metroplan orlando
A REGIONAL TRANSPORTATION PARTNERSHIP

2045

Metropolitan Transportation Plan

Technical Series #14

Scenario Planning -
Summary and Strategies

Adopted: 12/09/ 2020

What is in this document?

This technical series outlines the scenario planning exercise completed as part of the MetroPlan Orlando 2045 Metropolitan Transportation Plan (MTP). This document provides a summary of the scenario development process for four potential futures (Traditional Trends, Disruption Dilemmas, Technology Transformations, and Climate Consequences). It also describes the scenario analysis and results, strategy development effort, lessons learned, and next steps.

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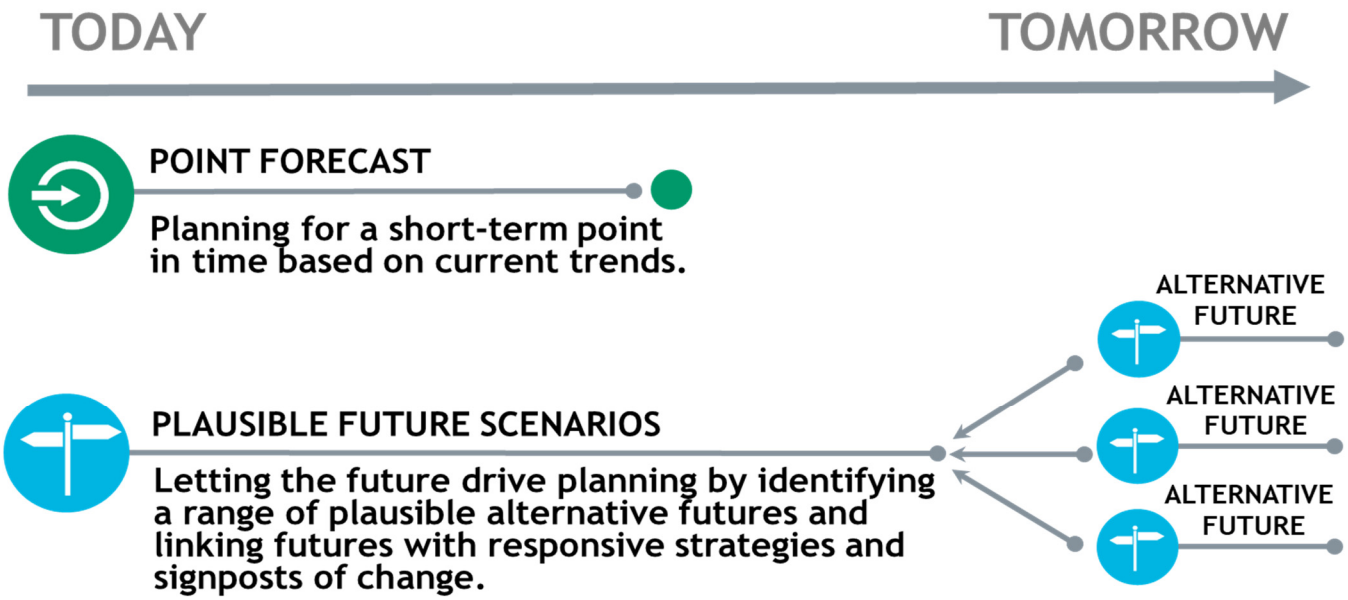
Introduction

MetroPlan Orlando conducted an exploratory scenario planning exercise to support the development of the 2045 Metropolitan Transportation Plan (MTP). This process identified and assessed a range of plausible futures for Central Florida's transportation system, based on a detailed analysis of trends and uncertainties. The needs, priorities, and strategies that respond to each of these futures was also identified. Exploratory scenario planning helps "future proof" the MTP by incorporating strategies and projects that prepare the region for a range of potential outcomes and provide greater resilience.

Scenario planning allows the MPO to better understand the forces driving change, evaluate approaches for how to prepare for and manage change, and inform strategic, long-term decision making. Scenario planning can be applied in a variety of ways and can describe a series of futures shaped by economic, environmental, land use, technology, demographic, and other forces that impact transportation supply and demand. An ***exploratory scenario process*** focuses on ***identifying and evaluating a range of alternative futures***, rather than selecting and working toward a single preferred future. This approach allows for a more robust evaluation of potential needs, projects, and strategies; prioritizing those that make sense for all alternative futures, advancing the most beneficial elements of some alternative futures, or mitigating the risks associated with other futures.

An exploratory scenario should be plausible, internally consistent, and challenging for strategic purposes. It should describe the fundamental drivers that create future uncertainty and convey the risk of relying on traditional forecasts and methods. It also should allow decision makers and the public to see the future in new ways and question their unspoken assumptions and typical approaches. Successful scenario planning involves engaging stakeholders, management teams, leadership, partners, and the public on a broad scale through a discussion of trends and tradeoffs that both captures and incorporates values and feedback into plans. Figure 14.1 illustrates a typical planning approach compared with a scenario planning approach.

Figure 14.1 | Why Scenario Planning?



Source: National Cooperative Highway Research Program Report 750, Foresight: Informing Transportation's Future

Report Organization

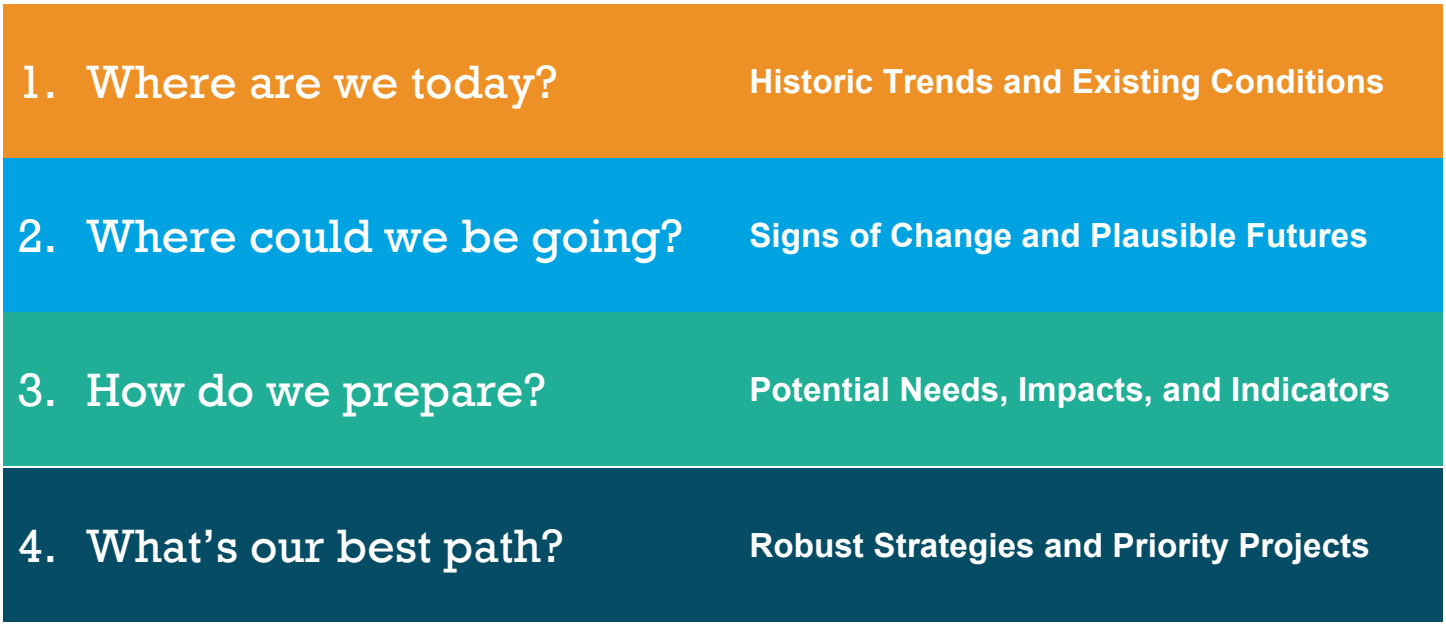
This report is organized in the following sections:

