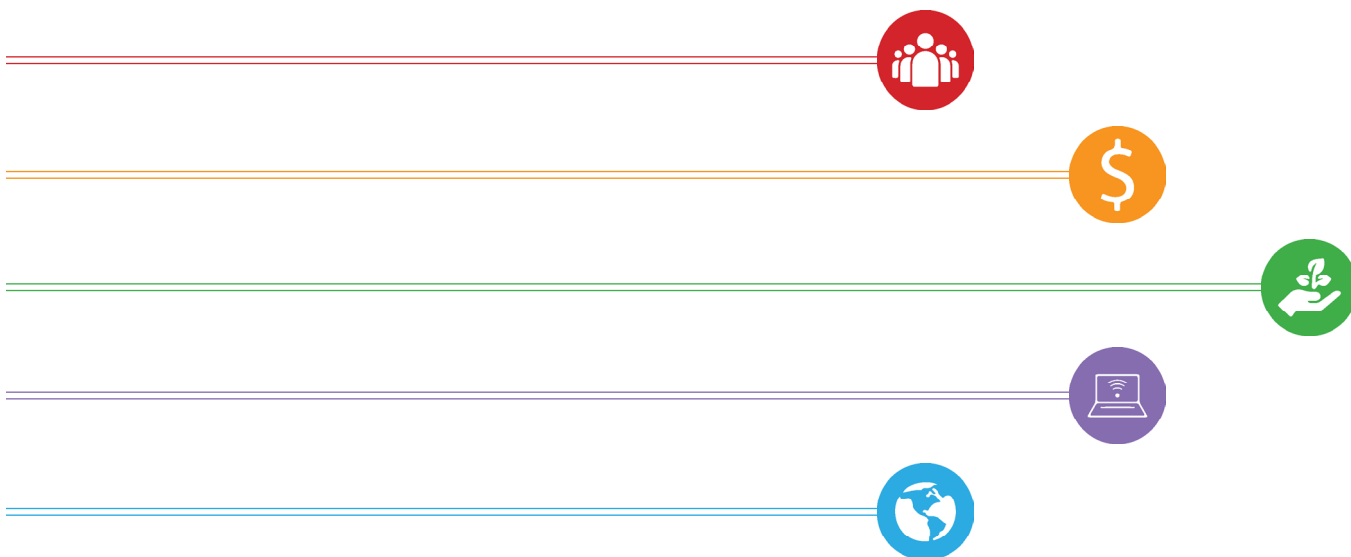
Moving Forward

Based on the Studio team's analysis and findings, technological uncertainties will pose the greatest threat under an innovation hub scenario in Florida. It was also found that the uncertainties in this future would mostly impact Florida's coastal urban and inland-urban areas. If an innovation hub scenario occurs in the next 50 years in Florida, being aware of the risks that may affect transportation planning is necessary for FDOT to determine which recommendations to implement.

The current FTP Vision Element lays out some solutions that could be considered in an innovation hub scenario such as:

- Expand transportation choices in urban centers: walking, bicycling, shared vehicles, streetcars, light rail, and more
- Create more options for high-speed travel between Florida's urban centers without using a car
- Ensure fast delivery to markets for innovation industries
- Test and deploy automated and connected vehicles and other new technologies to increase the efficiency and safety of the transportation system

The methods used to create this module and the information contained within it will aid in the creation of new solutions that will help mitigate against risks when FDOT updates the FTP Vision and Policy Elements.



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Conclusion

This Chapter analyzed how the 5 uncertainty areas that were researched during Phase I could lead to risks that could affect Florida's transportation system in the next 50 years. It also used a methodology to analyze how these risks and their consequences could affect FDOT's four non-risk based future scenarios that are outlined in the FTP Vision Element. The Fall Studio team identified where each scenario is most likely to occur in Florida and which uncertainty area could pose the biggest threat in a given scenario. Also, for each future scenario, the team outlined why certain risks could be a threat in that scenario and how the risks could affect the transportation system. Further analysis was done to explore how the identified risks in each scenario could threaten the achievement of FDOT's seven policy elements. The FDOT future scenario, Risks on the Horizon, was utilized as a section in each of the other non-risk based future analysis to explore extreme scenarios that could occur in Florida and disrupt trends and assumptions.

The following was found for each of the non-risk-based future scenarios:

- **A Return to Historic Growth:** Most likely to affect coastal-urban followed by inland-urban Florida and be most impacted by population **uncertainties**
- **Rural Rediscovery:** Most likely to affect inland-rural Florida and be most impacted by both environmental and technological **uncertainties**
- **Global Trade Hub:** Most likely to affect coastal-urban followed by inland-urban Florida and be most impacted by global **uncertainties**
- **Innovation Hub:** Most likely to affect inland-urban and coastal-urban Florida and be most impacted by technological **uncertainties**

It was also found during the policy goals analysis that achieving the goals of "Agile, Resilient, and Quality Infrastructure" and "Efficient and Reliable Mobility for People and Freight" would be most affected by risks in these scenarios.

The research, methods, and data contained within this chapter can be used to aid FDOT in updating the FTP Vision Element and FTP Policy Element. Each future scenario in the FTP Vision Element provides "Could We" solution statements for the trends that may arise from each future scenario. The Fall Studio team suggests that FDOT takes into consideration their analysis of where each future may affect Florida and the risks that may occur when they update the "Could We" transportation solution statements for the FTP Vision Element. Also, adding risks into the conversation for each scenario in the FTP Vision Element Update may make the scenarios more beneficial to future planning efforts. The goals outlined within the FTP Policy Element focus on long-range success for both transportation system performance, and support for statewide priorities. The team's analysis of how each future scenario could pose risks to achieving FDOT's policy goals should be used in updating the FTP Policy Element solutions that may need to be considered based on changing trends in various parts of the State.

There are a few general recommendations that may help FDOT to better incorporate risks and uncertainties in Florida's transportation planning. Guidelines may need to be updated and changed as different uncertainties and risks affect different parts of the State. As Florida continues to diversify, both economically and demographically, adapting recommendations to suit a community's needs is important in ensuring sustainable, widespread success of the proposed goals as outlined in the FTP. The Fall Studio team specifically examined the contrasting needs

within four community types; inland-rural, coastal-rural, inland-urban, and coastal-urban. Despite cultural and economic differences between each of the community types, the connectivity between them, and the necessity of equitable, efficient transportation for all citizens is a broader objective for each of the goals.

More specific demographic concerns within the broader shift in the state's population are of particular importance within the FTP. Millions of drivers within the state face more specialized concerns which could require alternative facilities, services, and transportation modes. These include elderly drivers, tourists, and new residents, some of whom may not be familiar with driving conditions within the state. Another layer within this complex demographic problem involves ensuring that all users of the state's transportation systems, have access to employment and adequate living conditions. Also, innovative techniques for funding transportation solutions may need to be embraced. This is due both to continued development patterns of growth, especially in urban areas, as well as the shifts in technology and funding mechanisms. As the use of transportation infrastructure increases, so too does the wear on the structures. Continued maintenance of the existing system will be required, in addition to new construction. This includes auto-oriented highway development, multi-modal transportation systems, and bike and pedestrian trails. Funding this level of infrastructure could prove more challenging. Funding mechanisms such as gas taxes, increases in parking fees in various urban areas, environmental impact fees, and congestion pricing are all options. While they have not been widely or popularly implemented within the state, they could prove to be viable funding pools.

As the FTP continues to be updated, the studio team recommends that FDOT goes through the process to conduct another scenario building session. This may help in creating new future scenarios that may materialize into reality in Florida and help to consider risks that may occur in those scenarios. The Fall Studio team has brainstormed two possible future scenarios that could be opportunities for FDOT to consider. The first is a scenario of a resilient and adaptable transportation system. Florida faces a number of unique challenges, especially concerning climate. Resiliency is required in ensuring continued economic success on both a domestic and global level. This includes a resilient and efficiently connected port system, wide-spread public transportation, and state-wide supply chains connecting rural and urban areas, so as to allow for the flow of goods and services. This scenario could possibly be combined with the current Risks on the Horizon scenario to envision a future where risks materialize even with a resilient and adaptable transportation system in place. Another future scenario that may materialize in Florida is that of cities where the majority of citizens are made up of people 60 years or older. With many retirees moving to Florida this may change the way certain cities are shaped and grow as well as the transportation solutions needed. FDOT has the opportunity to continue to update and create new future scenarios that are a part of the FTP to help in predicting which trends may occur and how to best be prepared for the uncertainties and risks that may need to be mitigated against.

Chapter 4

Strategies for Transportation Planning



Introduction

The Florida Department of Transportation (FDOT), an executive agency, is responsible for coordinating the statewide planning and development of Florida's transportation infrastructure. Its goal is to maintain a safe transportation system that ensures the mobility of people and goods, enhances economic prosperity, and preserves the quality of Florida's environment and communities. FDOT's Statewide Planning Team oversees a variety of planning activities that guide planning and project implementation efforts across the state. These efforts include the development and implementation of the Florida Transportation Plan (FTP), the management of the policy and programming for the Strategic Intermodal System (SIS; the state's priority transportation infrastructure network), and coordination for corridor planning and long-range planning activities that occur at the regional and local levels.

As the guiding body for these planning efforts, FDOT has recognized that there are risks on the horizon with potential implications to the integrity of Florida's transportation system and should thus be considered during the planning process. These risks have been organized in five issue areas: (1) uncertain Population forecasts, (2) Economic forces, (3) Environmental changes, (4) emerging Technologies, and (5) Global Issues. These five issue areas have been discussed and analyzed in chapters one and two of this report. The Summer and Fall Studio Teams evaluated risks and uncertainties identified in these issue areas, as supported by prevailing industry literature and testimony from industry experts, along with potential impacts of the risks within those issue areas specific to Florida's transportation infrastructure. As discussed in chapter three, these findings will help FDOT understand how risk and uncertainty should be addressed in the FTP 2020 update.

In addition to applying the Studio Team's risk research to the FTP update, FDOT has requested a review of risk analysis incorporation within its current transportation planning and project implementation processes. FDOT is interested in better understanding what risk management best practices are currently being utilized during planning and project development and where there is room for more robust risk consideration. This will enable FDOT to better anticipate the demand for future risk management and mitigation in the transportation planning processes it both oversees and manages. A consistent and thorough review of risk implications to planning and project implementation efforts will better promote the successful maintenance of a safe and reliable transportation system in the face of uncertainty and change on the horizon. When risk is considered at every planning level, from the FTP to Long-Range Transportation Plans to specific corridor studies, there is a greater likelihood that plans will maintain consistency and their overall visions, goals, and objectives will be achieved even as conditions change over time. Further, by including an intentional review of risks on the horizon and their potential implications to a specific project during project implementation, FDOT and its partners will better be able to provide a resilient funding structure and a sustainable project design that can withstand changes in population, policy, climate, technology, and the international landscape.

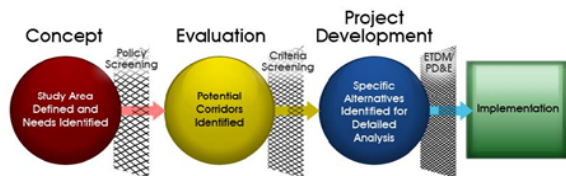
As such, the Fall Studio Team has developed a framework for risk assessment within each stage of the transportation planning process, along with a tool for implementing this risk assessment. By following the guiding framework through each of the stages in the planning process and by using the new Risk Assessment Tool, FDOT and its partners will be able to better ensure that planning efforts consistently consider the risks associated with future projects and address potential mitigation strategies to minimize the effects of those risks on planning and project outcomes. This will promote FDOT's goal of maintaining the long-term safety and integrity of Florida's transportation infrastructure, even in the face of risk and future uncertainties.

The Fall Studio Team has also conducted three case studies examining the planning development process for three Future Corridor plans: the Sketch Interstate Plan (SIP) for Interstate 95 (I-95), the State Road 80 (SR-80) Corridor Action Plan, and the East Central Florida Corridor Action Plan. The Team has evaluated these plans to identify best practices for incorporating risk into the planning process and provide recommendations for a more comprehensive risk evaluation within the planning process, the discussion of which is framed using the Team's recommended Risk Assessment Tool.

Methodology

Development of the Planning Framework

To begin, the Fall Studio Team reviewed FDOT's planning processes and methodologies. This included Long-Range Transportation Planning, transportation planning for comprehensive plan updates, Future Corridor planning, Efficient Transportation Decision Making, Project Development and Engineering, the development of the Strategic Highway Safety Plan, and the development of different modal plans. After an examination of several state planning processes, the Studio Team decided to use the four-stage process for when planning for Future Corridors as its structural basis for developing a broad planning framework upon which the Team will make its risk incorporation.



Original LRTP Planning Process
(Florida's Future Corridors, 2018)

The Team concluded the Future Corridor planning process was both comprehensive and straightforward, and it lent itself well to modification into a universal planning process in which the Team can pinpoint locations for use of the Risk Assessment Tool and other recommendations. This framework is designed as an all-encompassing structure that can apply to a wide variety of FDOT plans. As the Department administers these recommendations to specific projects, it may find it advantageous to readjust the location of the Team's recommended activities to comparable locations within the formal planning framework.

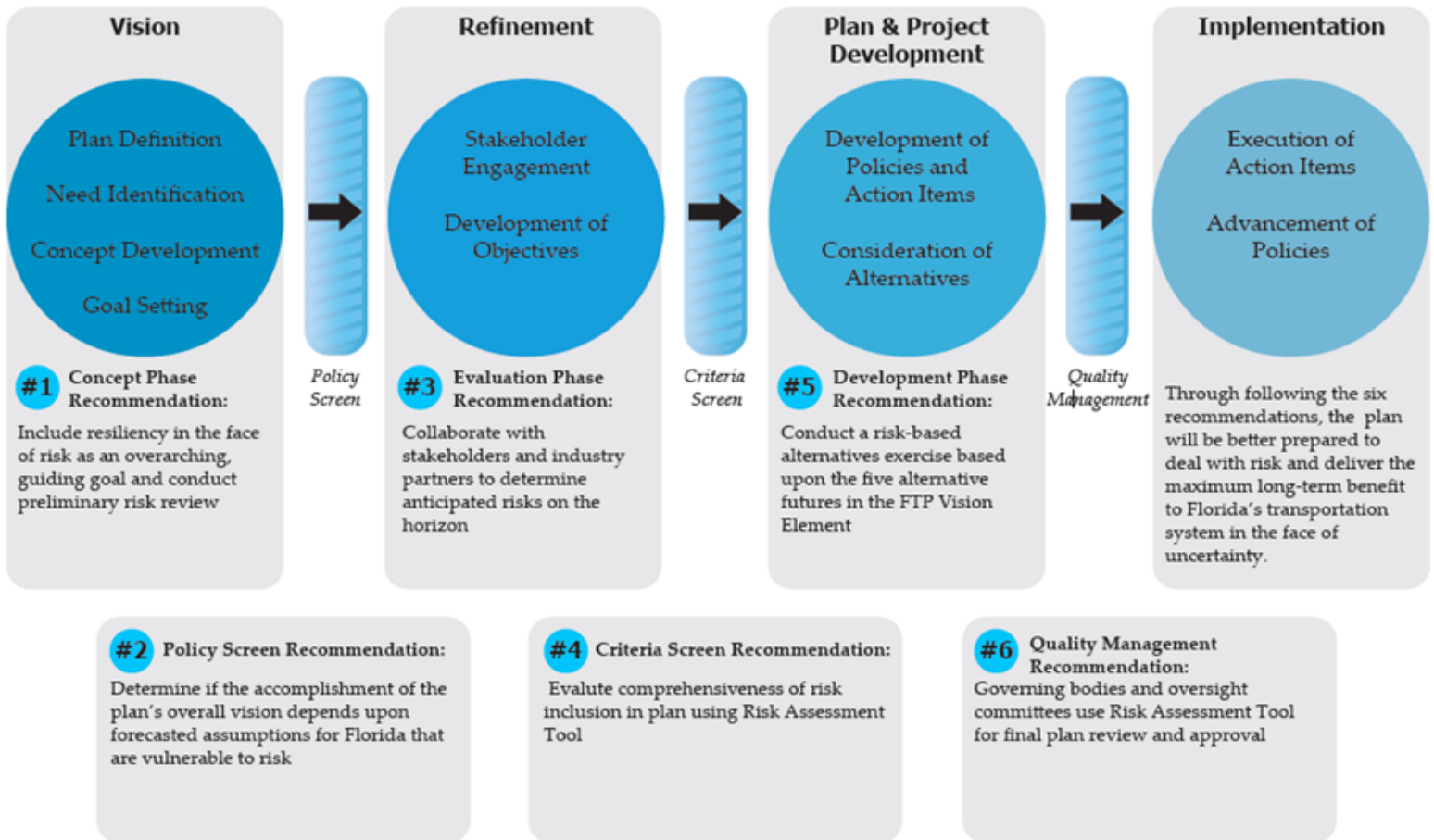
Development of Recommendations

The Studio Team developed six recommendations to assess risk at each stage of the planning process in the designed planning framework. The recommendations initially relate to the overall vision and assumptions of the planning project and move into distinct details as the process advances.