- **Scenario Development Process** provides an overview of the scenario planning process and the four exploratory futures considered in the MTP;
- **Scenario Analysis** reviews detailed quantitative and qualitative information on the potential impacts of the four alternative futures;
- **Strategy Development** describes how the alternative futures were used to identify potential MTP strategies; and
- **Lessons Learned and Next Steps** summarizes the experience applying the scenario planning process and how it could be improved as part of future work.

Scenario Development Process

MetroPlan Orlando used a four-step process to identify and develop the alternative futures (Figure 14.2).

Figure 14.2 | 2045 MTP: Scenario Planning Steps



Source: Cambridge Systematics, 2020

Step 1: Where Are We Today?

The first step was to evaluate the state of the region today, with a thoughtful analysis of historic trends and existing conditions across a range of topics. This analysis was integrated with the overall data collection and analysis for the 2045 MTP. The intent of the data collection and analysis was to understand the global, national, state, and regional trends impacting the future of transportation in Central Florida. MetroPlan Orlando developed a comprehensive database of regional trends and conditions that supported all aspects of plan development.

Step 2: Where Are We Going?

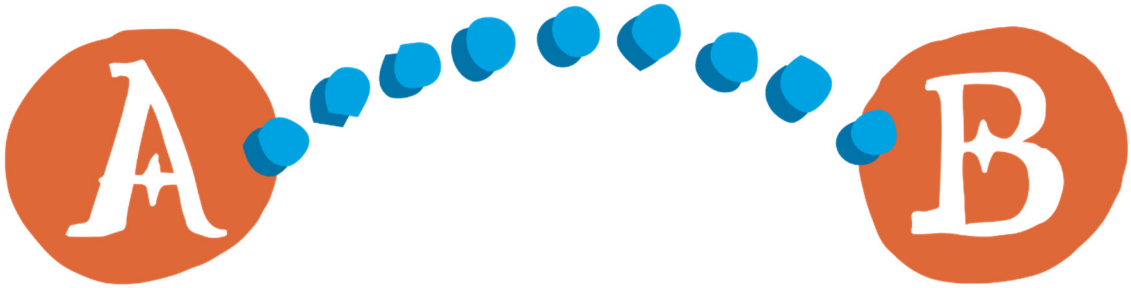
MetroPlan Orlando also collected existing forecasts and reviewed prior studies on how key aspects of the region could evolve over the next 25 years. The emphasis was on understanding where historic trends might continue, as well as identifying indicators and "signposts" that suggest areas in which the region may undergo significant change. The analysis identified six major drivers of change facing Central Florida between now and 2045. These drivers are the factors with the greatest potential to impact future transportation demand and supply, as discussed later in this section. Four alternative futures were developed based on combinations of assumptions about these six drivers of change.

Step 3: How Do We Prepare?

MetroPlan Orlando evaluated the potential impacts of the four alternative futures on the region's transportation system, with emphasis on how each future would shape demand and supply as well as influence the region's ability to accomplish its long-range goals and performance targets. The analysis combined detailed modeling of some potential impacts with input from available studies, subject matter experts, partners, and the public. These impacts were used to identify potential investment needs and policy or strategy changes for incorporation into the MTP.

Step 4: What's Our Best Path?

Finally, MetroPlan Orlando identified a list of priority strategies and projects for the MTP, narrowing the full list identified through the technical analysis and input from partners and the public. The priority list emphasized those projects and strategies most likely to be effective or important across the full range of plausible futures. The list also considered strategies that would help shape the future in a positive direction or help avoid potential undesirable outcomes. The final list of the projects and strategies was reviewed with the 2045 MTP Working Group, MetroPlan Orlando committees and Board, and provided for public comment as part of the draft plan.



Drivers of Change

The scenario planning process identified six key drivers of change:

1. Population

The region's population is perhaps the most critical driver, as it impacts nearly every other aspect of the region. The size and rate of growth of the population is a key determinant of overall travel demand. The University of Florida Bureau of Economic and Business Research (BEBR) projects population in the MetroPlan Orlando region to increase between 17 percent (low) and 71 percent (high) from 2020 to 2045.[1] The alternative futures consider this range for future planning purposes. Shifts in the demographic characteristics of the population also have an impact on transportation needs. The aging population, for example, has different transportation needs and preferences than younger population groups. The BEBR forecast projects that the share of Central Florida residents over the age of 65 could increase by 4.6 percentage points by 2045. Residents with disabilities, chronic health conditions, lower household income, or limited English proficiency all have unique transportation needs and preferences as well.

2. Economy

A strong and growing economy generates demand on the transportation system for moving both people and freight. Economic fluctuations impact the region's jobs, commuting patterns, and use of transit. Central Florida's economy today heavily depends on the tourism and service industries. To improve economic resilience and diversity, the region's economic development partners are leading efforts to create and attract a more diverse range of businesses and jobs, with an emphasis on aerospace and defense; advanced manufacturing; innovative technologies; life science and health care; logistics and distribution; and headquarters and regional offices. Each of these industries brings a different set of transportation needs. For example, increased emphasis on manufacturing, warehousing, and logistics in and around the region can lead to more truck traffic and increased development in industrial centers, while continued expansion of the region's medical technology and healthcare industries could shift development to major hospitals, healthcare centers, and research centers.

3. Visitation

Central Florida's tourism industry is one of the foundational components of the region's economy. The region's major attractions act as key origins and destinations and impact demand and performance of the transportation system, particularly during seasonal peaks. In 2018, 75 million visitors traveled to the Central Florida region, representing 34 visitors for every one resident in the region. The rate of growth in visitor activity will be a key determinant of future transportation demand. The COVID-19 pandemic significantly disrupted tourism and travel globally during 2020, including in Central Florida. Central Florida's visitor industry has sustained previous external shocks, such as the impacts of the 9/11 terrorist attacks, and resumed its long-term growth trend. Given the size and importance of tourism to Central Florida's economy, any significant shift in the number of visitors or the length or characteristics of visitor stays would have a major impact on the region's economy and transportation system. The region also could be impacted by a shift in the type of visitors choosing to visit Central Florida. Tourists coming to experience the attractions, for example, have different transportation needs and destinations than business travelers.

[1] University of Florida Bureau of Economic and Business Research, 2020

4. Technology

Technological innovations such as automated and connected vehicles, in-vehicle safety features, mobility apps, and broadband connectivity are changing the way people live, work, shop, learn, receive health care, and travel. The region has more mobility options than ever, and technology is making those options safer and more efficient. However, these advancements also present new data and cybersecurity challenges.

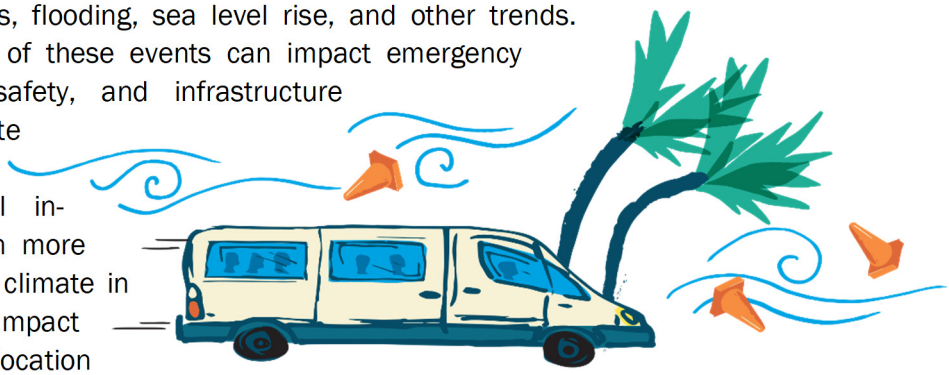
The lack of certainty and inconsistency in technology adoption rates create challenges in preparing for the future. There are a wide range of expectations for automated and connected vehicle technology adoption rates. Some projections suggest more than 33 million automated vehicles could be sold annually in 2040, accounting for 26 percent of new vehicles;[2] others suggest 95 percent of U.S. passenger miles traveled by 2030 could be served by fleets of on-demand autonomous electric vehicles owned by private corporations in a transportation-as-a-service model.[3] The technology assumptions for this alternative futures analysis were closely coordinated with a series of six technology scenarios developed by the Florida Department of Transportation (FDOT) to assist MPOs in long-range transportation plan updates.[4]

5. Land Use and Development

Land use and development decisions are closely tied to transportation. Where people choose to live and the activity centers they choose to visit are strongly influenced by the transportation system and vice versa. As new development and redevelopment occurs in the region, the transportation system will need to be designed to support shifts in land use. Higher density development, for example, is a key component for supporting a thriving transit system and is supportive of shared and micro-mobility options. Development around existing activity centers can impact congestion and create the need for new capacity, while the emergence of new activity centers can shift travel patterns and create demand where there previously was none. More industrial land uses that rely on freight activity, like manufacturing and warehousing, can increase the share of trucks on the region's major transportation corridors.

6. Climate

Changing climate is a risk the region must consider to ensure the transportation system is resilient to extreme weather events, flooding, sea level rise, and other trends. Increased frequency and/or intensity of these events can impact emergency evacuation and response, public safety, and infrastructure conditions. In some cases, climate changes could impact where people choose to live, including potential in-migration from areas that have been more severely impacted. Future changes in climate in Central Florida and beyond will impact infrastructure hardening programs, relocation of impacted populations centers, and quality of life considerations.



[2] IHS Markit

[3] RethinkX

[4] FDOT, Guidance for Assessing Planning Impacts and Opportunities of Automated, Connected, Electric, and Shared-Use Vehicles

Alternative Futures

Four alternative futures for the MetroPlan Orlando region were developed by adjusting six key drivers. These alternative futures were presented to and discussed with the MetroPlan Orlando 2045 MTP Working Group, Technical Advisory Committee, Community Advisory Committee, Municipal Advisory Committee, Transportation Systems Management & Operations Advisory Committee, and the MetroPlan Orlando Board to gather feedback. Adjustments were made based on this valuable partner and public input. During each of these meetings, polling software was used to collect feedback on how scenario planning could best be used to support the MTP and on the perceived viability and likelihood of each alternative future. This input significantly reshaped the futures, leading to a decision to replace an alternative future focused on growth in global trade with a new future to explore the potential impacts of economic shocks, public health crises, and slower population growth (Disruption Dilemmas). Table 14.1 illustrates the four alternative futures that were developed through this extensive analysis and outreach process. Contextual information about each potential future and the adjustments made to each of the six key drivers is included in the following pages.

Table 14.1 | 2045 MTP Alternative Futures

	Traditional Trends	Disruption Dilemmas	Tech Transformations	Climate Consequences
Description	Historic trends and conditions continue unchanged	Pandemics or other emergencies disrupt the region's population, visitor, and economic growth, affecting travel and development patterns	Major technology and innovation changes make Central Florida a destination for businesses and a younger workforce	Frequent extreme weather events and major sea level rise force the state's coastal residents to move inland.
Population	Increase by 40%	Increase by 20%	Increase by 40%	Increase by 60%
Economy	Moderate growth Tourism/service	Lower growth Healthcare/ Manufacturing	Moderate growth High-tech/research	High growth Construction/tourism
Visitation	Moderate growth	Lower growth	High growth More business travel	High growth Both international and domestic tourism
Technology	Minimum AV/CV impacts	AV/CV focused on targeted AV/CV zones Increased broadband access	High rate of AV/CV adoption Increased broadband access and transit automation	AV/CV focused on targeted AV/CV zones
Land Use and Development	Aligned with existing land uses	Lower density Shifts to manufacturing employment centers	Shifts to technology-based employment centers	Higher density along key corridors and in key activity centers
Climate	Moderate sea level rise and frequency of extreme weather events	Moderate sea level rise and frequency of extreme weather events	Moderate sea level rise and frequency of extreme weather events	High sea level rise and increased frequency of extreme weather events

Source: MetroPlan Orlando, 2045 MTP, Technical Series #8 – Scenario Planning Background and Development

Traditional Trends

Traditional Trends is the first future identified for the MetroPlan Orlando region. This future assumes the region would recover from the pandemic and recession in 2020 and return to historic trends based on strong growth in population, visitors, and the economy. The region would remain focused on the automobile as the primary means for transportation and the major transportation corridors and activity centers would remain the same as today (Table 14.2).

Table 14.2 | Traditional Trends: Key Drivers

Key Driver	Description
Population	Increase 40 percent by 2045 (BEBR Medium).
Economy	Steady economic growth focused on tourism and service industry.
Visitation	Steady growth in visitors with major destinations remaining the same.
Technology	The region embraces technology and AV/CVs account for 40 percent of the vehicle fleet by 2045.
Land Use	Development focused on major transportation corridors and on the fringes of the region with some urban infill.
Climate	Gradual increases in temperatures and more frequent extreme weather events. The region experiences impacts of moderate sea level rise.

Disruption Dilemmas

Disruption Dilemmas is a future designed to consider the impacts of potential disruptors on the region's transportation system. This future assumes one or more significant economic fluctuations occur between 2020 and 2045, as well as a heightened focus on health and safety due to major public health crises impacting the region. These disruptors would lead to slower growth in the region's population and economy and a reduction in visitor travel, especially for international visitors. The slower rate of growth and concerns about public health and safety could lead to lower density development over a greater area in Central Florida. This future also assumes significant shifts in travel behavior, with more people working remotely, hesitation to use public transportation and shared mobility options due to increased public health concerns, and growing demand for active transportation (Table 14.3).

Table 14.3 | Disruption Dilemmas: Key Drivers

Key Driver	Description
Population	Increase 20 percent by 2045 (BEBR Low).
Economy	Lower economic growth due to impacts from economic fluctuations, decreased tourism, and lower demand for construction.
Visitation	Slower than baseline growth in domestic visitors and decline in the number of international visitors.
Technology	The region has 40 percent AV/CV fleet with few vehicles completely automated. Greater focus on AV/CV service in specific "AV Zones."
Land Use	Greater emphasis on lower density and redevelopment.
Climate	Gradual increases in temperatures and more frequent extreme weather events. The region experiences impacts of moderate sea level rise.