The Risk Assessment Tool, presented in recommendation four, is the most exhaustive of the recommendations. This Tool addresses each risk identified in preceding chapters of this report in order to ensure that individual risks are explicitly considered. To develop the Risk Assessment Tool, the Studio Team leaned heavily on the results of the literature review findings and stakeholder outreach research results described in Chapter One and Chapter Two. These findings informed the questions included in the Tool. In a similar analysis exercise as the Alternative Futures risk and uncertainty review in Chapter 3, the Team developed risk assessment questions based upon the five issues areas (Population, Economics, Environmental, Technology, and Global Issues). Using the top three uncertainties for each issue area as guidance, which are based upon the literature review and stakeholder outreach survey findings, the Team has ensured that the risk assessment questions within the recommended Tool are comprehensive and evaluate the greatest risks to a planning project. This Tool was tested first within the Studio Team, with review by the project sub-Team primarily focused on the Alternative Futures analysis. The questions were then tested within the Department of Urban and Regional Planning student body, with non-Studio Team students reviewing the questions for clarity and understanding. These two quality assurance tests have ensured that the questions within the assessment are reflective of the prior research conducted in the project and that they are viable, resulting in the same interpretation by a variety of readers.

Framework for Risk Assessment in Planning

The Fall Studio Team has developed recommendations for assessing risk within a comprehensive planning framework that can apply to the various planning activities FDOT conducts and manages. The framework is a four-phase planning model that carries the development of a plan from visioning, refinement, and development to the plan’s ultimate implementation, with recommendations provided at and between each phase.



(FSU Fall Studio Team, 2018)

VISIONING PHASE

Planners first develop the overarching vision for the plan. This includes defining the plan and its purpose, identifying the transportation needs that the plan will address, and developing concepts for how to address those needs. The culmination of these exercises will result in the formation and setting of the plan's guiding principles and goals.

Recommendation #1:

The Studio Team recommends that planners in the Visioning stage consider the inclusion of resiliency in the face of risk as an overarching goal. Questions that should be asked at this stage are:

1. Would there be significant benefit in including resiliency as an overarching goal of this plan?
2. What are the assumptions on which the success of this plan is based on, and to what degree are they susceptible to risk?
3. What main categories of risk (Population, Economics, Environment, Technology, and Global Issues) are most relevant to this plan given its specific geographic context (costal/inland/urban/rural)?

POLICY SCREEN

After a plan's vision is defined and its goals are formulated, planners confirm that the plan is consistent with FDOT strategic plans and policies, along with regional and local comprehensive plans. This gives planners the opportunity to calibrate the initial plan concept, along with its purpose and need, based upon the values and goals promoted in other complementary plans.

Recommendation #2:

The Studio Team recommends that during the Policy Screen planners examine if the accomplishment of the plan's overall vision depends upon forecasted assumptions for Florida that are vulnerable to risk. The less assumptions made that are vulnerable to risk, the more resilient the plan will be. If risk-vulnerable assumptions are used in the plan's formation, as may be necessary, planners should consider the implications of changes to those assumptions to decrease the plan's volatility and increase the plan's resiliency.

To ensure that a consideration of risk has influenced the formation of the plan's vision and goals, the Fall Studio Team recommends that planners confirm that the goals incorporated in the plan provide considerations for the issue areas of population, economic, environmental, technological, and global uncertainty. By having risk considered in the plan's goals, planners will have a solid framework for further developing the plan's specific objectives and policies with respect to future uncertainties. The goals should be evaluated on the basis of:

1. Is the accomplishment of the plan's overall vision dependent upon forecasted assumptions for Florida that are vulnerable to risk? If so, has this been acknowledged and addressed, the recommendations for how to adjust in the face of change?
2. Do the goals address the full breadth of risk areas (Population, Economics, Environment, Technology, and Global Issues)?
3. To what extent is risk addressed? Is it to the minimum extent required or is it addressed innovatively and earnestly?

REFINEMENT PHASE

Once a plan's vision has been agreed upon and once the goals to actualize the vision have been defined, the plan will be further expanded to include specific objectives under each goal. To develop these objectives, planners work with stakeholders and industry partners to better understand how these goals can be achieved in a way that reflects the community the plan will serve. Recognizing the recommended overarching goal of resiliency, these risk-based objectives should seek to ensure a resilient transportation infrastructure for the stakeholders and users of Florida's transportation system.

Recommendation #3:

During the Refinement phase, it is recommended that planners discuss what future risks on the horizon are foreseen by stakeholders and industry partners within the five issue areas. This may take various forms based on the character of the plan, including public meetings, focus groups, or committees. For example, commercial stakeholders in the shipping industries are likely to have more recent and precise information that may suggest future areas of potential disruption for freight-supporting infrastructure that should be considered in plan formation. This type of feedback can help inform the development of risk-influenced or risk-based resilient objectives that support the achievement of the plan's goals.

CRITERIA SCREEN

After a plan's objectives are set, planners confirm that the objectives are comprehensive and will address the needs identified in the first Visioning planning phase. Depending upon the type of planning, different criteria are established to evaluate a plan's success in achieving its stated goals. This process is comprehensive and methodical, and it is designed to ensure that a plan's goals and objectives have been vetted for consistency and accuracy before moving into more detailed plan and policy development.

Recommendation #4:

The Fall Studio Team has developed a comprehensive Risk Assessment Tool to ensure that the goals and objectives of the plan have comprehensively considered the various uncertainties identified under each of the five issue areas. The Risk Assessment Tool is composed of a series of questions that address the specific risks identified in Chapter 1 and Chapter 2 of this report. Of the six recommendations, the use of the Risk Assessment Tool is the most focused in level of detail. The purpose of the Tool is to ensure that a plan does not overlook objectives, policies, and action items to address specific risks.

The organization of the Tool is adapted from the organization of the State Environmental Impact Report (SEIR) Environmental Analysis checklist. The first column of Risk Assessment Tool presents these "Risk Assessment Questions". The following three columns allow the end user to check "Yes," "No," or Not Applicable ("N/A"). The fifth and final "Basis for Decision" column directs the user to document the reasoning behind what her or she checked in the following columns. If "Yes" was checked, the page number and section where the risk was addressed should be given. If "N/A" was checked, the rationale as to why that risk does not apply should be given briefly. If "No" is checked, modification of the plan should be considered in order to minimize the plan's exposure to risk. It should be noted that it may not be feasible for every plan to address every risk, however if the feasibility to address all relevant risks should at least be explored.

These questions address a wide variety of risks and, while they are sorted by their distinct issue areas, there is a substantial level of interconnectedness between the Risk Assessment Tool questions and risk areas. For example, the Risk Assessment Tool question regarding mobility enhancement for low-income populations addresses the risk of growing income inequality, as well as the risk of an influx of refugees due to increasing climate change. This interconnectedness accentuates the importance of addressing as many of the risks presented in the checklist as possible. The better a plan is prepared for one risk, the better it will be able to adjust to a variety of them occurring concurrently.

Risk Assessment Tool

Risk Assessment Question:

Yes No N/A Basis for Decision

Population		Yes	No	N/A	Basis for Decision
	Does the plan increase mobility for disadvantaged populations? Low-Income Populations	[]	[]	[]	_____
	Physically Disabled Populations	[]	[]	[]	_____
	Does the plan consider the forecasted transportation preferences of future generations?	[]	[]	[]	_____
	Does the plan remain viable at both high- and low-ends of the population forecasts?	[]	[]	[]	_____
	Does the plan encourage and support growth management best practices?	[]	[]	[]	_____
	Does the plan include accessibility and safety for a wide spectrum of ages – from youth to aging populations?	[]	[]	[]	_____
	Does the plan account for the wayfinding needs of a growing number of non-native English speakers?	[]	[]	[]	_____

Economics		Yes	No	N/A	Basis for Decision
	Does the plan implement traffic demand management strategies to lessen congestion on the transportation system?	[]	[]	[]	_____
	Do funding sources for the plan remain stable in changing economic cycles (such as recessions or fluctuating interest rates)?	[]	[]	[]	_____
	Does the plan address the possibility of changing sources of financing?	[]	[]	[]	_____
	Does the plan include value-capture mechanisms (such as tolls or private public partnerships) for financing of the long-term maintenance of the project?	[]	[]	[]	_____

Environment		Yes	No	N/A	Basis for Decision
	Does the plan anticipate the growing risk of increased inland flooding?	[]	[]	[]	_____
	Does the plan anticipate the growing risk of increased sea level rise and coastal flooding?	[]	[]	[]	_____
	Does the plan utilize the Sea Level Scenario Planning Tool and/or NOAA Sea Level Rise Viewer?	[]	[]	[]	_____
	Does the plan anticipate the growing risk of increased extreme weather events?	[]	[]	[]	_____
	Does the plan anticipate the growing risk of increased storm surge?	[]	[]	[]	_____
	Does the plan anticipate increased transportation demand based upon changing usage patterns and need for evacuation routes due to increased extreme weather events or sea level rise?	[]	[]	[]	_____

Technology		Yes	No	N/A	Basis for Decision
	Does the plan account for new and emerging technology? Autonomous Vehicles?	[]	[]	[]	_____
	Connected Vehicles?	[]	[]	[]	_____
	Does the plan remain viable if anticipated technology is adopted slower than forecasted?	[]	[]	[]	_____
	Does the plan have policies to address the integration of new and old transportation technology?	[]	[]	[]	_____
	Does the plan consider impacts to user privacy and security?	[]	[]	[]	_____

Global Issues		Yes	No	N/A	Basis for Decision
	Does the plan promote resiliency regarding fluctuating freight and shipping demand due to changing global landscapes and economies?	[]	[]	[]	_____
	Does the plan support variations in international tourism in Florida as global wealth grows?	[]	[]	[]	_____
	Does the plan include the integration of infrastructure supporting alternative fuel-based technologies?	[]	[]	[]	_____

PLAN & PROJECT DEVELOPMENT PHASE

Once a plan's goals and objectives have been defined, planners can then establish exactly by what means the goals can be achieved and the objectives can be realized. These means are enumerated in the plan's policies and action items. To establish which actions and policies are the best mechanism, planners will develop and evaluate a series of alternatives for consideration. From this alternatives-evaluation exercise, planners can derive the plan's policies and action items.

Recommendation #5:

The Fall Studio Team recommends that alternatives for consideration should include a risk-based alternatives exercises based upon the five alternative futures provided in the Florida Transportation Plan's Vision Element: Return to Historic Growth, Rural Rediscovery, Global Trade Hub, Innovation Hub, and Risks on the Horizon. This exercise will resemble modules contained in Chapter Three of this report. The exercise contained within those modules considers the five alternative futures in context of the FTP. A similar exercise should be done at this stage replacing the FTP with the plan in development. The goal of these exercises is to ensure the chosen policies and goals remain an effective means of achieving the plan's goals and objectives even when threatened by risks in the five uncertainty areas.

QUALITY MANAGEMENT SCREEN

Once the plan's vision, goals, objectives, and policies have been established, the plan is reviewed by governing bodies and oversight committees to ensure compliance, comprehensiveness, and consistency.

Recommendation #6:

The Fall Studio Team recommends that the governing bodies and oversight committees use the Risk Assessment Tool as a guiding framework for their final review and approval. The Tool highlights the most prevalent and likely risks within each of the five issue areas to assist governing bodies and oversight committees with their comprehensive final review. In this final review phase, the governing body should examine the following three criteria:

1. Was the plan revised to include elements that addressed the risk assessment questions that it did not satisfy upon initial use of the Risk Assessment Tool (if any)?
2. Were items that were checked "Yes" or "N/A" during the initial use of the Risk Assessment Tool done so properly?
3. Is the degree to which the plan considered the risks presented in the Risk Assessment Tool satisfactory?

Risk Assessment Case Study Analysis

Introduction

The Risk Assessment Tool, to be used during the Criteria Screening phase, provides comprehensive guidance for evaluating a plan to ensure that risk has been considered (1) comprehensively across the five issue areas of and (2) thoroughly, addressing the full spectrum of multi-faceted risks and uncertainties within each issue area. To demonstrate the merit of this tool and to provide examples of plans that satisfactorily or unsatisfactorily address the issue areas and their corresponding risks, the Studio Team has evaluated three Future Corridor Plans: the Sketch Interstate Plan (SIP) for Interstate 95 (I-95), the State Road 80 (SR 80) Corridor Action Plan, and the East Central Florida Corridor Action Plan. The Studio Team applied the Risk Assessment Tool to identify which plans sufficiently or inadequately addressed each individual risk question and used this process to provide recommendations for the Florida Department of Transportation to incorporate in future Florida plans.

Interstate 95 Sketch Interstate Plan (SIP)

The I-95 Sketch Interstate Plan (SIP) is a study of the entire 222-mile corridor of Interstate 95 in the state of Florida, spanning six counties (Brevard, Volusia, Flagler, St. Johns, Duval, and Nassau) and three Transportation Planning Organizations (Space Coast TPO, Volusia TPO, and North Florida TPO). The plan explores options to improve mobility within the I-95 corridor by identifying mainline concepts to serve high-speed and high-volume travel, in order to facilitate interstate and regional commerce and long-distance trips with a heavy focus on trucking and freight as well as multi-modal systems (Executive). The results of the SIP have informed future planning studies in the SIS/FIHS Plan and the Long-Range Transportation plans of the Space Coast, Volusia, and North Florida TPOs, as well as future studies as Operational Analysis

Reports (IOARs), Project Development and Environmental studies (PD&E), Interchange Justification Reports (IJRs), and Interchange Modification Reports (IMR). While the SIP does serve as a standalone document, its findings will also serve as the basis for the next study phase, which may consist of a Multimodal Master/Action Plan and NEPA review. Because of its far-reaching impacts, it is critical that a plan like the I-95 SIP incorporates risk into its planning process.

State Road 80 (SR 80) Corridor Plan

The Florida Department of Transportation has conducted a corridor study with a 20-year horizon for a 45-mile stretch of State Road 80 (SR 80) located in Palm Beach County. The SR 80 roadway corridor provides access and connection to several communities, commercial developments, and employment destinations within the region. The corridor is recognized as a high-priority network which serves as a major truck corridor for moving freight across the state, supports regional travel, and accommodates high-speed and high-volume through traffic. The SR 80 Corridor Action Plan provides a clear understanding of the corridor's existing functions, problems and needs to be addressed, and it identifies a comprehensive vision for the future. Because this corridor functions as means of travel for a wide range of populations and transportation needs, it is essential that corridor planning incorporates appropriate identification and evaluation of potential risks.

East Central Florida Corridor Action Plan

The East Central Florida Corridor Task Force was established in November of 2013 and submitted its final report in December of 2013. This report provided recommendations regarding future transportation corridors serving portions Brevard, Orange, and Osceola counties. The plan recognized that the upcoming development of several mixed-used

centers on the eastern fringe of the urbanized area will increase travel demand and projects the population to nearly double to 3.8 million in the next 50 years. The 21 guiding principles balance address concerns regarding limited north-south and east-west options while balancing considerations regarding conservation, countryside, and economic centers. Because of the expected importance of this corridor, it is vital that risk be properly considered in order to ensure its long-term sustained success.

Issue Area 1: Population

Florida is one of the fastest growing states in the country and is projected to experience continuous rapid growth over the next 50 years. Uncertainty surrounding who Florida’s future residents are, where they will live, and how they will prefer to travel presents risks to the State’s transportation network. Because of this, it is important that future planning efforts consider and address the potential impacts of future population changes on each end of population forecasts. Further, as discussed within the literature review and stakeholder outreach of this report, certain populations have been identified as needing special consideration in future transportation planning: low-income populations, physically disabled persons, youth and aging populations, and non-native English speakers. After evaluating the plans using the risk assessment tool, The Studio Team recognizes that all three plans have made a comprehensive effort to address population risks, with one gap lying in the identification of mobility for physically disabled populations.