Tech Transformations

Tech Transformations is a future designed to consider the potential impacts large scale technology adoption and implementation could have on the region's transportation system. This future assumes strong growth in automated, connected, electric, and shared vehicle technologies with a high rate of adoption (Table 14.4). This future also suggests greater reliance on emerging micro-mobility options and improved broadband access across the region.

Table 14.4 | Tech Transformations: Key Drivers

Key Driver	Description
Population	Increase 40 percent by 2045 (BEBR Medium) with a larger share of the population age 18-34.
Economy	Higher economic growth with a greater focus on high-tech industries (aerospace, simulation, research/development, technology).
Visitation	Visitor growth similar to baseline with a greater emphasis on business travel.
Technology	The region has 80 percent AV/CV fleet by 2045 with multiple AV subscription services. Greater focus on automated transit.
Land Use	Both urban and rural areas experience growth as AVs and telepresence allow people to live wherever they desire.
Climate	Gradual increases in temperatures and more frequent extreme weather events. The region experiences impacts of moderate sea level rise.

Climate Consequences

Climate Consequences is a future focused on the impacts of a changing climate on Central Florida. Increases in the frequency and severity of extreme weather events, precipitation, inland flooding, and heat all could impact the region's population, economy, and infrastructure. The future also assumes additional population growth in Central Florida from in-migration from coastal communities or Caribbean Islands with significant sea level rise. (Table 14.5).

Table 14.5 | Climate Consequences: Key Drivers

Key Driver	Description
Population	Increase 60 percent by 2045 (BEBR High).
Economy	Strong economic growth with booming construction and service industries to accommodate new population growth.
Visitation	Higher visitor growth than baseline with increase in both domestic and international tourism.
Technology	The region embraces technology and AV/CVs account for 40 percent of the vehicle fleet.
Land Use	Denser development along major transportation corridors, in and around activity centers, and new development in neighboring counties.
Climate	Gradual increases in temperatures and higher frequencies of extreme weather events. The region experiences impacts of high sea level rise.

Scenario Analysis

MetroPlan Orlando analyzed the four alternative futures to understand their potential impacts on the region's transportation system, with emphasis on whether the region would be able to make progress toward the MTP goals and transportation performance targets. Based on this analysis, MetroPlan Orlando identified a range of potential investment needs and supporting strategies.

The impact analysis included a combination of quantitative and qualitative inputs. The quantitative input primarily came from use of the region's travel demand model to estimate the impacts of each future on the roadway system and identify potential investment needs. The qualitative input addressed transportation modes and goal areas not specifically covered through the travel demand model, based on a review of available literature, similar scenario planning processes in other states, subject matter expertise, and partner and public input.

This section of the report discusses how the Central Florida Regional Planning Model (CFRPM) was used to quantitatively evaluate the four alternative futures; describes the qualitative inputs; and documents the conclusions about the impacts of the four futures on the region's goals and performance targets.

Demand Model Background

As part of the MTP process, the regional travel demand model applied socioeconomic, employment, and land use data, as well as other inputs to estimate regional mobility needs. Modeling helps plan for population growth, fluctuation or decline, changes in industry mix and employment, future land uses, and more. These factors impact trip generation and origin/destination patterns. Models are specified to the needs and characteristics of a community. The goal is not to predict the future, but rather, to evaluate the impacts of multiple futures to help identify the needs, strategies, and projects that prepare the region for those impacts.

Travel Demand Modeling Adjustments

The use of the regional travel demand model provides traditional quantitative metrics for many aspects of the region's transportation system for each of the four alternative futures. CFRPM version 7, the latest version provided by FDOT, was used for this analysis. This model has a base year of 2015 and horizon year of 2045 with data sets for every five years from 2015 to 2045. Year 2045 was used for this exercise.

The model covers an 11-county region; however, the evaluation of the four futures was limited to the MetroPlan Orlando planning area consisting of Orange, Osceola, and Seminole counties. The project team modified the CFRPM model input files to reflect the six drivers of change and assumptions defined for each alternative future, working in close coordination with MetroPlan Orlando staff. These modifications were focused in the following areas:

- Changes to the overall level of population, employment, and visitor growth;
- Changes to the allocation of employment growth among major sectors (e.g., commercial and industrial);
- Changes to the geographic distribution of future population, employment, and visitors across the region, by targeting growth in key areas of impact (e.g., premium transit corridors, focused development areas, industrial or logistics zones); and
- Changes to transportation system capacity and operations related to the adoption of new technologies such as automated and connected vehicles.

Once the model inputs were adjusted, the CFRPM model was run for each alternative future. Standard model outputs were calculated for each alternative future, including vehicle miles traveled (VMT), vehicle hours traveled (VHT), and vehicle hours of delay (VHD). The model outputs helped identify potential needs and strategies for the MTP.

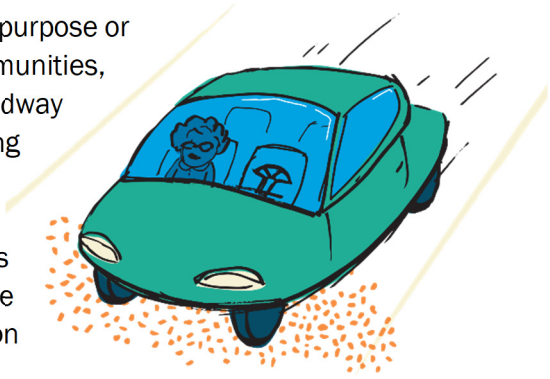
Technology Impact Analysis

The analysis of potential impacts of emerging technologies primarily reflects recent analysis developed by FDOT as part of the report, *Guidance for Assessing Planning Impacts and Opportunities of Automated, Connected, Electric and Shared-Use (ACES) Vehicles.*

FDOT incorporated this guidance into the CFRPM as six possible levels of automation—ranging from minimal impacts to significant system wide impacts, including multiple automated fleets or automated transit.[1] The model can be run with no ACES consideration, or with any one of six options activated. The CFRPM evaluates the impacts of the six levels of automation on system capacity, such as the ability to accommodate more vehicles per lane through reduced headways.

Three of these six levels were used to reflect the types and levels of automation for the MetroPlan Orlando alternative futures:

- **Slow Roll.** The baseline comparison level of automation assumes minimal change. This level takes into consideration the adoption of current technological advances and assumes incremental change within 30 years. However, no major innovations beyond currently available technology and investments already in motion is adopted. Therefore, there are no significant roadway related impacts. This level is used in the Traditional Trends alternative future.
- **Niche Service Growth.** Innovation proliferates, but only in special purpose or "niche" automated vehicle zones, including retirement communities, campuses, transit corridors, urban cores, and ports. Roadway adjustments are applied to all selected geographies representing key activity centers. This level of automation is used in both Disruption Dilemmas and Climate Consequences. Both futures assume greater reliance on technology. The priorities of addressing public health and extreme impacts of climate change are anticipated to limit the rate of adoption and focus it on defined geographic areas.