Population	Does the plan increase mobility for disadvantaged populations?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	SR 80
	Low-Income Populations	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	SR 80
	Physically Disabled Populations	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	Does the plan consider the forecasted transportation preferences of future generations?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	East Central FL
	Does the plan remain viable at both high- and low-ends of the population forecasts?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	East Central FL
	Does the plan encourage and support growth management best practices?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	I-95, East Central FL
Does the plan include accessibility and safety for a wide spectrum of ages – from youth to aging populations?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	East Central FL, SR 80	
Does the plan account for the wayfinding needs of a growing number of non-native English speakers?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	SR 80	

Interstate 95

The I-95 SIP plan provides a robust conversation regarding the consideration of population forecasts, anticipated development patterns, and growth management best practices in its Executive Summary and Future Conditions Report.

Question Four: Does the plan encourage and support growth management best practices?

In its Executive Summary, the SIP first presents growth rates and BEBR data, but takes the analysis a step further to discuss the pattern of land use and development that is expected to ensure from the projected population growth. Below is included as an example:

“Future growth is anticipated as infill between existing developments in Nassau County between Yulee and Fernandina Beach...All of the current population and employment centers are located in existing urban areas or in suburban locations near the confluence of major roadways. Most

of the proposed development areas are on the edge of these suburban locations. This mirrors Florida’s development pattern over the past several decades - expansion on the fringe of urban areas where land values are cheaper. While that pattern of development is initially cheaper regarding land values, it becomes a financial burden for suburban or rural areas to extend infrastructure and provide standard services such as fire, police, and schools. The current economic downturn may alter the development pattern as several of these proposed developments have been put on hold or scaled down; however, it is still important to plan for their eventual development (perhaps at an even greater density).” (Executive, p. viii)

Chapter 2 of the Future Conditions section of the SIP contemplates this in more detail. The report provides a county-by-county forecasted land use analysis, along with commentary regarding the potential implications of this development on the I-95 corridor. A strong example of this is its discussion regarding St.

Johns County:

“Since most of I-95 is located adjacent to undeveloped/natural or newly developing areas, variations from the existing land uses are anticipated. The future land use maps, created in 2008 by St. Johns County, display substantial changes in the northern portion of the county and surrounding the City of St. Augustine. Specifically, from International Golf Parkway to the Duval County line, in the northern third of the County, the I-95 corridor is expected to develop with additional mixed-use developments immediately adjacent to the interchanges surrounded by new residential areas. The majority of the growth in St. Johns County is anticipated in this area over the next few decades. Smaller pockets of new commercial development surrounded by new residential development are expected between St. Augustine and I-95.” (Future, p. 2-3)

State Road 80

An analysis of demographics of the study area was completed to identify population trends and develop a snapshot of the community that SR 80 serves. The demographics section describes the community through population and employment density, vehicle access and commuting patterns, poverty and household income, age, minorities, and language. The components of this part of the plan address the first, sixth, and seventh questions in the Population section of the Risk Assessment Tool. As development is projected to increase along the SR 80 corridor, the action plan has identified the need to provide for increasing travel demands by enhancing access through capacity and travel options. The plan specifically states:

“As the densification occurs, current development patterns suggest that SR 80 will continue to be the main east-west corridor in the study area. Therefore, without changes to the transportation network or new transportation options, travel demand on SR 80 will continue to increase. To

address this, it will be important to consider multimodal improvements to SR 80, parallel routes, and the connection in between them in the future” (State, p.17).

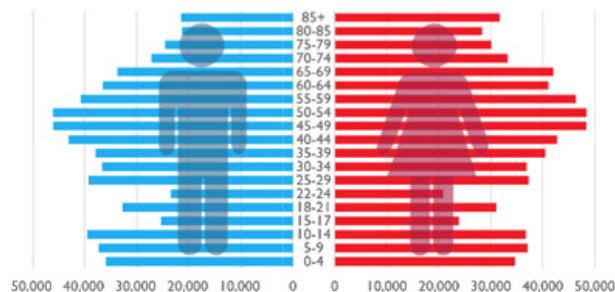
Question One: Does the plan increase mobility for Low-income populations?

79% of commuter trips are made via personal vehicle from households with incomes below the countywide median that are concentrated in the western side of the corridor. The eastern side of the corridor has a large concentration of households in poverty, which has at least one person who commutes via transit, walking or biking (State, p.24). This indicates that there are concentrations of households that depend on multimodal improvements along the corridor study area. By highlighting these areas of commuter patterns, the strategic action plan satisfactorily identifies transportation needs for low- and median-income populations living within the corridor areas.

Question Five: Does the plan include accessibility and safety for a wide spectrum of ages – from youth to aging populations?

Within the limits of the corridor study, elderly populations are distributed fairly evenly throughout the region, with more than one in three households in Palm Beach County having a person 65 years of age or older residing in them. Additionally, 27 percent of all households in Palm Beach County have one or more children up to age 18. It is stated that both populations face similar issues and are more likely to rely on alternative forms of transportation because they are less likely to have access to a vehicle.

“When considering sex and age, there are more females than males in the county with a skewed correlation of elderly females than males. This is especially important to understand when considering pedestrian and bicycle accommodations, as there is a “gender gap” in perceived safety between females and males”(State, p. 23).



Question Six: Does the plan account for the wayfinding needs of a growing number of non-native English speakers?

Furthermore, the SR 80 plan identifies an increase in racial and ethnic minority populations over time. Between 1980 and 2010, the racial ethnic and minority population increased by 14 percent to 39 percent and is expected to increase to 50 percent by 2030 (State, p.25). These areas with higher concentrations of minority populations also have a lower level of income and English proficiency.

“The majority of the racial and ethnic minority population is composed of black and Hispanic people, and the trend is expected to continue. Because of this, it is important to consider the unique cultural differences when planning as well as to accommodate those who are not proficient in English when planning” (State, p. 25).

By addressing multiple demographic trends and characteristics within the beginning stages of the strategic action plan, it helps to ensure that transportation enhancements and projects planning along the SR 80 corridor are implemented to provide adequate access for a wide range of populations residing in the study area.

East Central Florida Corridor

The East Central Florida Corridor Plan addresses a number of the questions

contained in the Population section of the Risk Assessment Tool in a variety of ways throughout the final document. The plan addresses change transportation preferences, the uncertainty in population forecasts, growth management best practices, and safety for many ages – addressing questions two, three, four, and five, respectively.

Question Two: Does the plan consider the forecasted transportation preferences of future generations?

Recommendation: *“Plan enhanced or new transportation corridors, where appropriate, to accommodate multiple modes of transportation, including opportunities for recreational trails and other forms of active transportation, and to accommodate multiple uses, including utility infrastructure.” (p. 40)*

Question Three: Does the plan remain viable at both high- and low-ends of the population forecasts?

“Forecasts for the level and distribution of future population vary across the study area’s counties and across functional areas (for example, land use, transportation, and water supply planning). These differences make it difficult to integrate different plans and to address the impacts of major developments or infrastructure investments across jurisdictional boundaries.” (p. 37)

Question Four: Does the plan encourage and support growth management best practices?

Recommendation: *“Locate major transportation corridor improvements and, if needed, new facilities in areas targeted for growth in regional and local plans. When planning new or enhanced transportation corridors that are intended to support new population and employment centers, ensure that these new centers are consistent with the “How Shall We Grow?” principles and promote:*

- *Compact development in both urban centers and adjacent areas;*
- *Mixed-use development with integration of*

residential and commercial uses; East Central Florida Corridor Task Force Final Report 40

- *Open space, parks, greenways, agricultural areas, and buffers between centers; and*
- *“Green” community designs that support a reduced urban and environmental footprint, such as reduced water consumption.” (p. 39)*

Plan and develop transportation corridors in a manner that protects the region’s most productive agricultural lands and other rural lands with economic or environmental significance. (p. 39)

Recommendation: “Plan and develop multimodal transportation corridors that are consistent with the How Shall We Grow? principles and provide:

- *Connectivity between centers and to other regions;*
- *Congestion relief; - Choices for moving people and goods; and*
- *Concurrency with new development.” (p. 40)*

Recommendation: “Make early decisions about the location of new or enhanced corridors to ensure effective coordination with conservation and land use decisions and to enable timely preservation, management, or acquisition of property necessary to accommodate existing and planned transportation facilities.” (p. 40)

Question Five: Does the plan include accessibility and safety for a wide spectrum of ages – from youth to aging populations?

Recommendation: “Plan, design, construct, and operate transportation corridors to be safe and secure for all users.” (p. 40)

Key Recommendations

Overall, the SR 80 and the East Central Florida Corridor Plan satisfactorily identified a large majority of the population-related risks, showcasing a holistic view of transportation related to all populations. However, there was a lack of population risk identification within the I-95 plan. By utilizing the Risk Assessment Tool while creating the I-95 plan, the plan

could have been more resilient to fluctuating growth patterns and changing demographics. Additionally, the Risk Assessment Tool could have encouraged a conversation of physically disabled population mobility in all three plans. The Studio Team encourages the continued use and incorporation of best practices for addressing growth management strategies and suggests keeping up with population trends to ensure the transportation system stays viable for all demographics and future generations.

Issue Area 2: Economics

Transportation demand has always been closely linked to economic activity. How Florida’s economy performs in the future will influence both the infrastructure capacity necessary to accommodate the State’s transportation needs and the availability of funding for new projects and the maintenance of existing assets. As such, future planning efforts should consider the projected economic climate in its analysis. This includes an assessment of how a plan would lessen congestion and sources of funding for future projects (how they may change, how they may fluctuate, and what opportunities exist for value-capture and self-funding). The Studio Team recognizes that all three reviewed plans identify at least one economic risk addressed in the Risk Assessment Tool.

Economics	Does the plan implement traffic demand management strategies to lessen congestion on the transportation system?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<u>SR 80</u>
	Do funding sources for the plan remain stable in changing economic cycles (such as recessions or fluctuating interest rates)?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<u>East Central FL</u>
	Does the plan address the possibility of changing sources of financing?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<u>I-95, East Central FL</u>
	Does the plan include value-capture mechanisms (such as tolls or private public partnerships) for financing of the long-term maintenance of the project?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<u>I-95</u>

Interstate 95

The I-95 SIP discusses economic risk boldly and directly in the report’s Executive Summary and then more in depth in the Future Conditions section.

Question Three: Does the plan address the possibility of changing sources of financing?

The SIP begins its consideration of economic impacts by stating the need to “*identify creative funding solutions to construct some of these major new roadways, interchanges, transit, and proposed capacity expansions, ...[because] for the large majority of these projects, funding for construction has not been identified and with financial shortfalls across Florida and the United States, some of these projects may never be developed.*” The plan comments that while “*Florida has changed the mechanism by which to fund transportation improvements (shifting a portion of the financial burden for the existing and future transportation network on developers), ...the recent economic climate has made a significant number of private developments infeasible.*” (Executive, p. xiv)

In Chapter 4 of the Future Conditions Report, the SIP explores in great detail the parallel routes to I-95 that may relieve traffic demand on I-95. Economic considerations for complementary projects to I-95 expansions or improvements were provided, with a strong example provided in its discussion regarding the First Coast Outer Beltway and River Crossing:

“The First Coast Outer Beltway is a proposed southwest outer-bypass of Jacksonville connecting I-10 and I-95 through Duval, Clay, and St. Johns counties. The combination of Branan Field Chaffee Road (SR 23) and St. Johns River Crossing Corridor form the beltway. Several segments of the Branan Field Chaffee Road (SR 23) portion are currently under construction. No segments of the St. Johns River Crossing are under construction. The Department anticipates this facility to be a public-private partnership, and as such, a facility with tolls. If the partnership does not happen, the Department does not have an anticipated funding source and the project will be delayed indefinitely” (Future, p. 4-7).

Question Four: Does the plan include value-capture mechanisms (such as tolls or private public partnerships) for financing of the long-term maintenance of projects?

Chapter 4 of the Future Conditions Report continues with an inventory and assessment of major future roadway and transit projects planned for each of the six counties represented in the SIP. The conversation regarding the First Coast Outer Beltway is continued, saying that

“due to a lack of available funds, FDOT has explored possible public-private ownership deals to assist in paying for the roadway. The St. Johns River Crossing portion of the project is not anticipated to be completed until 2030, unless a public-private partnership can be formed which would move the completion date sooner. If a public-private partnership can be formed, the facility will have tolls” (Future, p. 4-18).

Similar economic considerations were given to other projects, with State Route 9B (future I-795) as another example,

“In March 2010, a Design-Build project began for the segment between US 1 (Phillips Hwy.) and SR 9A; completion of this four-lane limited access connection is expected in the summer of 2012. Final design and right-of-way phases continue for the segment between I-95 and US 1, including the interchanges at both facilities. There is no construction funding programmed at present, beyond the current Design-Build project” (Future, p. 4-18).

Other project mentions include the source of funding (with tolls given as an example for the Northern Outer Beltway) and the cost of a project (such as the \$240 million estimated cost for the North Corridor Commuter Rail in Jacksonville). This section concludes with a thorough recapitulation of the importance of considering economic risk when planning for future transportation infrastructure, discussing

the need to address funding shortfalls, explore and secure public-private partnerships, and consider how the economic and development climate continues to change (Future, p. 4-20).

State Road 80

As addressed in the executive summary of the plan, the SR 80 corridor has seen a significant increase in residential, commercial and industrial development plans, therefore traffic estimates show the need for additional capacity along the corridor.

“With the potential for even more new development traffic to come that will rely on the corridor and the complexities of these issues, FDOT initiated the SR 80 Action Plan to work with local governments to investigate a broad range of transportation alternatives and land use strategies affecting travel demand along the corridor” (State, p. 1).

Question One: Does the plan implement traffic demand management strategies to lesson congestion on the transportation system?

The key findings state three important factors which lead to heavy levels of traffic congestion which have created environmental, economic, social and other ramifications: (1) There is little coordination between transportation and land use in decision making; (2) Freight is an important component of the corridor; (3) There is recurring congestion in the corridor that will increase in the future. The plan provides potential transportation solutions that will relieve congestion by addressing the three issues.

The strategic action plan evaluates the corridor by separating it into three segments including rural, agricultural, and suburban. The suburban segment is defined from Hooker Highway to 20-mile bend and was identified as the segment with the most need to improve capacity to serve the future projects' population growth and development trends. This includes transportation improvement

strategies including additional capacity through using grade-separated systems, additional capacity through alternative intersection design, access management and network improvements (State, p.79).






An example of a transportation recommendation included improving SR 715 is provided below:

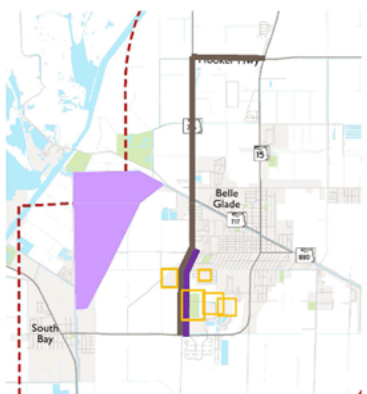
SR 80 from Ave F to Ave B (Downtown)

Issue: Freight traffic conflicts with "Main Street" goal. Trucks are frequent and pose safety and comfort issues to other modes.

Solution: Redesign SR 715 as Freight Route in the short term & alleviate traffic from downtown. This could also be configured to provide access to the ILC.

- Improve SR 715
 - 2 to 4 lane widening planned
 - Need to ensure adequate bike lanes, sidewalks, and pedestrian crossings for schools and parks are included

-  Study Area
-  Alternative Freight Routes
-  Ped Bike Crossing & Infrastructure Improvements
-  School & Recreation Destinations
-  Future ILC



This is only one example of multiple recommendations explained in Chapter 7: Alternative and Strategies within the strategic action plan. By thoroughly evaluating needs within the multiple segments and providing in depth transportation recommendations, the SR 80 corridor plan study satisfies the risk assessment criteria which effectively implements traffic demand management strategies to lessen congestion.

East Central Florida Corridor

The East Central Florida Plan briefly mentions two economic risks that affect the future execution of its action items. While it does identify the factors as issues of the plan, ideally potential solutions should be expanded upon before the plan satisfies the question on the Risk Assessment Tool.

Question Two: Do funding sources for the plan remain stable in changing economic cycles?

Issue: *"The Task Force recognizes that the need for and economic feasibility of each specific corridor alternative – particularly the potential new corridors – will depend heavily on the magnitude and timing of future population and economic growth, including the buildout of existing and planned developments."*

Question Three: Does the plan address the possibility of changing sources of financing?

Issue: *"Funding availability for corridor development and corridor operation and management, especially for rail and transit systems."*

Key Recommendations

As all transportation-related plans are required to consider funding and revenue strategies, it is to no surprise that each plan addresses at least one economic risk factor. The East Central Florida Corridor study and the I-95 plan satisfactorily address the possibility of changing financing sources, which enhances their economic vitality and resiliency. However, utilizing the Risk Assessment Tool for each of the case study plans and in future transportation plans would provide a plan that was more resilient to changing economic factors which may not have been previously considered.

Issue Area 3: Environmental

Florida’s natural environment is one of its most attractive features and greatest assets, supporting a tourism industry that supports the state’s economy. Because of this, the importance of preserving Florida’s natural environment is underscored in the 2015 FTP Vision element. In addition, there are uncertainties and risks on the horizon regarding environmental changes, including volatile weather events, climate change, flooding and storm surge, and sea level rise, and how those changes may impact Florida’s transportation system. As such, it is crucial that future planning efforts for Florida’s transportation network take environmental uncertainties into account.

Environment	Does the plan anticipate the growing risk of increased inland flooding?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<u>I-95, East Central FL</u>
	Does the plan anticipate the growing risk of increased sea level rise and coastal flooding?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
	Does the plan utilize the Sea Level Scenario Planning Tool and/or NOAA Sea Level Rise Viewer?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
	Does the plan anticipate the growing risk of increased extreme weather events?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<u>East Central FL</u>
	Does the plan anticipate the growing risk of increased storm surge?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
	Does the plan anticipate increased transportation demand based upon changing usage patterns and need for evacuation routes due to increased extreme weather events or sea level rise?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<u>I-95, East Central FL, SR 80</u>

Most plans the Studio Team has reviewed do prudently discuss planning for hurricane evacuation routes, with examples provided from all three case studies identified in the Risk Assessment Tool. The Studio Team does support, however, additional consideration of risk as it relates to flooding (inland and coastal), sea level rise, and storm surge.

Interstate 95

Question Five: Does the plan anticipate increased transportation demand based upon changing usage patterns and need for evacuation routes due to increased extreme weather events or sea level rise?

Chapter 4 of the Future Conditions Report within the I-95 SIP begins with a discussion regarding hurricane evacuation routes, explaining that the hurricane events also include “coastal hazards [such as] high tides and storm surge” as well as “inland flooding” (Future, p. 4-1). The plan explains that hurricanes must be planned for because they “may disrupt critical infrastructure and services, such as: transportation systems; fuel supplies; fresh water supplies and delivery; and electrical power delivery” (Future, p. 4-1). While the SIP itself does not provide recommendations for

mitigation strategies, it does acknowledge that each of the “counties, metropolitan planning areas, FDOT districts, and other state agencies have put together hurricane emergency management plans to not only deal with the effects, but also to be proactive to avoid and minimize damage” (Future, p. 4-1).

State Road 80

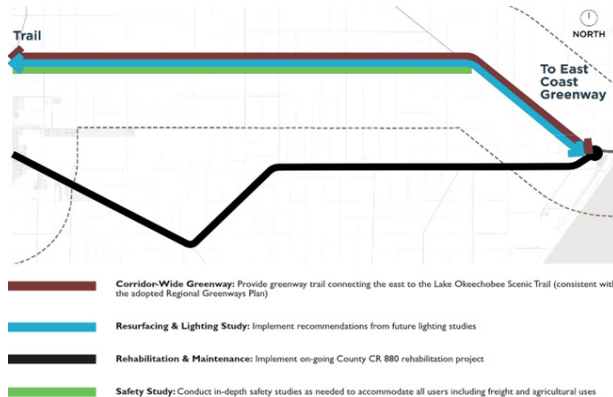
Question Five: Does the plan anticipate increased transportation demand based upon changing usage patterns and need for evacuation routes due to increased extreme weather events or sea level rise?

The SR 80 plan completed an evaluation of historical and environmental context review. The agricultural segment areas encompass agricultural or conservation uses, few destinations, high truck percentage, and little access and low network connectivity. A need identified in this segment included an additional east-west arterial for emergency and evacuation purposes. The potential strategy for alleviating this need was to upgrade CR 880 as a 24/7 accessible alternative route to SR 80 for western communities such as South Bay and Belle Glade (State, p.81).

promote additional development in hazardous areas or areas not planned for growth.” (p. 41)

Key Recommendations

It can be noted that all three plans provided criteria which adequately addressed environmental risk mitigation regarding the need for evacuation routes due to increased extreme weather or sea level rise, proving that this risk is highly important to all plans. The Risk Assessment Tool can be an extremely valuable in coastal areas to ensure the resiliency of communities when implementing new transportation projects. In coastal areas of Florida, the Studio Team encourages including the growing risk of sea level rise and coastal flooding in future transportation plans and utilizing the Sea Level Scenario Planning Tool and/or NOAA Sea Level Rise Viewer to provide mitigation strategies. Additionally, use of the Risk Assessment Tool in transportation planning can help ensure that historically sensitive areas of flooding or high levels of storm surge are highlighted to put emphasis on high risk areas and to encourage plans to continue to address the growing risks of environmental uncertainties.



The East Central Florida Corridor Plan directly addresses three of the questions presented in the Environment section of the Risk Assessment Tool. It addresses the identified risks in a way that is concise, specific, and actionable reasonable relative to the scope of the plan. These questions would be considered satisfactory when checking off the corresponding questions on the checklist.

Question Three: Does the plan anticipate the growing risk of increased extreme weather events?

Issue: *“Vulnerability to climate trends and extreme weather events for transportation corridors and population centers located in low-lying coastal areas or close to the St. Johns River, Econlockhatchee River, Indian River Lagoon, and other water bodies.” (p. 21)*

Question Five: Does the plan anticipate increased transportation demand based upon changing usage patterns and need for evacuation routes due to increased extreme weather events or sea level rise?

Recommendation: *“Plan, design, construct, and operate transportation corridors to support emergency evacuation, emergency response, and post-disaster recovery activities; ensure that corridor improvements intended to enhance emergency evacuation and response are not used to*

Issue Area 4: Technology

The next fifty years are projected to produce significant changes in transportation technology, coalescing with and eventually replacing traditional, predictable, familiar transportation networks. In order to plan effectively for the future, long-term planning efforts should consider the resiliency of the plan or project when integrated with new technologies, such as autonomous or connected vehicles. The impacts of projected rates of user adoption and system integration should also be analyzed, as well as issues regarding user privacy and technological transportation system cyber security.

A discussion of technological risks, uncertainties, or forecasts has not been observed by the Studio Team in the plans it has reviewed. Given the far-reaching and radical effects of new transportation technology, especially surrounding autonomous and connected vehicles, the Studio Team strongly recommends their consideration in future planning efforts. Likewise, future planning efforts should discuss, based on their geographic location (coastal/inland), level of density (urban/rural), and population composition (youth/aging; native/non-native English speakers), the projected adoption rates of new technologies in the planning area. Further, plans should consider, as the integration of technology increases, the effects of new transportation technology on user privacy as well as its vulnerability to cyber security threats.

Technology	Does the plan account for new and emerging technology?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	East Central FL
	Autonomous Vehicles?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
	Connected Vehicles?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
	Does the plan remain viable if anticipated technology is adopted slower than forecasted?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
	Does the plan have policies to address the integration of new and old transportation technology?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
	Does the plan consider impacts to user privacy and security?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____

East Central Florida Corridor

While the East Central Florida Corridor Plan does not go into great depths about incorporating new technology, it does include one recommendation which would satisfy the first question in the Technology section of the Risk Assessment Tool.

Question One: Does the plan account for new and emerging technology?

Recommendation: *“Use state-of-the-art and energy-efficient infrastructure, vehicles, materials, technologies, and methodologies, where economically feasible, to develop and operate transportation corridors.”* (p. 40)

Key Recommendations

By utilizing the Risk Assessment Tool, there is a huge opportunity for all Florida plans to consider different technological risks on the horizon. Although the East Central Florida Corridor Plan mentioned the use of new technology, it would benefit from expansion on the types of technology and the integration of that technology in the plan area. All three case studies evaluate road networks in the state of Florida, which would be directly affected by autonomous and connected vehicle technology. The Fall Studio team recognizes that technology is changing rapidly and new policies and plans should be proactive in addressing technological uncertainties and threats to protect the safety of the transportation system and its users. The Risk Assessment Tool can help to provide structure for analyzing these abstract concepts.

Issue Area 5: Global Changes

Changes in population and the geopolitical landscape are expected to impact transportation networks globally. In Florida, with an international tourism economy and seaports supporting international freight, transportation planners must be cognizant of the global political climate, cost of traditional fuel, and emerging international markets. As such, future planning efforts should consider the resiliency of a plan or project in the face of fluctuating international shipping demand, variations in international tourism, and the evolution of alternative fuel-based technologies. The Studio Team recognizes that many plans will not explicitly address global issues to remain politically neutral and instead will address the outcomes of global events as independent phenomenon. This is understandable as a political necessity of the planning practice and as long as the risks are considered in the plan recommendations – even if the causes are not publicized in the plan – the corresponding questions in the Risk Assessment Tool can still be satisfied.

Global Issues	Does the plan promote resiliency regarding fluctuating freight and shipping demand due to changing global landscapes and economies?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	SR 80
	Does the plan support variations in international tourism in Florida as global wealth grows?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	East Central FL
	Does the plan include the integration of infrastructure supporting alternative fuel-based technologies?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

State Road 80

The SR 80 Corridor Action Plan highlights the importance of the corridor to support the movement of regional freight and goods, while ensuring that the state of Florida is resilient to fluctuating global economies. The predominant commodities moved throughout this corridor includes sugar, molasses, vegetables and aggregate (pg.51). Freight volumes are anticipated to grow as development occurs along the corridor.

Question One: Does the plan promote resiliency regarding fluctuating freight and shipping demand due to changing global landscapes and economies?

“The importance of SR 80 and freight connections to the Port of Palm Beach, Florida’s Turnpike and I-95 is fundamental in understanding existing operations in the corridor. The truck volumes and percentages include a base of line haul freight activity from the western mines, farms, and refineries moving through the developed areas to connect to the Port, Turnpike, and I-95. Because of this, traffic on SR80 has a major impact on freight movement and on the economy” (p.51).

East Central Florida Corridor

The East Central Florida Plan recognizes the vital role that tourism and international travel plays within the economies within the study area. It addresses the fact that tourism levels are expected to increase over the years and that Florida’s transportation systems must take that trend into account during planning processes.

Question Two: Does the plan support variations in international tourism in Florida as global wealth grows?

Recommendation: “Support continued growth in personal and visitor travel, including cruise passengers using Port Canaveral and visitors traveling between major attractions in the three counties.” (p. 45)

Key Recommendations

The Studio Team acknowledges that the specific considering of global issues is not required by the Florida Department of Transportation in future planning efforts, which may influence the lack of global risk identification in Florida plans. While applying the Risk Assessment Tool, it can be noted that SR 80 and the East Central Florida Corridor study included global issues regarding freight and international tourism. As freight and tourism are two of Florida's biggest economies, the Studio Team suggests additional consideration regarding the relationship between the transportation network and the success of these industries and strategies for global risk mitigation that might derail these interconnected systems. Furthermore, the fleet of vehicles seen on Florida roadways are changing due to technology, so all plans should consider the risk of new infrastructure projects and ensuring transportation plans support new vehicle improvements. The Risk Assessment Tool can be used to ensure that global issues such as these are considered holistically and thoroughly.

Conclusion

Considering the potential risks to and implications of risk on a plan or project is widely considered an integral component of planning and project development. Therefore, risk analysis should be happening as early as possible in the process. Changing a plan or project design is costly, and the likelihood of substantive changes being made (even in the light of new knowledge or information) decreases as the planning or project development process proceeds. To ensure that the findings of a risk analysis are effective in their influence, risk should be incorporated into the planning process from the onset during the visioning and goal-setting phases. Further, to ensure that risk consideration is comprehensive and addresses the various

uncertainties for each issue area, the Team has recommended the use of a comprehensive evaluation method via the Risk Assessment Tool. A consistent and standardized risk evaluation conducted at the plan refinement phase will ensure that the multi-faceted aspects of risk are all equally considered in the planning and project development process. The case study analysis provides an evaluation of the Sketch Interstate Plan (SIP) for Interstate 95 (I-95), the State Road 80 (SR 80) Corridor Action Plan, and the East Central Florida Corridor Action Plan that address criteria in the Risk Assessment Tool, giving examples of how to apply the Tool in practice in both plan development and plan review. The Studio Team identified that the issue areas of Population, Economics, and Environment were most robustly discussed, while plans often forewent discussing risks within the issue areas of Technology and Global Issues.

Ultimately, application of these risk-integration recommendations in the planning and project development process will help to ensure the resiliency of each planning effort and project implementation in the face of future uncertainties. If risk analysis procedures are standardized and made consistent, the Studio Team is confident that there is a greater likelihood that the overall visions, goals, and objectives within the plans developed by FDOT or with its oversight and partnership will be achieved when applied in practice, even as conditions in the future change.

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Conclusion



With the intent of supporting the scheduled 2020 update to the Florida Transportation Plan (FTP), the purpose of this project has been to increase FDOT's understanding of risk and the influence that risk has on Florida's transportation network. This project has also endeavored to make recommendations regarding risk integration within current planning processes to ensure that, in the face of uncertainty and change, FDOT can maintain a safe, interconnected and reliable transportation system, promoting economic prosperity and preserving the quality of the environment.

The Mark & Marianne Barnebey Planning and Development Lab, with the support of the Summer and Fall 2018 sessions of the graduate capstone studio course, "Advanced Planning Problems" (the "Studio Teams"), conducted a two-phase project to meet the above objectives. The Studio Teams first identified and assessed transportation risks and consequences in Phase I, and the Teams evaluated alternative futures and strategies for transportation planning in Phase II.

During the literature review and stakeholder outreach for risk identification and assessment, discussed in Chapter 1, the Studio Teams learned that the factors below present the greatest risks to Florida's transportation infrastructure:

- Rate of population growth;
- Changing demographic diversity;
- Needs of special populations;
- Ability to generate revenue sources;
- Ability to securing financing;
- Increasing income inequality;
- Changing landscapes;
- Effects of climate change;
- Frequency and intensity of natural disasters;
- Slow adoption of technology;
- User privacy;

- Cyber security;
- Emerging global economies;
- Geopolitical issues; and
- Fuel dependency.

In this report, Chapter 2 expanded this discussion to better understand the consequences of these risks and their implications on both existing transportation assets and future scenario planning. The assets identified as most at risk are as follow (listed in order from highest to lowest level of vulnerability): transit, airports, seaports, freight/rail, US highways, interstates, toll roads, bridges, state parks, national parks, state roads, county roads, and scenic highways. The Studio Team also learned that planning professionals predict economic uncertainties as having the highest risk and global issues as having the lowest risk for affecting Florida's future transportation system. Further, stakeholders are concerned with the demographic and environmental uncertainties, as they may have a higher likelihood of impact on and span of impact on Florida's future transportation system. Based on total risk score, population, economic and environment uncertainties were determined to be the most pressing risks to Florida's transportation assets. Specifically, rapid population growth, congestion, another recession, decreasing transportation funding, sea level rise and storm surge were some of the most significant risks. While areas of technological uncertainties received moderate total risk scores, two global issues of rising energy prices and global recession received a high-risk score, indicating greater vulnerability for Florida's transportation assets.

In Chapter 3, results of the risk identification and assessment process and consequence identification process were then applied to an analysis of the four non-risk based Alternative Future Scenarios as defined in the FTP Vision Element: Return to Historic Growth; Rural Rediscovery; Global Trade Hub; and Innovation Hub. The Risks on the Horizon alternative future is presented as

a section within these four futures to better analyze extreme risks that could pose a threat. Since each future could potentially occur simultaneously in different parts of the State, the Studio Team determined where in the State each future would have the most affect. It was also determined which risks would most affect each future and how those risks could affect transportation. The Studio Team then evaluated how the risks in each future could have an effect on FDOT's ability to achieve the FTP Policy Element Goals. The Studio Team recommends that FDOT use the studio team's analyses to better discuss how the identified risks will influence transportation solutions in the FTP 2020 update in the face of each alternative future.