- **Robo Transit.** This is the most technologically progressive level of automation. On-demand shared services proliferate and integrate with other modes via cooperative data sharing, policies, and infrastructure. Roadway adjustments are applied regionally. This scenario was used for Technology Transformations to reflect the potential impacts of significant advances in the use of technologies across the region.

Future-Specific Adjustments

The CFRPM model was adjusted for each of the four futures using specific, quantitative changes to the socioeconomic data and/or transportation network. Four of the key drivers were considered in this process: population, employment, visitation, and technology. Changes in development patterns were considered through the allocation of growth to identified geographies containing key activity centers.

Traditional Trends. This baseline future assumes a return to pre-COVID-19 trends and is based largely on historic trends across all six drivers. These conditions are reflected in the 2045 existing plus committed (E+C) network, which captures anticipated future socioeconomic activity and programmed and planned investments. The E+C network did not require modifications for this future, except for technology. This future assumes minimal adoption of ACES reflected by the "Slow Roll" level of automation. Table 14.6 summarizes the assumptions for this future.

Table 14.6 | Traditional Trends Model Assumptions

Key Factors	Adjustments to the Model
Population Increase 40 percent by 2045.	No adjustments to the model were necessary. The E+C network incorporates BEBR medium forecasts, which were used to represent this scenario. The largest increase in population follows increased development along highway transportation corridors in Osceola County.
Economy Steady economic growth focused on tourism and service industry.	No adjustments to the model were made. The E+C network incorporates moderate growth overall and focuses on traditionally dominant industries including tourism and services.
Visitation Steady growth in visitors with major destinations remaining the same.	No adjustments to the model were made. The E+C network incorporates moderate growth overall.
Technology The region embraces technology and AV/CVs account for 40 percent of the vehicle fleet by 2045.	The model was adjusted by activating the Slow Roll ACES option. This included adjustments to the network, trip distribution assumptions, and mode choice shifts designed to reflect a greater use of AVs, longer trip lengths, and growth in non-motorized activity. A detailed description of the Slow Roll assumptions are available from FDOT.[5]
Land Use and Development Development focused on major transportation corridors and on the fringes of the region with some urban infill.	The E+C network with moderate projections are in alignment with existing land use projections. No adjustments to the model were made.
Climate Gradual increases in temperatures and more frequent extreme weather events. The region experiences impacts of moderate sea level rise.	No adjustments to the model were made.

[5] Guidance for Assessing Planning Impacts and Opportunities of Automated, Connected, Electric, and Shared-Use Vehicles, FDOT.

Disruption Dilemmas. This future represents low growth conditions, exploring shifts and declines due to economic fluctuations and public health crises. It assumes a lower-than-baseline population increase and a reduction in employment and visitor travel. There is focused adoption of ACES in special purpose or "niche" zones, including retirement communities, campuses, transit corridors, and urban cores. The E+C network was adjusted to reflect these changes. Table 14.7 summarizes the assumptions for this future.

Table 14.7 | Disruption Dilemmas Model Assumptions

Key Factors	Adjustments to the Model
Population Increase 20 percent by 2045 (BEBR Low).	The E+C network incorporated BEBR low rates to represent this scenario. E+C network adjustments were made at the Traffic Analysis Zone (TAZ) level, based on input from MetroPlan Orlando staff. A growth factor of zero was assigned to TAZs with the highest poverty rates while low and medium growth factors were assigned to TAZs with lower rates. This resulted in overall growth for the region that is lower than BEBR Low rates.
Economy Lower economic growth due to impacts from economic fluctuations, decreased tourism, and lower demand for construction.	E+C network incorporated lower growth overall with network adjustments made at the TAZ level, based on input from MetroPlan Orlando staff. TAZs representing healthcare and manufacturing areas were assigned a moderate growth factor accounting for increases in health care and social assistance, manufacturing, transportation and warehousing, and information. All other TAZs were assigned a low growth factor with uniform shifts in employment from commercial employment to the higher growth sectors at the TAZ level.
Visitation Slower-than-baseline growth in domestic visitors and decline in the number of international visitors.	The E+C network incorporated recession-level low growth based on a lower hotel occupancy rate. E+C network adjustments were made at the TAZ level, based on input from MetroPlan Orlando staff. TAZs coded as 1 represented TAZs with 100 or more hotel rooms; lower occupancy rates were applied to these TAZs.
Technology The region has 40 percent AV/CV fleet with few vehicles completely automated. Greater focus on AV/CV service in specific "AV Zones."	The model was adjusted by activating the Niche Service ACES option. This included adjustments to the network, trip distribution assumptions, and mode choice shifts designed to reflect a greater use of AVs, particularly in defined geographies. This included increased roadway capacity, longer trip lengths, an increased number of trips, and reduced commuter trips to reflect a greater percentage of the population working from home (WFH).
Land Use and Development Greater emphasis on lower density and redevelopment.	No adjustments to the model were made.
Climate Gradual increases in temperatures and more frequent extreme weather events. The region experiences impacts of moderate sea level rise.	No adjustments to the model were made.

Tech Transformations. This future assumes moderate growth overall, with the highest level of ACES adoption in the region. The impacts of large-scale technology adoption drive growth in high-tech industries and attract more business travelers to the region, shifting major activity centers from existing attraction areas to major technology employment centers and convention centers. The E+C network was adjusted to account for a higher number of trips to represent segments of the population with increased mobility due to AV availability, as well as for improved system efficiency and capacity resulting from AV operating characteristics. Table 14.8 summarizes the assumptions for this future.

Table 14.8 | Tech Transformations Model Assumptions

Key Factors	Adjustments to the Model
Population Increase 40 percent by 2045 (BEBR Medium) with a larger share of the population age 18-34.	No adjustments to the model were made. The E+C network incorporates BEBR Medium forecasts, which were used to represent this scenario, similar to Traditional Trends. The largest increases in population were concentrated near premium transit and activity centers in the southeastern portion of the region.
Economy Higher economic growth with a greater focus on high-tech industries (aerospace, simulation, research/development, technology).	E+C network adjustments were made at the TAZ level, based on input from MetroPlan Orlando staff. TAZs representing high growth areas included high-tech industries (information and scientific/technical services) with uniform shifts in employment from commercial employment to the higher growth sectors at the TAZ level.
Visitation Visitor growth similar to baseline with a greater emphasis on business travel.	E+C network adjustments were made at the TAZ level, based on input from MetroPlan Orlando staff. Occupancy rate increases were applied to TAZs representing hotels supporting business travel to reflect additional business travel resulting from significant growth in high tech jobs and activity.
Technology The region has 80 percent AV/CV fleet by 2045 with multiple AV subscription services. Greater focus on automated transit.	The model was adjusted by activating the Robo Transit ACES option. This included adjustments to the network, trip distribution assumptions, and mode choice shifts designed to reflect a significantly greater use of AVs, throughout the region. This included increased roadway capacity, longer trip lengths, and an increased number of trips to reflect increased use of AVs and AV fleets.
Land Use and Development Both urban and rural areas experience growth as AVs and telepresence allow people to live wherever they desire.	The E+C network is in alignment with moderate projections in existing land use. No adjustments to the model were made.
Climate Gradual increases in temperatures and more frequent extreme weather events. The region experiences impacts of moderate sea level rise.	No adjustments to the model were necessary.