Applying the learnings gathered during the literature review and hazard assessment of Chapter 1, the stakeholder outreach and consequence identification of Chapter 2, and the alternative futures analysis of Chapter 3, the Studio Team presented a series of recommendations for how to better integrate a conversation about risk assessment and mitigation into transportation planning in Chapter 4. A guiding framework with six recommendations was developed, along with a specific Risk Assessment Tool checklist, with the goal that FDOT and its partners will be able to better ensure that planning efforts consistently consider the risks associated with future projects and address potential mitigation strategies to minimize the effects of those risks on planning and project outcomes. Chapter 4 further included a case study analysis of three future corridor action plans to provide an example of application of the Risk Assessment Tool and recommendations for comprehensiveness and thoroughness of risk consideration in transportation planning. The Studio Team identified that the issue areas of Population, Economics, and Environment were most robustly discussed in these plans, while

plans often forewent discussing risks within the issue areas of Technology and Global Issues. The Studio Team believes that if risk analysis procedures are standardized and made consistent, resilient goals and objectives for all five issue areas within the plans developed by FDOT or with its oversight and partnership will be achieved when applied in practice, even as conditions in the future change.

Ultimately, while understanding and predicting the future is hard and inherently an imperfect practice, the findings of this report provides valuable insight for long-term transportation planning (specifically regarding the FTP update) and for practical application to other transportation and project development processes managed or overseen by FDOT. This report has provided recommendations for how Florida's transportation system should evolve in the face of risk to support mobility in the future and what consideration should be given to risk (in five key issue areas of Population, Economics, Environment, Technology, and Global Issues) when conducting the planning, policy-setting, and implementation of the FTP update. This report has also evaluated the FTP's four Alternative Future Scenarios (Return to Historic Growth; Rural Rediscovery; Global Trade Hub; and Innovation Hub) for how they might be disrupted by risks and their uncertainties. Lastly, this report has reviewed FDOT's day-to-day planning processes, from preliminary planning and design through project implementation, and it has made recommendations for how to apply the enhanced understanding of risk, as derived from this project, to those processes. The BPDFL and the Summer and Fall Studio teams are confident that the insights gained from this project will be able to advise the FTP update team and will positively influence resilient planning and project development processes across the state.

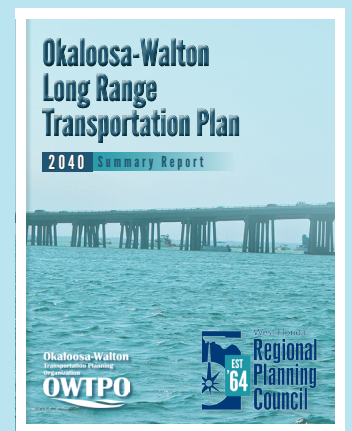
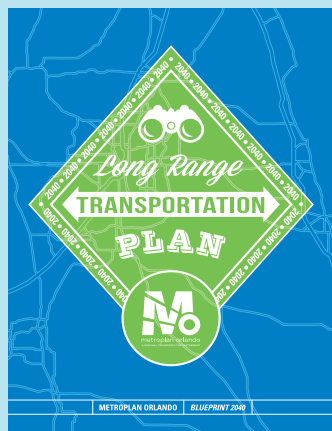
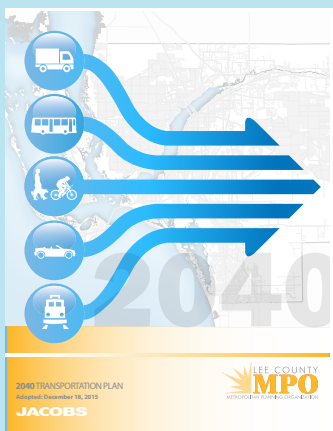
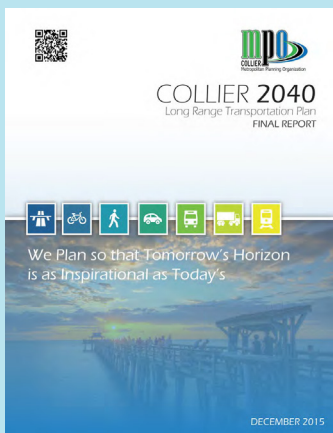
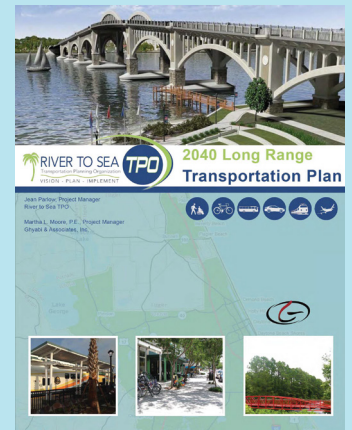
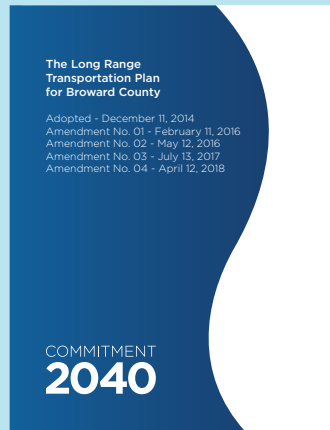
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Appendix

Appendix A: Risk Assessment Strategies for Long-Range Transportation Planning Whitepaper

Appendix B: Stakeholder Outreach

Appendix A: Risk Assessment Strategies for Long-Range Transportation Planning



Introduction

The office of Policy Planning at the Florida Department of Transportation (FDOT) coordinates with 27 Metropolitan Planning Organizations (MPOs) as well as other state departments, federal and local partners to create and implement Long-Range Transportation Plans (LRTP) for each MPOs jurisdiction. According to the Federal Transit Administration, Metropolitan Planning Organizations are created to represent localities in all urbanized areas and carry out the metropolitan transportation planning process. Long-Range Transportation Plans are an essential component in the transportation planning process of each MPO, as they provide an opportunity for community members and professional stakeholders to collaborate, visualize and define the transportation needs and achievements they hope to reach within the next 20 years. In order to ensure the network continues to stay safe and reliable in the future, MPOs should incorporate a conversation of transportation-related risks in their Long-Range Transportation Plan components.

As established in January 2018, the Federal Highway Administration (FHWA) and Federal Transit Administration (FTA) worked in collaboration with the Florida Department of Transportation (FDOT), the Metropolitan Planning Organization Advisory Council (MPOAC), and Florida's MPOs to clearly identify document expectations for future LRTP updates. As a result of this collaboration, a document was produced which addresses Federal Strategies for Implementation Requirements for LRTP updates for the Florida MPOs. 23 CFR 450.306, 316 and 324 describe the basic requirements of the scope of the metropolitan transportation planning process and suggestions for additional LRTP content regarding risk mitigation (Administration F. H., 2018.). The next cycle of LRTPs are required to implement new planning risk factors which

improve the resiliency and reliability of the transportation network. This includes emerging issues including rapid technology, natural disaster risk reduction, scenario planning, impact analyses and equity.

The purpose of this paper is first to highlight best practices from Florida MPOs who planned well for risk in their long-range transportation plans and second to identify gaps in risk-based long-range transportation planning so that MPOs may have an opportunity to further enhance their planning for the next cycle of LRTP updates. The presented findings can be used as a guiding tool for the Florida Department of Transportation, MPOs and other partners and stakeholders as recommendations and examples for how to incorporate risk mitigation strategies into the LRTP planning process so that Florida's transportation network stays resilient in the future.

Methodology

The Studio Team identified risk analysis best practices and areas for opportunity after reading and analyzing the LRTPs for the 27 Florida MPOs. A spreadsheet was created to evaluate all LRTPs using the same risk criteria which allowed the Team to easily recognize relationships between what risk factors were being mentioned the most and which risk factors were being mentioned the least. The risk criteria were divided into five issue areas including Population, Economy, Environment, Technology and Global Issues. Each issue area was then further subdivided using the top three risk factors identified in the Literature Review section identified in the Assessment of Planning Risks and Alternative Futures final report. The Studio Fall team concluded that on average, 25% of the MPOs LRTP documents mention or address 41% of the risks. The completed spreadsheet can be found in Appendix A.

LRTP exemplary best practices for risk inclusion were highlighted depending on how well the MPO addressed each risk factor and incorporated strategies as identified in the Federal Strategies for Implementation Requirements for LRTP Updates for the Florida MPOs document. LRTP areas for opportunity in risk review were identified by a dearth of risk factors mentioned by the MPO; this paper provides recommendations for how the future LRTP updates can incorporate federal risk assessment strategies and risk mitigation.

Best Practices for Risk Mitigation Inclusion in LRTPs

During its assessment of the LRTPs for each of the 27 Florida MPOs, the Fall Studio Team learned that MPOs were most successful at addressing risks in the issue areas of Population, Economics, and Environment. A discussion of each of these issue areas and corresponding best practices worthy of replication or mirroring by other MPOs are included below.

Population

41% of all 27 evaluated MPO LRTPs elaborated on the three population risks which include Population Growth, Demographic Changes and Special Populations. As identified in Federal Strategies for Implementation Requirements for LRTP Updates for the Florida MPOs, scenario planning has been identified as a proactive change in the LRTP planning process. Scenario planning can be used by an MPO to consider baseline factors in comparison with predicted assumptions related to growth, population and employment distribution. The Fall Studio Team identified the Hillsborough County MPO as an exemplary study which thoroughly addresses population risks using scenario planning and addressed all three risk factors.

Hillsborough MPO

To identify population growth patterns, the MPO analyzed historic and projected growth trends. It is stated in its Imagine: 2040 Hillsborough Long Range Transportation Plan that the purpose of the plan update is “to plan for the anticipated approximately 600,000 new people that are projected to call Hillsborough County home in 2040” (MPO, pg.17). To project the future growth trends, the 2040 planning process included a project called Imagine 2040 Growth Scenarios. This process was conducted to inform the Long-Range Transportation Plan update and accompanying comprehensive plans within the MPO identified area regarding different future patterns of growth and employment. A

working group of residents and stakeholders engaged in interactive workshops to analyze current population and employment trends and identify three future growth scenarios including 1. Suburban Dream, 2. Busting Metro, and 3. New Corporate Centers (MPO, pg.43). Each scenario included a description of the potential future and its accompanying population and employment pattern maps. The projections of these scenarios shaped the goals, objectives and policies identified in the LRTP update.

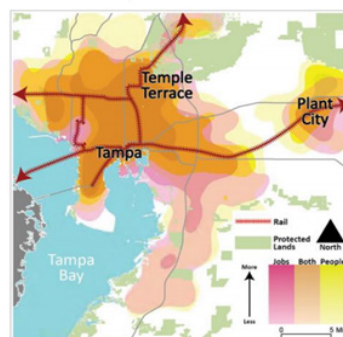


Figure 2-12
2040 Population and Employment patterns under the Busting Metro Scenario

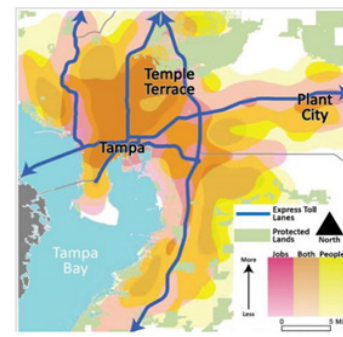


Figure 2-13
2040 Population and Employment patterns under the New Corporate Centers Scenario

Additionally, the plan discussed that Hillsborough has a larger working age population, and as a result transportation challenges are more focused on commuting and multimodal transportation needs for diverse demographic groups (MPO, pg.36). Seniors and persons with disabilities and or low-income populations were also identified at an estimated of 34% of the total population, which highlights the need for transportation choices which support special populations (MPO, pg.97). The identification of growth patterns, demographic changes and special populations within their LRTP planning process provides an opportunity for planners and stakeholders to ensure transportation decisions and projects are planned with these factors in mind, which mitigates future risks related to providing transportation for all populations.

Economics

The Federal Strategies for Implementation Requirements for LRTP Updates for the Florida MPOs document identifies fiscal constraints MPOs might face when updating their LRTPs. To mitigate fiscal and economic risk, LRTPs are required to be described in enough detail to develop a cost element component of the plan with the source of funding for each phase documented for the first 10 years while looking at a 20-year horizon. While implementing transportation project investments, MPOs should be cautious to economic risks including securing financing, generating revenue sources and income inequality. 74% of all 27 evaluated MPO LRTPs discussed the three economic risks which include Generated Revenue Sources, Securing Financing, and Income Inequality.

Ocala/Marion TPO

The Ocala/Marion TPO provides a comprehensive look at how to fund their LRTP goals and objectives while addressing risk mitigation for securing financing, generating revenue sources, and income inequality.

An environmental justice review was used to identify areas with a high concentration of minority, low-income and other traditionally under-served populations (Organization O.M, pg. 3-33). To assess the transportation impacts of inequality, the environmental justice areas were overlaid with the LRTP needs plan assessment. An analysis of the LRTP projects were then conducted to ensure the proposed investments did not adversely impact human health in certain areas. This process can be found in multiple LRTP documents and provides a clear way to ensure equity for all community members.

	EJ Areas	Non-EJ Areas	Total
Population	140,848	192,655	333,503
Percent of Population	40.4%	59.6%	100%
Cost Feasible Roadway Projects	\$142,975,000	\$278,445,000	\$421,420,000
Per Capita	\$1,015	\$1,445	\$1,264
Mileage	22.2	21.4	43.6
Interchanges/Overpasses	\$84,838,000	\$38,000,000	\$122,834,000
Unfunded Needs Roadways	\$426,760,000	\$388,311,000	\$815,082,000
Per Capita	\$3,030	\$2,016	\$2,444
Mileage	38.9	36.2	75.1
Transit Plan (All Capital and Operating Costs 2020–2040)	\$114,534,000	\$38,766,000	\$153,300,000
Per Capita	\$813	\$201	\$460
Mileage	52.0	17.6	69.6
Cost Feasible Trails (2020–2040)	\$3,406,000	\$24,693,000	\$28,100,000
Per Capita	\$24	\$128	\$84
New Trails Mileage	8	58	66
Existing Mileage, All Trails	19	19	38

Additionally, this TPO’s LRTP has included revenue projects from federal, state, and local sources at an estimated \$1.5 billion dollars through the year 2040, noting that for the 2021-2040 planning timeframe \$74.6 are estimated for future transit services (Organization O.M, pgs.4-1, 4-4). Finally, fuel taxes were addressed as a major portion of Ocala/Marion county’s local transportation revenues, stating that “based on this trend, new government fuel efficiency standards, and deflation trends used by FDOT, it was assumed that fuel tax per capita revenue levels will decrease by approximately 3.0% annually through 2040. The total local fuel tax expected to be collected through 2040 is \$410.1 million” (Organization O.M, pg.4-4). By providing a chapter identifying funding of the plan and completing the environmental justice review, the Ocala/Marion LRTP showcases a comprehensive view of resilient economic strategies.

Environment

Florida's geography consists of an abundance of natural environments and growing cities. It is stated in the Federal Strategies for Implementation Requirements for LRTP Updates for the Florida MPOs document that MPOs should consult with agencies that are responsible for natural disaster risk and promote policies and practices which supports an integrated transportation system for all users that is efficient, equitable, safe, and environmentally sustainable. The three risks identified with the Environmental issue area include Changing Landscapes, Climate Change, and Natural Disasters. When evaluating the 49% of LRTPs which addressed all three environmental risks, the Fall Studio Team highlighted the River to Sea TPO as having best practices related to including environmental risk using a collaborative approach consisting of mitigation strategies, an environmental justice review, ETDM screening process, and public outreach.

River to Sea TPO Long-Range Transportation Plan

The River to Sea TPO Long Range Transportation Plans covers 1,400 square miles of Volusia County which contains some of the fastest growing cities in the state, such as Deland and Deltona, as well as environmentally sensitive land (Organization R. T., 2016). The LRTP helps to create high quality transportation facilities through a collaborative approach to implement environmentally sustainable local initiative projects.

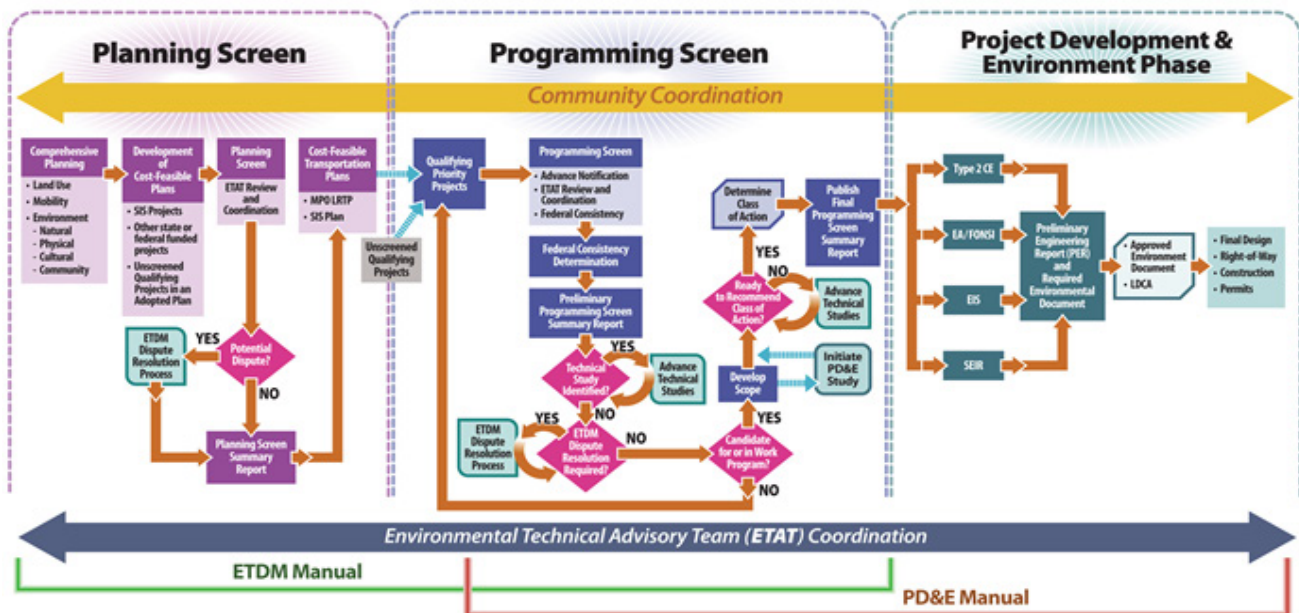
As identified in Chapter 6 of the LRTP, Technical Planning Process, a key area of emphasis is security. The TPO identifies security as "an issue that must be proactively addressed, whether in anticipation of terrorist attacks, natural disasters, or the potential for other system failures" (Organization

R. T., pg.58). These security issues can be mitigated in transportation infrastructure improvements by focusing on evacuation needs and ensuring adequate capacity necessary for large scale evacuation in the event of a disaster. Additionally, they identify the role that Intelligent Transportation Systems (ITS) play in "supporting safety and security during man-made and natural disasters" (Organization R.T., pg.58). The LRTP aims to mitigate environmental security risks by implementing an effective and efficient transportation network which follows three objectives: Provide for a safer and reliable system for modes and travel; Improve the security of the entire transportation system; an Improve the ability of the transportation system to support emergency management response and recovery.

Additionally, the projects included in the 2040 River to Sea LRTP update have been vetted through the Efficient Transportation Decision Making Process (ETDM) and PD&E Process (Organization R.T., pg.21). The two-tiered Efficient Transportation Decision Making (ETDM) process has a planning screening phase and programming screening phase to review the potential environmental effects of transportation projects before implementation, as shown below. During the Planning Screen, comments received from an Environmental Technical Advisory Team (ETAT) and the public help FDOT and TPOs to identify environmental considerations that assist in assessing projects for inclusion or advancement in LRTPs and further into the cost feasible plan. The PD&E manual provides project analysts and Project Managers with a framework for the consistent development of analysis, technical studies, and Environmental Documents for transportation projects to achieve compliance with federal and state laws, regulations, and requirements.

Last, the River to Sea TPO sent the LRTP document to environmental stakeholders to

give them the opportunity to comment on any issues before the document was approved (Organization R.T, pg.77). The TPO's L RTP planning process put high emphasis on mitigating environmental risk when making transportation related decisions. By going through a multi-step planning process, the L RTP ensures that future transportation projects will adequately provide to the community members while remaining resilient to environmental conditions.



Areas of Opportunity for Risk Mitigation Inclusion in LRTPs

While interpreting the results of the spreadsheet analysis, the Fall Studio Team identified that the majority of LRTPs in the state of Florida addressed some level of risk mitigation for population, economy and environment. There was a serious lack or gap, however, in the identification of technology and global issue risks when reviewing all 27 Long-Range Transportation Plans. This gap may be explained because there are no federal LRTP strategies that require the addressing of technological and global risks in long-range transportation planning. These emerging issues may not be required by federal law and the topics to be addressed in LRTPs, but these issues are of critical importance and should be addressed in the future cycle of LRTP updates for Florida’s MPOs. Included below are recommendations for how to incorporate technological and global risk assessment and mitigation strategies into an MPOs LRTP.

Technology

Only 27% of all 27 evaluated MPO LRTPs elaborated the three identified Technological risks which include the Slow Adoption of New Technology, User Privacy, and Cyber Security. Therefore, the Studio Team recognizes an opportunity to more comprehensively and thoroughly address technological risk during the long-range transportation process. One method MPOs may adopt is based on the concept of Mobility on Demand, discussed in the Federal Strategies for Implementation Requirements for LRTP Updates for the Florida MPOs document begins to touch on the concept of Mobility on Demand. Mobility on Demand is defined as “an innovative, user-focused approach which leverages emerging mobility services, integrated transit networks and operations, real-time data, connected travelers, and cooperative Intelligent Transportation Systems (ITS) to allow for a more traveler-centric, transportation system-of-systems approach, providing improved

mobility options to all travelers and users of the system in an efficient and safe manner” (Administration F.H, pg.7). These advancements in technology will provide an opportunity to enhance the transportation system, and they are an area that the MPO can start to address in the next round of LRTP updates.

Pinellas County MPO

The 2040 Pinellas Long Range Transportation Plan recognizes that in addition to socioeconomic and demographic changes, the county will see a shift in transportation technology. The LRTP has identified that technology is changing the way public transportation is used by consumers, streamlining the process of information sharing, and is being used to address congestion and safety on the roadways. Pinellas County has made a considerable investment in transportation-related technology and believes that in the next five years, Intelligent Transportation System (ITS) applications will be implemented on all major roadways (Organization P. C., 2014). Technologies within an ITS system include smart traffic signals, video monitoring, surveillance, and messaging systems. Specific technology applications and their benefits were identified in LRTP and are presented below.

Application	Example
Arterial Management Systems	Manage traffic with coordinated signals to reduce delay during peak periods.
Freeway Management Systems	Monitor freeway conditions to provide traveler information and quicker emergency response.
Traveler Information	Utilize websites, telephone, television, radio and roadway signs to communicate travel conditions.
Transit Management Systems	Provide bus arrival times by monitoring route information using GPS technology.

Table 3-1: ITS Technology Applications.

Although the LRTP has confirmed that new technology will soon be implemented and discussed how these systems can be used to enhance the transportation network, it does not identify potential mitigation strategies for technological risks. The top three technological risks have been identified by the Studio Team as slow adoption of new technology, cyber security and user privacy.

There is an opportunity for all 27 MPOs to further explore the relationship between technology and their transportation system by not only educating LRTP readers on what to expect in the future but provide guidance for mitigating potential risks. For example, Pinellas County states that new technology including, mobile transit trip planning and mobile ticketing, can improve the functionality of the public transit system (Organization P.C. pg, 3-7). There is an opportunity for Pinellas County to further expand on this assumption by evaluating the associated risks using several guiding questions. First, how would a slow adoption of new technology affect the public transportation system? For example, how will the public transportation system continue to provide to elderly and low-income populations who might not have access to a smart phone? Second, how will the public transportation system ensure user privacy when integrating mobile electronic payment technology? Third, how can Pinellas County ensure cyber security protection of its electronic data and operational information systems when integrating autonomous and smart technology within the public transportation system?

It is essential that all MPOs in the state of Florida address technological risks when evaluating the integration of new technology in order to ensure a transportation system that continues to be safe, reliable and efficient.

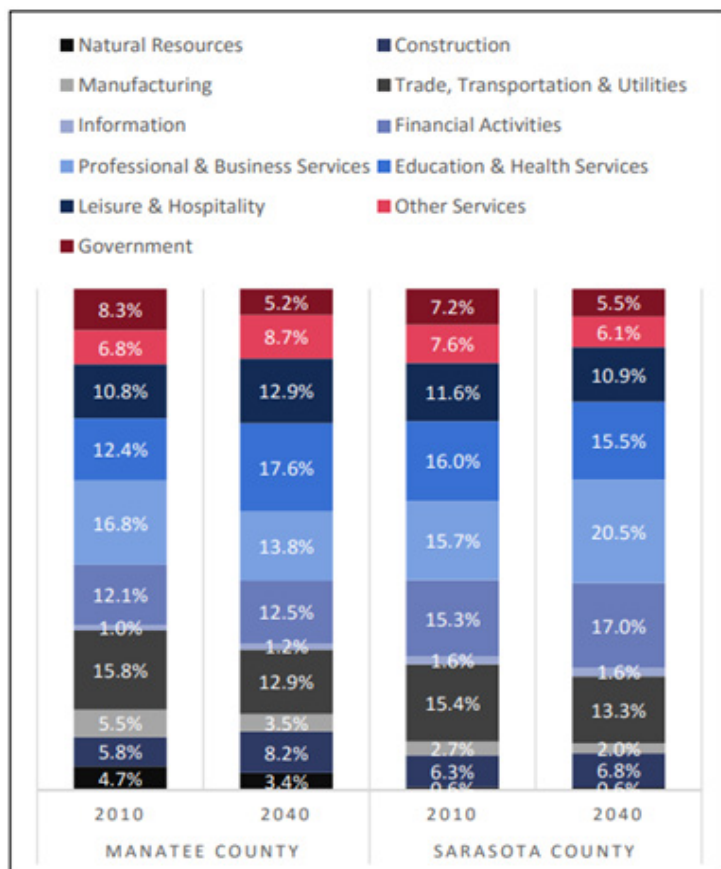
Global Issues

The state of Florida is positioned to continue expanding as an international hub for travel, tourism, and trade over the next 50 years. As global demographics, economic cycles, and political stabilities are constantly shifting, the success of Florida's transportation system can be put in jeopardy. The Studio Team recommends that global issues should be a topic of discussion within LRTPs and be considered as a component that should be required in the federal expectations document. Currently, however, only 15% of the LRTPs discuss risks in the Global Issues risk areas, which include Emerging Economies, Geopolitical Issues and Fuel Dependency. To mitigate global issue externalities, MPOs should incorporate a conversation addressing risks within emerging economies, geopolitical issues and fuel dependency.

Sarasota/Manatee MPO

The Sarasota/Manatee MPO LRTP has taken a progressive approach to addressing potential global issues. The next cycle of LRTP updates, however, has an opportunity to further identify the potential risks their MPO might see regarding these issues. The LRTP identifies that economies will remain stable throughout 2040 and predicts three super-sector growth industries within each county (Organization S.M, pg.2-11). Employment distribution by super-sector is shown in the graphic below. To further expand on the risks of emerging economies, the MPO should consider scenario planning to address risk factors regarding positive and negative shifts in the economies and what those scenarios might look like for the citizens in Sarasota and Manatee County.

Additionally, there is an opportunity for the LRTP to enhance its guiding objectives and policies. For example, Objective 5.4 states, “support and develop energy efficient transportation solutions that make use of new energy technologies, infrastructure, and policies to support improved public health, low impact development, use of low speed vehicles, and alternative fuel sources” (Organization S.M, pg.3-8). The Studio Team recommends that the Sarasota/Manatee County MPO explore a deeper level of analysis with this objective asking questions like the following: What will efficient transportation solutions look like in the face of emerging and unpredictable global issues? How will the geopolitical climate affect these solutions? What if Manatee and Sarasota County can no longer depend on gas for automobile fueling, what other options are available? By including a more robust conversation regarding the potential impacts of global issues, Sarasota/Manatee County’s LRTP will be more equipped to be resilient in the face of uncertainties in the global issues risk areas.



Conclusion

The conducted methodology and presented findings can be replicated in other research projects and studies which seek to address the resiliency of the transportation network in the face of risks and uncertainties. The case studies highlighted within this document as well as the Federal Strategies for Implementation Requirements for LRTP Updates for the Florida MPOs document, can be used as guidance to ensure that the future cycle of LRTPs provide the most comprehensive and sustainable vision for a successful transportation system.

Appendix B: Stakeholder Outreach

Phase 1 Outreach

The Phase 1 survey team conducted the stakeholder outreach prior to, and concurrent with, the literature review. The Team also approached stakeholder outreach through a structured process. Over twenty stakeholders provided direct input concerning the five uncertainty areas. Initial contact began on June 9th and concluded on July 13, 2018. As seen below, a majority of the stakeholders (43%) who provided identifying information had specializations related to transportation planning. The remainder of the stakeholders had expertise in fields concerning the economy, population, environment, technology, and global issues.

Exhibits 1.1 through 1.5 on the following pages show relevant information to how stakeholder outreach was conducted in Phase 1. These exhibits include:

- Exhibit 1.1: Stakeholder Outreach Letter
- Exhibit 1.2: Stakeholder Outreach Template
- Exhibit 1.3: Stakeholder Outreach Survey
- Exhibit 1.4: Stakeholder Outreach Questions and Answers
- Exhibit 1.5: Summer Survey Participants

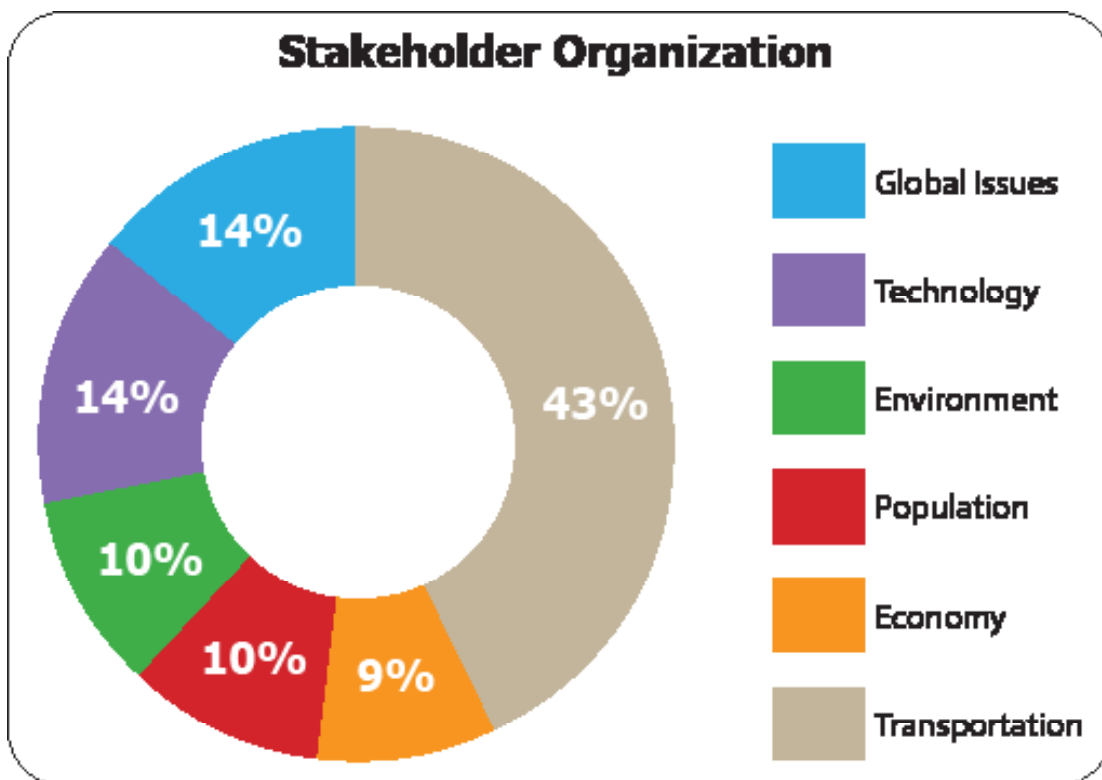


Exhibit 1.1: Stakeholder Outreach Letter



The Florida State University
Department of Urban and Regional Planning
Room 331A BEL
113 Collegiate Loop
PO Box 3062280
Tallahassee, Florida 32306-2280

Hello, my name is Kathrina Regnier, and I am a graduate student in the Urban and Regional Planning Department at FSU. I am currently serving as the project manager for my studio capstone project titled: *Assessment of Planning Risks and Alternate Futures for the Florida Transportation Plan Update*. As a part of this project, my fellow classmates and I are working with the Florida Dept. of Transportation on the 2020 update to the Florida Transportation Plan. Our preliminary findings and research have led us to your contact due to your experience and position in your field.