Climate Consequences. In this future, the region experiences the highest growth due to in-migration from coastal communities displaced by sea-level rise. Higher density development concentrates around key corridors and activity centers. The existing roadway network cannot effectively accommodate the population so transit, bicycle, and pedestrian networks must be expanded. Emerging technology continues, focused in niche areas. Table 14.9 summarizes the assumptions for this future.

Table 14.9 | Climate Consequences Model Assumptions

Key Factors	Adjustments to the Model
Population Increase 60 percent by 2045 (BEBR High).	The E+C network incorporated BEBR High rates to represent this scenario. E+C network adjustments were made at the TAZ level, based on input from MetroPlan Orlando staff to reflect higher population growth concentrated along premium transit corridors and key activity centers with BEBR Medium rates everywhere else.
Economy Strong economic growth with booming construction and service industries to accommodate new population growth.	E+C network adjustments were made at the TAZ level, based on input from MetroPlan Orlando staff. TAZs representing high growth areas included construction; arts entertainment, recreation/accommodation and food service; health care and social assistance; educational services; and retail trade with uniform shifts in employment from commercial employment to the higher growth sectors at the TAZ level.
Visitation Higher visitor growth than baseline with increase in both domestic and international tourism.	E+C network adjustments were made at the TAZ level, based on input from MetroPlan Orlando staff. Higher hotel occupancy rates were applied for select attraction TAZs, such as those near theme parks to reflect an overall higher growth in visitation for the region.
Technology The region embraces technology and AV/CVs account for 40 percent of the vehicle fleet.	The model was adjusted by activating the Niche Service ACES option. This included adjustments to the network, trip distribution assumptions, and mode choice shifts designed to reflect a greater use of AVs, particularly in defined geographies. This included increased roadway capacity, longer trip lengths, an increased number of trips, and reduced commuter trips to reflect a greater percentage of the population working from home (WFH).
Land Use and Development Denser development along major transportation corridors and activity centers with development in neighboring counties.	No adjustments to the model were made.
Climate Sharp increases in temperatures and more frequent extreme weather events. More severe impacts of sea level rise.	No adjustments to the model were made.

Land Use Impacts

No model adjustments were made to land use in any of the four scenarios. Land use considerations were accounted for in the distribution of population growth, economic growth, visitation increases/decreases, and technology applications for each scenario. The approach focused on high level development patterns, not specific land use decisions. Note that the scenario analysis was exploratory with no preferred alternative selected. The Cost Feasible Plan (CFP) incorporated baseline trends and is consistent with local government land uses. As a result, no approved land use designations were compromised by this analysis. For example, in the Traditional Trends scenario, the highest population and economic growth were focused on the southern portion of the region with pockets of high growth throughout, while in the Climate Consequences scenario, the highest population and economic growth were focused along the region's major transportation corridors. In the Tech Transformations scenario, employment shifted from the fringes of the region and growth was focused in pockets of the central and northern portions of the region near existing activity centers. Disruption Dilemmas saw declines in visitation (hotel occupancy rates) in the southern portion of the region and experienced the greatest decline in population and economic growth on the fringes of the region. The location of this growth and/or decline influences the trip generation for each scenario along with factors like vehicle hours traveled and vehicle hours of delay.

Qualitative Analysis

The modeling results were supplemented by a qualitative assessment of the potential impacts of the four alternative futures. This assessment drew from several sources:

- A review of current or recent MetroPlan Orlando research on the impacts of potential trends on the region's transportation system, including the recent Connected and Automated Vehicle Readiness study;
- A review of recent partner studies on the future of Central Florida, including the Orlando Economic Partnership's Orlando 2030 and Transportation 2030 reports; the *How Shall We Grow?* regional vision and the follow up *How Did We Grow?* study; and the East Central Florida Regional Planning Council's Strategic Regional Policy Plan;
- Research on long-term trends and uncertainties conducted at the statewide level by the Florida Department of Transportation in support of the Florida Transportation Plan update and the Florida Chamber Foundation as part of the Florida 2030 initiative;
- A review of national literature on the impacts of changing trends and disruption on the transportation network, including the Transportation Research Board's Foresight research; and
- Subject matter expertise from members of the 2045 MTP Working Group, MPO advisory committees, and the project team.

This qualitative analysis provided direct input to each alternate future by informing model adjustments (e.g., identification of TAZs to be modified).

Summary of Model Results

The CFRPM provides a variety of metrics for each of the four futures based on the adjustments described above. Key metrics include total trips generated, VMT, VHT, and VHD. Table 14.10 summarizes the total trips generated in addition to these three metrics by future as compared to the 2045 MTP baseline by percent change.[6] The table also provides the scenario-specific values for each metric. The Disruption Dilemmas future, as the low growth future, represents the lowest number of trips and a reduction over the baseline across all metrics. The Tech Transformation future, matching the Traditional Trends moderate growth, has the highest increase in VMT (+20%) due to the most aggressive adoption of AVs. Increased use of AVs increases VMT (more trips) but also operates more efficiently, resulting in the equivalent of increased system capacity, which dampened the increase in VHT and VHD (+21% and +22% respectively). This can be compared to the Climate Consequences future, which represents high growth but limited adoption of AVs; this results in the most significant increase in VHT and VHD (+30% and +65% respectively) but a relatively small increase in VMT (+7%). Although total VMT and trips are lower in the Climate Consequences scenario than in the Tech Transformations scenario, Climate Consequences demonstrates the highest growth in truck trips. As illustrated by these results, each of these four alternative futures could result in significantly different traffic patterns, number of trips, and system performance.

Table 14.10 | Model Results by Percent Change by Metric by Scenario Compared to Baseline

	Baseline (E+C)	Traditional Trends	Disruption Dilemmas	Tech Transformations	Climate Consequences
		Scenario Total (% Change from Baseline)	Scenario Total (% Change from Baseline)	Scenario Total (% Change from Baseline)	Scenario Total (% Change from Baseline)
Vehicle Miles Traveled	199,432,100	199,455,106 (0%)	192,586,934 (-3%)	239,217,867 (+20%)	213,086,004 (+7%)
Vehicle Hours Traveled	6,625,511	6,632,262 (0%)	5,986,190 (-10%)	7,987,178 (+21%)	8,594,495 (+30%)
Vehicle Hours of Delay	2,560,870	2,567,336 (0%)	2,065,338 (-19%)	3,126,790 (+22%)	4,227,831 (+65%)
Total Trips	16,346,884	16,755,557 (+3%)	15,635,922 (-5%)	19,109,407 (+16%)	18,555,148 (+14%)

Source: CFRPMv7, VHB, Cambridge Systematics, MetroPlan Orlando 2045 MTP

[6] Note for purposes of the modeling exercise, the distinction between baseline and Traditional Trends is limited to the application of an ACES option.

Impacts of Alternative Futures on Achieving 2045 MTP Goals

The 2045 MTP identified five long-range goals for Central Florida's transportation system:

- Goal #1: Safety and Security – Provide a safe and secure transportation system for all users;
- Goal #2: Reliability and Performance – Leverage innovative solutions to optimize system performance;
- Goal #3: Access & Connectivity – Enhance communities and lives through improved access to opportunities;
- Goal #4: Health & Environment – Protect and preserve our region's public health and environmentally sensitive areas; and
- Goal #5: Investment & Economy – Support economic prosperity through strategic transportation investment.

The quantitative and qualitative analyses described throughout this report helped evaluate how the region might make progress toward achieving each goal in each alternative future. Tables 14.11 through 14.14 describe the potential impacts by goal for each alternative future.

Table 14.11 | Traditional Trends: Potential Impact on 2045 MTP Goals

MTP Goal	Potential Impacts
Safety/Security	• Traffic safety likely to remain a significant concern, particularly for vulnerable road users (pedestrians and bicyclists).
Reliability/Performance	• VMT growth continues to outpace available highway capacity, increasing delay and decreasing system reliability.
Access/Connectivity	• Continued concerns about access to jobs and services, particularly for lower-income residents, seniors, the transit dependent, limited English proficiency, veterans, and disabled populations.
Health/Environment	• Continued emphasis on highway travel with impacts on air quality, sprawl, and public health.
Investment/Economy	• Need to support continued growth in visitors, and global and domestic freight.

Table 14.12 | Disruption Dilemmas: Potential Impact on 2045 MTP Goals

Key Driver	Potential Impacts
Safety/Security	• Increasing concern about risk of infection from using transit and shared mobility options. • Increasing maintenance costs and lower effective capacity on transit vehicles.
Reliability/Performance	• VMT reduction from telework partially offset by increasing home delivery and service trips. • Shift in travel by time of day/origin-destination/facility. • Short-term shift for local trips from transit and shared mobility to single-occupancy vehicle and active transportation; long-term impact uncertain. • Short-term shift for long-distance from air to cars; uncertainty about timing for enhanced passenger rail service.
Access/Connectivity	• Increasing value of broadband connectivity. • Potential for increasing digital divide for unbanked and underbanked persons, limited English proficiency population, disabled, elderly, and veterans.
Health/Environment	• Ongoing public health concerns. • Positive impacts on air quality and environment from reduced vehicle-miles traveled.
Investment/Economy	• Slower job growth and reduced capital investment due to uncertainty. • Reduction in fuel tax and sales tax revenues for transportation.

Table 14.13 | Tech Transformations: Potential Impact on 2045 MTP Goals

Key Driver	Potential Impacts
Safety/Security	• Significant reduction in crashes due to reduced driver error. • New risks related to operations of a mixed fleet of vehicles with various levels of automation. • New risks related to cybersecurity.
Reliability/Performance	• Increased system efficiency and increasing telecommuting, distance learning, and distance medicine.
Access/Connectivity	• Increased mobility for seniors, children, and disabled residents. • Increase in zero-occupant trips. • Increase in extreme commutes. • Micro-mobility options and Mobility as a Service become common for first-/last-mile trips. • Growing concerns about equity and digital divide. • Increasing competition for curb space.
Health/Environment	• Improvements resulting from more efficient and active travel. • Large number of electric vehicles leads to reduced use of motor fuels.
Investment/Economy	• Growth in technology industry. • Shift in energy sources and related transportation needs. • Potential reduction in motor fuel taxes, parking fees, and other revenue sources.

Table 14.14 | Climate Consequences: Potential Impact on 2045 MTP Goals

Key Driver	Potential Impacts
Safety/Security	• Increasing number of extreme weather and flooding events.
Reliability/Performance	• VMT growth continues to outpace available capacity.
Access/Connectivity	• Growth in both urban cores and exurbs, with corresponding capacity and connectivity needs. • Increasing demand for a range of connectivity options.
Health/Environment	• Land-use conflicts due to higher growth and development demand in previously undeveloped areas.
Investment/Economy	• Competing infrastructure investment needs: balancing capacity improvements and maintenance/retrofit.

Impacts of Alternative Futures on Performance Targets

MetroPlan Orlando also assessed the implications of the four alternative futures on the region's ability to make progress toward transportation performance requirements defined under federal rule in five areas:

- **Highway safety**, including fatalities (total and rate), serious injuries (total and rate), and non-motorized fatalities and serious injuries;
- **Pavement and bridge condition;**
- **Travel time reliability and truck freight reliability;**
- **Transit asset management**, including the condition of transit equipment, rolling stock, infrastructure, and facilities; and
- **Public transportation safety,** including reportable fatalities, injuries, and safety events (total and rate) and the mean distance between mechanical failures.

The quantitative and qualitative analyses helped evaluate how the region might make progress toward its performance targets in each alternative future (see Tables 14.15 through 14.18).

Table 14.15 | Traditional Trends: Potential Impact on Performance Targets

Key Driver	Potential Impacts
Highway Safety	• Continuation of recent trends in roadway safety. • Growth in highway travel and associated congestion continues to place upward pressure on crash, fatality, and serious injury rates, particularly for vulnerable road users. • Advancements in automated and connected vehicle technologies partially offset the overall growth rate in travel.
Pavement and Bridge Condition	• Continuation of recent trends and forecasts of Interstate and non-Interstate NHS pavement and bridge condition as identified in FDOT's Transportation Asset Management Plan. • Increasing overall traffic and growth in truck traffic increase wear and tear on existing system.
Travel Time Reliability and Truck Freight Reliability	• Congestion and reliability on key highway corridors are expected to worsen as population, employment, and visitation grows. • Vehicle miles traveled increase due to additional development on the fringes of the region, creating longer commute times and distances.
Transit Asset Management	• Continuation of recent trends and forecasts of state of good repair of transit vehicles, infrastructure, and facilities as identified in the region's Transit Asset Management plans.
Public Transportation Safety	• Continuation of recent trends, with emphasis on working to reduce transit safety events and improve the reliability of transit vehicles.

Table 14.16 | Disruption Dilemmas: Potential Impact on Performance Targets

Key Driver	Potential Impacts
Highway Safety	• Slower population growth and reduction in visitor travel could lead to reduced roadway fatalities and serious injuries compared to the Traditional Trends future. • Increased walking and bicycling could result in more non-motorized fatalities and serious injuries.
Pavement and Bridge Condition	• Lower than expected increases in VMT result in less wear and tear on pavement and bridges, leading to improving asset conditions. • Reduced transportation revenues may impede ability to maintain assets in good condition.
Travel Time Reliability and Truck Freight Reliability	• VMT reductions due to slower growth and increased telework could result in more reliable travel for passenger vehicles and trucks on major corridors in the region. • Customer reluctance to use public transportation, shared mobility, and aviation could increase overall highway travel on major interregional corridors.
Transit Asset Management	• With residents more hesitant to use public transportation due to health concerns and reduced transportation revenues, transit providers could have a difficult time maintaining transit assets in a state of good repair.
Public Transportation Safety	• Reduction in transit ridership and shift toward smaller vehicles with fewer passengers per vehicle could shift exposure to safety risks; could see an increase in minor incidents but fewer major safety events.

Table 14.17 | Tech Transformations: Potential Impact on Performance Targets

Key Driver	Potential Impacts
Highway Safety	• Significant increases in automated and connected vehicle deployment expected to lead to dramatic reductions in crashes related to driver error, resulting in vastly improved fatality and serious injury performance.
Pavement and Bridge Condition	• Increased reliance on automated and connected vehicles increases overall VMT by increasing the ease of travel for students, seniors, disabled persons, and others with limited mobility options today. • Increased use of automated and connected vehicles also make extreme commutes a more feasible option for workers wishing to live in rural or other urban areas. • Additional VMT puts more wear and tear on infrastructure, leading to worsening pavement and bridge condition unless maintenance keeps pace.
Travel Time Reliability and Truck Freight Reliability	• Technology provides advanced trip planning capabilities and allows for unprecedented network efficiency, allowing improved performance in passenger vehicle and truck reliability overall despite increased VMT. • Reliability could decline in some corridors where traffic growth is most significant.
Transit Asset Management	• Transit technologies lead to improved network planning, resulting in extended useful life of transit vehicles.
Public Transportation Safety	• Increased automation and use of technology could improve overall system safety and security.