As a part of our research for the 2020 update, our class is conducting research to consider the challenges and risks that may affect the future of transportation in Florida to understand how risk and uncertainty should be addressed in transportation planning processes. I was wondering if you would be willing to help us with our research by participating in a short survey.

The purpose of this survey is to engage experts in an assessment of a wide variety of vulnerabilities and risks that may affect Florida's future transportation system. The types of uncertainties and future risks have been classified into the following categories:

- Population
- Economics
- Environmental
- Technological
- Global issues

Your responses will help to inform our research on the challenges that may impact Florida's future transportation system. By completing the survey, you are providing consent for us to use your survey responses as part of the research findings.

If you are willing to participate, I can send you a link to the online survey. Additionally, if you have any questions about the project or what you are being asked to contribute, please feel free to contact myself or my professor, and Planner-in-Residence at FSU, Dennis Smith by e-mail at dsmith3@fsu.edu.

Thank you for your time and I really appreciate your willingness to participate and contribute to our research.

Sincerely,



Kathrina Regnier

Exhibit 1.2: Stakeholder Outreach Template

Hello _____,

My name is _____ and I am a graduate student in the Urban and Regional Planning Department at FSU. We are currently completing our capstone requirement working with the Florida Dept. of Transportation on the 2020 update to the Florida Transportation Plan. Our preliminary findings and research have led us to your contact due to your experience and position in your field.

As a part of our research for the 2020 update, our class is conducting research to consider the challenges and risks that may affect the future of transportation in Florida to understand how risk and uncertainty should be addressed in transportation planning processes. Our project is aptly titled: *Assessment of Planning Risks and Alternate Futures for the Florida Transportation Plan Update*. I was wondering if you would be willing to help us with our research by participating in a short survey.

The purpose of this survey is to engage experts in an assessment of a wide variety of vulnerabilities and risks that may affect Florida's future transportation system. The types of uncertainties and future risks have been classified into the following categories:

- Population
- Economics
- Environmental
- Technological
- Global issues

Your responses will help to inform our research on the challenges that may impact Florida's future transportation system. By completing the survey, you are providing consent for us to use your survey responses as part of the research findings.

If you are willing to participate, I can send you a link to the online survey. Additionally, if you have any questions about the project or what you are being asked to contribute, please feel free to contact myself or my professor, and Planner-in-Residence at FSU, Dennis Smith by e-mail at djsmith3@fsu.edu.

Thank you for your time and I really appreciate your willingness to participate and contribute to our research.

Sincerely,

Exhibit 1.3: Stakeholder Outreach Survey



Transportation Risk Assessment - Summer 2018 Studio

Stakeholder Survey

The Florida Transportation Plan (FTP) is the single overarching statewide plan guiding Florida's transportation future. The FTP is updated every 5 years, and in preparation for the next FTP update in 2020, the Florida Department of Transportation (FDOT) is conducting research to consider the challenges and risks that may affect the future of transportation in Florida. A team of faculty and students from Florida State University was tasked with helping FDOT to identify these challenges and understand how risk and uncertainty should be addressed in transportation planning processes.

The purpose of this survey is to engage experts in an assessment of a wide variety of vulnerabilities and risks that may affect Florida's future transportation system. The types of uncertainties and future risks have been classified into the following categories:

- Population
- Economics
- Environmental
- Technological
- Global issues

Please complete the survey below to inform our research on the challenges that may impact Florida's future transportation system. The survey typically takes only 10 minutes to complete. By completing the survey you are providing consent for us to use your survey responses as part of the research findings.

Additionally, if you have any questions about the project or the survey, please feel free to contact Dennis Smith, Planner-in-Residence at FSU's Department of Urban & Regional Planning, by e-mail at dsmith3@fsu.edu.

Thank you,
FSU Research Team

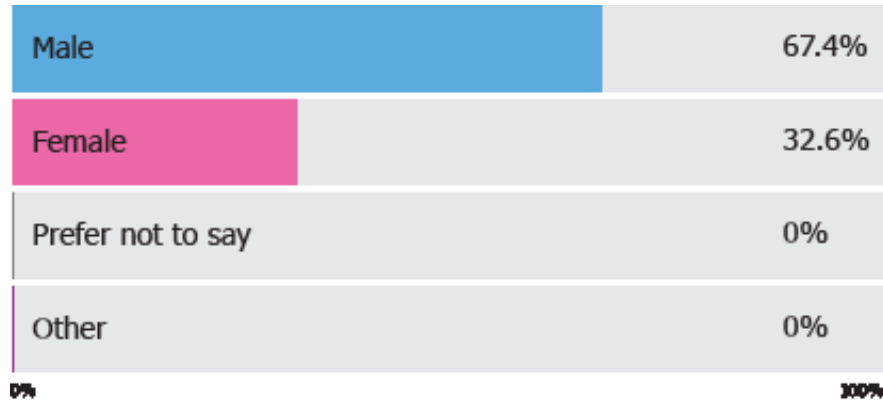
*** 1. Please provide the following contact information.**

Organization Name	<input type="text"/>
Position Title	<input type="text"/>
City/Town/County	<input type="text"/>
Email Address (optional)	<input type="text"/>

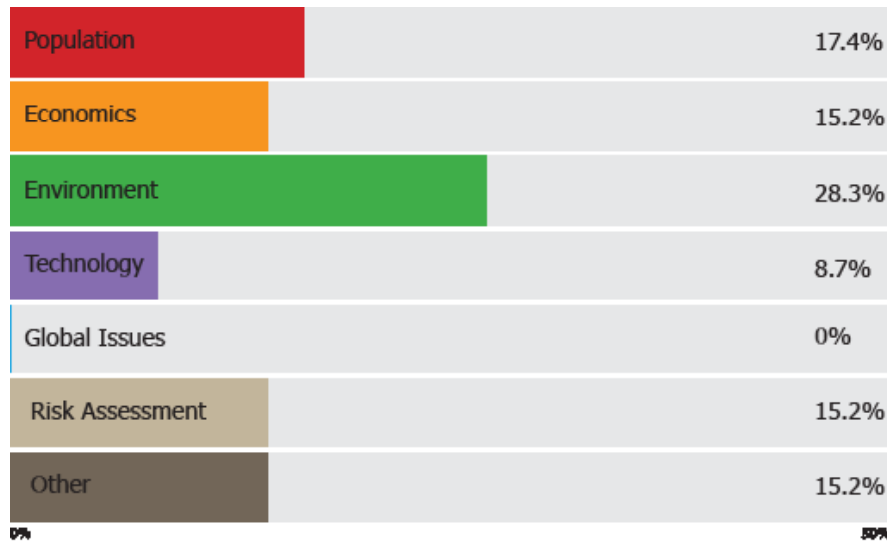
Exhibit 1.4: Stakeholder Outreach Questions and Answers

The stakeholder survey contained a total of fourteen (14) questions. The first question four questions sought to obtain important information about the stakeholders and their professions. The following ten (10) questions aimed to obtain the participants' expert opinions on how uncertainty areas could affect Florida's transportation system in the future.

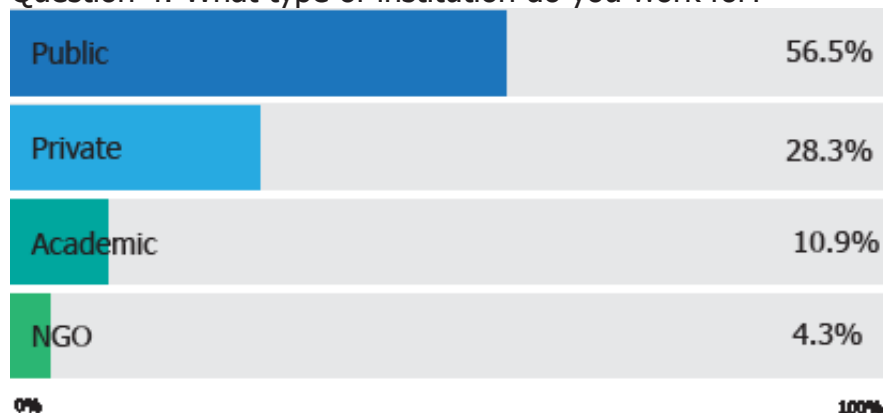
Question 2: With which gender do you identify?



Question 3: Which of the following risk categories does your professional expertise most align with?



Question 4: What type of institution do you work for?



Question 5: How likely is it that the following population risks will impact Florida’s future transportation system in the next 25 or 50 years?

	Weighted Score	
	25 years (2045)	50 years (2070)
Rapid Population Growth	4.2	4.1
Population Decline	1.8	2.1
Suburban Congestion	4.1	3.8
Political Polarization	3.4	3.2
Immigration	3.7	3.6
Aging Population	4.2	4.0

Question 8: How likely is it that the following technology risks will impact Florida’s future transportation system in the next 25 or 50 years?

	Weighted Score	
	25 years (2045)	50 years (2070)
Cyber Security	3.9	3.9
Low funding for Smart Infrastructure	3.4	3.3
Slow Adoption of New Technology	3.4	3.2
Outdated Government Regulation	3.7	3.7
User Privacy	3.5	3.6

Question 6: How likely is it that the following economic risks will impact Florida’s future transportation system in the next 25 or 50 years?

	Weighted Score	
	25 years (2045)	50 years (2070)
Growing Household Income Inequality	3.7	3.8
Worse Traffic Congestion	4.4	4.0
Increasing Fuel Costs	3.7	3.7
Transportation funding Decreases	3.6	3.6
Financing New Infrastructure	3.8	3.8
Another Recession	4.0	4.3

Question 9: How likely is it that the following global issues will impact Florida’s future transportation system in the next 25 or 50 years?

	Weighted Score	
	25 years (2045)	50 years (2070)
Global conflict (war)	2.7	2.9
Rising energy prices	3.8	3.9
Global epidemics	2.8	3.0
Food crises	2.6	2.8
Climate refugees	3.2	3.4
Global recession	3.5	3.7
Terrorism	3.3	3.3

Question 7: How likely is it that the following environmental risks and hazards will impact Florida’s future transportation system in the next 25 or 50 years?

	Weighted Score	
	25 years (2045)	50 years (2070)
Storm Surge	4.1	4.3
Inland Flooding	3.9	4.1
Declining Water Quality	3.4	3.6
Water Scarcity	3.2	3.5
Sea Level Rise	4.0	4.4
Extreme Weather	4.0	4.2
Extreme Temps	3.4	3.7
Fire Hazards	3.4	3.5
Reduction of Open Space	3.7	4.0

Question 10: What is the potential degree of impact of the following population risks on Florida’s future transportation system in the next 25 or 50 years?

	Weighted Score	
	25 years (2045)	50 years (2070)
Rapid Population Growth	3.8	3.8
Population Decline	1.3	1.6
Suburban Congestion	3.6	3.6
Political Polarization	2.6	2.4
Immigration	2.7	2.9
Aging Population	3.8	3.6

Question 11: What is the potential degree of impact of the following economic risks on Florida’s future transportation system in the next 25 or 50 years?

	Weighted Score	
	25 years (2045)	50 years (2070)
Growing Household Income Inequality	3.8	3.1
Worse Traffic Congestion	1.3	4.0
Increasing Fuel Costs	3.6	3.3
Transportation funding Decreases	2.6	3.5
Financing New Infrastructure	2.7	3.6
Another Recession	3.8	3.4

Question 12: What is the potential degree of impact of the following environmental risks and hazards on Florida’s future transportation system in the next 25 or 50 years?

	Weighted Score	
	25 years (2045)	50 years (2070)
Storm Surge	3.5	3.8
Inland Flooding	3.2	3.5
Declining Water Quality	2.7	2.9
Water Scarcity	2.4	2.7
Sea Level Rise	3.4	3.8
Extreme Weather	3.5	3.8
Extreme Temps	2.7	2.9
Fire Hazards	2.6	2.7
Reduction of Open Space	3.0	3.3

Question 13: What is the potential degree of impact of the following technology risks on Florida’s future transportation system in the next 25 or 50 years?

	Weighted Score	
	25 years (2045)	50 years (2070)
Cyber Security	3.2	3.3
Low funding for Smart Infrastructure	2.9	2.9
Slow Adoption of New Technology	2.9	2.9
Outdated Government Regulation	3.3	3.2
User Privacy	2.9	3.0

Question 14: What is the potential degree of impact of the following global issues on Florida’s future transportation system in the next 25 or 50 years?

	Weighted Score	
	25 years (2045)	50 years (2070)
Global conflict (war)	2.0	2.0
Rising energy prices	3.2	3.3
Global epidemics	2.1	2.2
Food crises	1.9	2.1
Climate refugees	2.3	2.7
Global recession	3.0	3.2
Terrorism	2.6	2.6

For Questions 5 through 14, participants were asked to rate the likelihood and impact of the uncertainty areas on a five-point likert scale. For questions related to the likelihood of uncertainty areas affecting the future answers ranged from 1-very unlikely to 5-very likely. For questions related to impacts of the uncertainty areas on the future answers ranged from 1-low to 5-high. Responses were recorded and calculated using a weighted scoring system. The exact equation used to determine weighted scores was:

$$[(a*1)+(b*2)+(c*3)+(d*4)+(e*5)] / n$$

Where,

a = very unlikely or low

b = unlikely or low medium

c = neutral or medium

d = likely or medium high

e = very likely or high

n = total number of responses to the question

Exhibit 1.5: Summer Survey Participants

The Phase 1 survey team administered the questionnaire to a select group of professionals in planning or related fields. These professionals, listed in the table below, were asked to share the questionnaire with other professionals who have relevant work experiences. In total, the survey team’s outreach efforts resulted in reaching 52 professionals with wide-ranging and relevant backgrounds. Please note that in an effort to respect each participant’s privacy, the survey did not require participants to provide responses with identifying information.

Name	Title	Association	Category
Tim Chapin	Dean of COSS	FSU	Population
Dan Pennington	Community Planner	Florida DEO	Economy
Janet Bowman	Director	Nature Conservancy	Environment
-	-	ARCP	Environment
-	-	Arcadis	Environment
-	-	Arcadis	Environment
Ricky Fitzgerald	Office Manager	Freight and Multimodal Operations Office	FDOT
Brian Hutt	Transportation Planner	Lake-Sumter County	MPO
Gina Torres	Transportation Planner	Hillsborough County	MPO
Bud Whithead	Transportation Planner	Hillsborough County	MPO
David Merrick	Director	Emergency Management and Homeland Security Program	Risk Assessment
Marcia Lathou	Title V	St.Lucie County	TPO
Lon Frye	Director	Citrus County	Transit Services Director
Chris Wigglesworth	Transportation Planner	FDOT	Transit
Gabrielle Matthews	Planning Administrator	FDOT	Transit
Tom Blush	-	Jones Edmunds	Transportation/private
-	-	-	Transportation/private
Jacob Durrance	Disaster Recovery Specialist	DEO	-
Shawn College	Team Lead on Environmental Planning	Hillsborough County City-County Planning Commission	-
Sarah Mckinley	Transportation Planner	Hillsborough County	-
Tisha Holmes	Professor	FSU	-
Greg Stuart	Executive Director	Broward Metropolitan Planning Organization	-

Phase 2 Outreach

The Phase 2 survey team furthered stakeholder outreach in Phase 2 through three steps and with a main focus of validating the initial findings from the Phase 1 survey. The validation process began with making certain modifications to the structure and content of the questionnaire. This was followed by administering the survey at the annual conference for APA Florida and online to participants mentioned in Exhibit 1.5 of this appendix. The Fall Studio Team administered the Phase 2 survey from September 11, 2018 to September 16, 2018. In total, 35 professional planners responded to this survey. A majority (30) of these respondents were professionals who received the survey at the APA Florida Conference.

Exhibits 2.1 through 2.3 on the following pages show relevant information to how stakeholder outreach was conducted in Phase 1. These exhibits include:

- Exhibit 2.1: Stakeholder Outreach Email
- Exhibit 2.2: Stakeholder Outreach Questions and Answers
- Exhibit 2.3: Fall Survey Participants

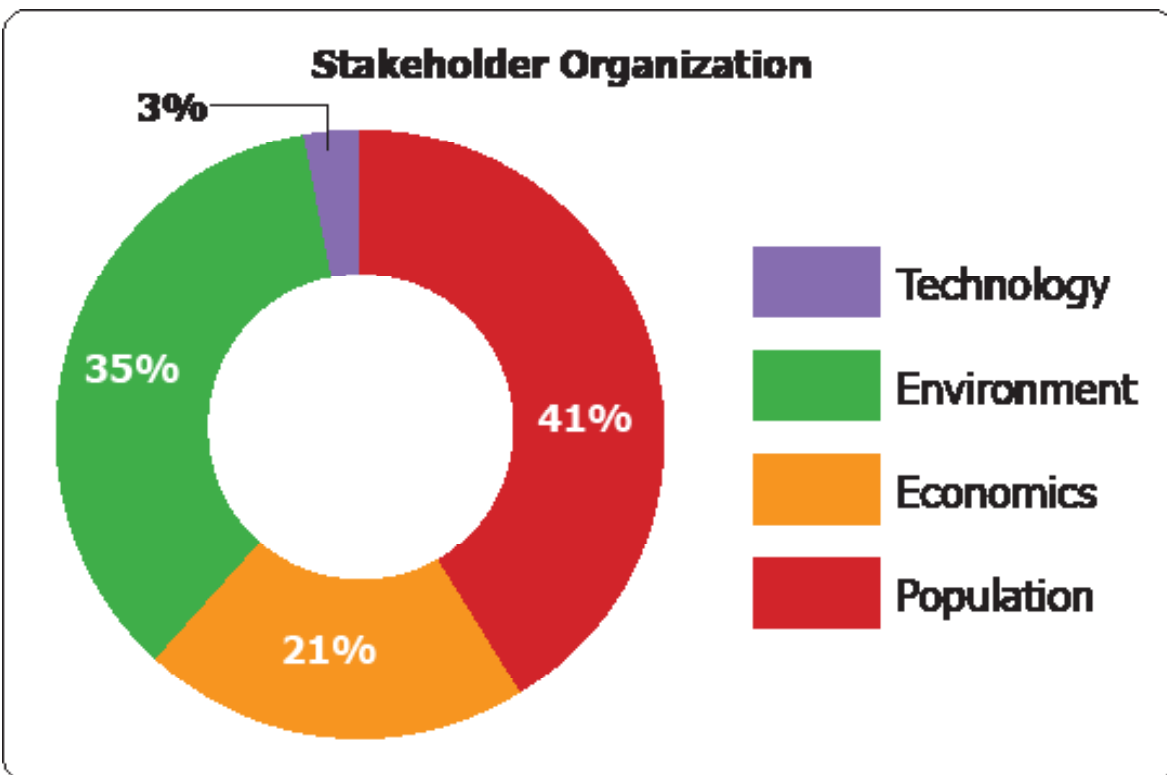


Exhibit 2.1: Stakeholder Outreach Email

Although a majority of Phase 2 survey respondents were engaged at the APA Florida annual conference, the Studio Team thought it prudent to reach potential key informants who were not at the conference. To do this, the team drafted and sent the following email to respondents who had previously submitted survey responses in addition to a few other stakeholders who were identified.

Greetings,

My name is Eric Williams, and I am a graduate student in the Urban and Regional Planning Department at FSU. We are currently completing our capstone requirement working with the Florida Department of Transportation (FDOT) on the 2020 update to the Florida Transportation Plan. The title of our studio project is Assessment of Planning Risks and Alternate Futures for the Transportation Plan Update. The Summer Studio Team of 2018 worked on the risk assessment and identified the assets at risk that can be addressed in the Florida Transportation Plan (FTP) 2020. We, the Fall Studio Team of 2018, are validating the findings of that research which will be further used to identify the impacts of those risks on the alternative futures outlined by FDOT. Our preliminary findings and research have led us to your contact due to your experience and position in your field. We would like you to participate if you would be willing to help us with our research by participating in a short survey.

The purpose of this survey is to engage experts in an assessment of a wide variety of vulnerabilities and risks that may affect Florida's future transportation system. The types of uncertainties and future risks have been classified into the following categories:

- Population
- Economics
- Environmental
- Technological
- Global issues

Your responses will help to inform our research on the challenges that may impact Florida's future transportation system. If you are willing to participate, please click on the link provided below. Also, if you know someone who can provide important insight, feel free to pass this survey to them.

Survey link:

<https://www.surveymonkey.com/r/WM3YR88>

Additionally, if you have any questions about the project or the survey, please feel free to contact Dennis Smith, Planner-in-Residence at FSU's Department of Urban & Regional Planning, by e-mail at djsmith3@fsu.edu.

Thank you for your time, and we appreciate your willingness to participate and contribute to our research.

Thank you,
FSU Fall Studio Team of 2018

Exhibit 2.2: Stakeholder Outreach Questions and Answers

The Phase 2 survey was restructured and contained some content that differed from the Phase 1 survey. For example, the Phase 2 survey does not contain a question regarding the participant's sex or gender identification, but does include a question addressing participants' consent for responses to be used. The Phase 2 survey also limited responses related to the respondents expertise area to the five uncertainty areas identified within this report. Additionally, the Phase 2 survey incorporated open-ended questions to allow respondents an opportunity to qualify their answers or share other relevant expertise. Answers to the open-ended responses are not included in this appendix; however, they are available to the Florida Department of Transportation. Despite the differences in the Phase 1 and 2 surveys, the answers provided to this survey generally supported the previous findings as discussed in this report.

Introduction

In preparation for the next Florida Transportation Plan update in 2020, the Florida Department of Transportation (FDOT) is conducting research to consider the risks that may affect the future of transportation in Florida. A team of faculty and students from Florida State University was tasked with helping FDOT to identify these risks and understand how uncertainty should be addressed in transportation planning processes. Please complete the survey below to inform our research on the challenges that may impact Florida's future transportation system.

Additionally, if you have any questions about the project or the survey, please feel free to contact Dennis Smith, Planner-in-Residence at FSU's Department of Urban & Regional Planning, by e-mail at djsmith3@fsu.edu.

Thank you,
FSU Research Team

Information regarding respondents

Do you provide consent for us to use your survey responses as part of our research findings?

Yes	100%
No	0%

Please provide the following contact information

Position Title: _____

City/Town/County: _____

Email Address (optional): _____

Which of the following risk categories does your professional expertise most align with?

Population

Economics

Environment

Technology

Global Issues

Question 4: How likely is it that the following Population risks will impact Florida’s future transportation system in the next 25 or 50 years?

	Weighted Score	
	25 years (2045)	50 years (2070)
Rapid Population Growth	4.8	4.9
Suburban Congestion	4.6	4.5
Political Polarization	3.5	3.3
Immigration	3.9	4.0
Aging Population	4.4	4.3
Population Decline	2.3	2.7

Question 5: What is the potential degree of impact of the following Population risks on Florida’s future transportation system in the next 25 or 50 years?

	Weighted Score	
	25 years (2045)	50 years (2070)
Rapid Population Growth	4.6	4.7
Suburban Congestion	4.6	4.5
Political Polarization	3.3	2.9
Immigration	3.3	3.3
Aging Population	4.7	4.3
Population Decline	2.7	2.7

Question 6: The FTP identifies four Alternative Future Scenarios (listed below). Please rank (1 highest, 4 lowest) these future scenarios by their likelihood that they would be impacted by Population factors.

	Weighted Score
Return to Historic Growth	2.91
Rural Rediscovery	1.58
Global Trade Hub	2.82
Innovation Hub	2.67

Open Response Questions:

Question 7: How do you think Population risks will affect Florida’s transportation system in your highest ranked Alternative Future Scenario?

Question 8: How is your organization incorporating the future impacts of Population risks and uncertainties into your active planning projects and processes?

Question 9: What should FDOT do to anticipate and respond to Population risks and uncertainties?

Question 10: How likely is it that the following Economic risks will impact Florida’s future transportation system in the next 25 or 50 years?

	Weighted Score	
	25 years (2045)	50 years (2070)
Growing Household Income Inequality	4.8	4.8
Worse Traffic Congestion	4.8	4.0
Increasing Fuel Costs	4.0	4.0
Transportation funding Decreases	4.4	4.5
Financing New Infrastructure	4.2	4.3
Another Recession	4.0	5.0

Question 11: What is the potential degree of impact of the following Economic risks on Florida’s future transportation system in the next 25 or 50 years?

	Weighted Score	
	25 years (2045)	50 years (2070)
Growing Household Income Inequality	4.2	4.5
Worse Traffic Congestion	4.4	4.0
Increasing Fuel Costs	4.0	4.3
Transportation funding Decreases	4.2	3.8
Financing New Infrastructure	3.6	3.3
Another Recession	4.0	4.3

Question 12: The FTP identifies four Alternative Future Scenarios (listed below). Please rank (1 highest, 4 lowest) these future scenarios by their likelihood that they would be impacted by Economic factors.

	Weighted Score
Return to Historic Growth	3.00
Rural Rediscovery	1.50
Global Trade Hub	2.50
Innovation Hub	3.00

Open Response Questions:

Question 13: How do you think Economic risks will affect Florida’s transportation system in your highest ranked Alternative Future Scenario?

Question 14: How is your organization incorporating the future impacts of Economic risks and uncertainties into your active planning projects and processes?

Question 15: What should FDOT do to anticipate and respond to Economic risks and uncertainties?

Question 16: How likely is it that the following Environmental risks will impact Florida's future transportation system in the next 25 or 50 years?

	Weighted Score	
	25 years (2045)	50 years (2070)
Storm surge	4.6	4.7
Inland flooding	4.5	4.8
Declining water quality	3.9	4.1
Water scarcity	3.5	3.9
Sea level rise	4.7	5.0
Extreme weather (i.e. tropical cyclones)	4.5	4.7
Extreme temperatures	4.5	4.7
Fire hazards	3.9	4.2
Reduction of open space	3.7	4.0

Question 17: What is the potential degree of impact of the following Environmental risks on Florida's future transportation system in the next 25 or 50 years?

	Weighted Score	
	25 years (2045)	50 years (2070)
Storm surge	4.1	4.3
Inland flooding	3.8	4.2
Declining water quality	2.9	3.0
Water scarcity	3.0	3.5
Sea level rise	4.5	4.9
Extreme weather (i.e. tropical cyclones)	4.3	4.6
Extreme temperatures	3.8	4.2
Fire hazards	3.5	3.7
Reduction of open space	3.2	3.4

Question 18: The FTP identifies four Alternative Future Scenarios (listed below). Please rank (1 highest, 4 lowest) these future scenarios by their likelihood that they would be impacted by Environmental factors.

	Weighted Score
Return to Historic Growth	2.91
Rural Rediscovery	1.45
Global Trade Hub	2.55
Innovation Hub	3.09

Open Response Questions:

Question 19: How do you think Environmental risks will affect Florida's transportation system in your highest ranked Alternative Future Scenario?

Question 20: How is your organization incorporating the future impacts of Environmental risks and uncertainties into your active planning projects and processes?

Question 21: What should FDOT do to anticipate and respond to Environmental risks and uncertainties?

Question 22: How likely is it that the following Technology risks will impact Florida's future transportation system in the next 25 or 50 years?

	Weighted Score	
	25 years (2045)	50 years (2070)
Cyber security	3.0*	4.0*
Lack of funding for smart infrastructure	4.0*	5.0*
Slow adoption of new technology	4.0*	5.0*
Outdated government regulation	5.0*	3.0*
User privacy	2.0*	2.0*
Reduction of open space	3.7*	4.0*

Question 23: What is the potential degree of impact of the following Technology risks on Florida's future transportation system in the next 25 or 50 years?

	Weighted Score	
	25 years (2045)	50 years (2070)
Cyber security	3.0*	3.0*
Lack of funding for smart infrastructure	4.0*	5.0*
Slow adoption of new technology	4.0*	4.0*
Outdated government regulation	5.0*	3.0*
User privacy	1.0*	1.0*
Reduction of open space	3.7*	4.0*

Question 24: The FTP identifies four Alternative Future Scenarios (listed below). Please rank (1 highest, 4 lowest) these future scenarios by their likelihood that they would be impacted by Technology factors.

	Weighted Score
Return to Historic Growth	1.00*
Rural Rediscovery	2.00*
Global Trade Hub	4.00*
Innovation Hub	3.00*

Open Response Questions:*

Question 25: How do you think Technology risks will affect Florida’s transportation system in your highest ranked Alternative Future Scenario?

Question 26: How is your organization incorporating the future impacts of Technology risks and uncertainties into your active planning projects and processes?

Question 27: What should FDOT do to anticipate and respond to Technology risks and uncertainties?

Question 28: How likely is it that the following Global Issues will impact Florida’s future transportation system in the next 25 or 50 years?

	Weighted Score	
	25 years (2045)	50 years (2070)
Global conflict (war)	**	**
Rising energy prices	**	**
Global epidemics	**	**
Food crises	**	**
Climate refugees	**	**
Global recession	**	**
Terrorism	**	**

Question 29: What is the potential degree of impact of the following Global Issues on Florida’s future transportation system in the next 25 or 50 years?

	Weighted Score	
	25 years (2045)	50 years (2070)
Global conflict (war)	**	**
Rising energy prices	**	**
Global epidemics	**	**
Food crises	**	**
Climate refugees	**	**
Global recession	**	**
Terrorism	**	**

Question 30: The FTP identifies four Alternative Future Scenarios (listed below). Please rank (1 highest, 4 lowest) these future scenarios by their likelihood that they would be impacted by Global factors.

	Weighted Score
Return to Historic Growth	**
Rural Rediscovery	**
Global Trade Hub	**
Innovation Hub	**

Open Response Questions:**

Question 31: How do you think Global Issues will affect Florida’s transportation system in your highest ranked Alternative Future Scenario?

Question 32: How is your organization incorporating the future impacts of Global Issues and uncertainties into your active planning projects and processes?

Question 33: What should FDOT do to anticipate and respond to Global Issues and uncertainties?

* There was one participant who identified as an expert in technology. The validation of this survey is addressed within the report.

** There were no participants who identified as experts in global issues. The validation of this survey is addressed within the report.

The equations used to calculate the weighted scores were the same between Phase 1 and 2 surveys. Please reference the specific calculation at the end of the Phase 1 survey in this appendix.

Exhibit 2.3: Fall Survey Participants

The Phase 2 survey team administered the Phase 2 survey to professionals in planning or related fields. Certain information about these professionals is listed in the table below. Most of these professionals (30) were engaged at the APA Florida Conference; however, several (5) of the professionals were not at the conference and received the survey through email.

Position	Organization	Location (County)
Airport Engineer	Tallahassee International Airport	Leon
Senior Planner / GIS Analyst	City of Ocala	Marion
Senior Land Use Planner	Cotleur and Hearing	Duval
government consultant		leon
Chief, Comprehensive Planning	City of Miami	Miami-Dade
Director, Building Division	Polk BoCC	Polk County
Senior Planner	Apalachee RPC	Leon
Strategic and Organizational Coordinator	Florida Department of Economic Opportunity	Leon
Student	Florida Atlantic University	Palm Beach
VP Sales	Municode	Leon
consultant	MJAPLAN consulting	Polk County
Planning Manager	FDOT D1	Polk
Comprehensive Planning Administrator	Long Range Planning Division	Polk County
City Planner	City of Wilton Manors	Broward
Community Development Services Director	City of Wilton Manors	Broward
Senior Planner	Prosser, Inc.	Duval
Planner	City of Fort Lauderdale	Broward
Director of emergency program of TC RPC	Treasure Coast Regional Planning Council	Treasure Coast
Planner	Wade Trim	Hillsborough
Transportation specialist	Dot	Leon
Senior Marketing Coordinator	University of Florida	Alachua
Assistant Planner	City of Zephyrhills	Pasco
Staff Planner	Metro Forecasting Models	Lee
Senior Site Planner	Palm Beach County Zoning Division	Palm Beach
City Historic Preservation Planner	City of West Palm Beach	Palm Beach
Director of Planning	Keith	Broward
Senior Marketing Coordinator	HDR, Inc.	Palm Beach
president	Richard Walton LLC	Volusia
Outreach Coordinator	Florida Atlantic University	Palm Beach
Principal Planner	Development Impact	Sacramento
COSSPP Dean	FSU	Leon
Senior Transportation/Transit Planner	HDR, Inc.	Leon
Planning Analyst	DEO	Leon

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