Table 14.18 | Climate Consequences: Potential Impact on Performance Targets

Key Driver	Potential Impacts
Highway Safety	• An increase in population leads to greater overall VMT, although transit and active transportation options expand as well. • VMT growth as well as additional precipitation and flooding continue to put upward pressure on crash, fatality, and serious injury rates.
Pavement and Bridge Condition	• Substantial investment in hardening existing infrastructure and developing new infrastructure will improve the condition of pavement and bridges over time. • This may be offset by increased occurrences of extreme weather events that would damage existing facilities.
Travel Time Reliability and Truck Freight Reliability	• The existing roadway network cannot effectively accommodate the increase in population and VMT. • Disruptions from extreme weather- as well as construction work zones from repairing or expanding infrastructure- lead to additional nonrecurring congestion, reducing travel reliability for passenger vehicles and trucks.
Transit Asset Management	• Higher density development and premium transit services result in increased transit ridership, placing demand on maintaining a state of good repair for transit vehicles and infrastructure.
Public Transportation Safety	• Increased ridership and potential for greater operation during weather events could increase exposure to safety risks.

Summary of Scenario Analysis Key Findings

Key takeaways from this analysis include:

- ***The long-term trends and uncertainties evaluated through the exploratory futures could have significant impacts on the region's ability to meet the 2045 MTP goals.*** The MTP identifies projects and strategies that are intended to help achieve the 2045 goals in the context of these trends and uncertainties.
- ***The region's ability to meet its federally required performance targets, which address performance over one- to four-year periods, primarily will reflect current trends, rather than long-term changes and uncertainties.*** However, the MTP futures provide useful context for understanding long-term strategies and investments that may be needed to continue to achieve performance targets over time.
- ***The disruptions experienced by the region's transportation system and economy due to COVID-19 provide an opportunity for a deeper understanding of how significant external events, such as those anticipated in the Disruption Dilemma future, could impact transportation performance.*** MetroPlan Orlando will collect and review available data on the transportation impacts of COVID-19, which will help prepare for future disruptions.
- ***From a long-term perspective, a key determinant of the region's progress toward its goals and performance targets is growth in travel, including the distribution among travel modes for both people and freight.*** Growth in VMT for both cars and trucks is correlated with safety, pavement/bridge condition, and system reliability. Growth in transit ridership is a key factor in transit asset management and safety. It will be important to understand how travel choices are evolving during and after COVID-19 to help inform future performance and needs analyses.
- ***Achieving the region's goals and performance targets reflects many factors***. In some cases, a single trend may have multiple impacts, potentially in different directions. For example, an increase in use of automated and connected vehicles is anticipated to significantly improve safety (due to dramatic reduction in the number of crashes associated with human error) and system efficiency (due to the ability to accommodate more vehicles on a single roadway and to reduce nonrecurring delay due to crashes). However, automated and connected vehicles could significantly increase VMT by providing mobility options for seniors, students, disabled persons, and others who have limited options today and enable more extreme commutes for people who wish to live on the fringes of the urban area. In addition, the region may need to accommodate empty vehicles searching for parking or circulating after dropping off passengers. How the region manages increased use of technology is likely to be a key determinant of future performance. The MTP identifies specific research and policy development needs in this area. Similarly, more attention is needed on how the region prepares for, mitigates, responds to, and recovers from extreme weather events, public health crises, and other major disruptions - another area in which the MTP has identified specific strategies.

Strategy Development

Strategy Identification

The alternative futures and impact analyses were used to help identify specific strategies to support MetroPlan Orlando's long-range goals, in addition to the project investments defined in the Cost Feasible Plan. The strategies focus on enhanced or new approaches to policies, investments, implementation activities, and partnerships that could be initiated today to help accomplish the long-range goals for Central Florida's transportation system.

MTP strategies were developed through a collaborative process including:

- Analysis of the potential impacts of the four alternative futures on the region's ability to accomplish its long-range goals and performance targets;
- Synthesis of policies and strategies identified throughout all aspects of the 2045 MTP process, as well as prior MetroPlan Orlando plans and studies; partner plans from FDOT, LYNX, the Central Florida Expressway Authority, the Greater Orlando Aviation Authority, the East Central Florida Regional Planning Council, the Orlando Economic Partnerships; and local government comprehensive plans;
- Review of best practices from other long-range planning efforts around the nation; and
- Partner and public input, including MetroPlan Orlando's board, committees, and 2045 MTP working group.

The process emphasized how we can "future proof" the plan by identifying:

- Robust strategies that are anticipated to be impactful across all four of the alternative futures;
- Strategies that would help shape the future in a positive direction; and
- Strategies that would help hedge against risks that, if they occur, could have significant impacts on the region's ability to meet its goals.

The relevant strategies identified through this effort were organized based on the MTP goals as well as seven investment areas that correspond to key elements of the CFP:

- Safety & Security;
- Roadway Network;
- Transportation Systems Management and Operations (TSMO), Intelligent Transportation Systems (ITS) & Technology;
- Transit & Shared Mobility;
- Bicycle & Pedestrian;
- Freight; and
- Interregional Connectivity.

The strategies identified through this process are long-term approaches to accomplishing the MTP goals and might involve multiple specific actions by MetroPlan Orlando and its partners during the next 25 years.

Strategy Screening

The following subsections detail the strategies within each category and how important they are to each future, with each either being "very important", "somewhat important," or "not relevant." The degree of importance was assigned based on a review of the modeling and qualitative analysis results and informed by subject matter expertise. Within each table, strategies are listed in order based on the number of futures for which they are deemed to be "Very Important."

Safety & Security

The Safety & Security strategies focus on efforts to reduce fatalities and serious injuries on Central Florida's transportation system and prepare for, mitigate, respond to, and recover from security risks and emergency events. Table 14.19 lists the strategies and how they relate to the four futures. Advancing initiatives to help accomplish the region's vision of zero transportation-related fatalities and serious injuries is very important to all futures. Updating emergency evacuation plans is somewhat important in Traditional Trends, but more significant in all other futures. This reflects the need to address public health crises (Disruption Dilemmas) or more frequent or severe extreme weather events (Climate Consequences), as well as the need to adapt plans to reflect greater use of automated, connected, electric, or shared vehicles during emergencies (Tech Transformations). Identifying and mitigating cybersecurity and data security risks also is important in all futures, but of greater significance in Disruption Dilemmas and Tech Transformations because of the greater role technology plays in these futures.

Table 14.19 | Safety & Security Strategies

Strategy	Traditional Trends	Disruption Dilemmas	Tech Transformations	Climate Consequences
Continue to advance Vision Zero initiatives	●	●	●	●
Update emergency management plans	○	●	●	●
Identify/mitigate cybersecurity/data security risks	○	●	●	○

Note: ● = Very Important; ○ = Somewhat Important

Roadway Network

The Roadway Network strategies address efforts to maintain, enhance, and expand the capacity of the roadway network. As shown in Table 14.20, two of these strategies are very important in all futures: maintaining roads and bridges in a state of good repair, and improving local street network connectivity. Expanding use of managed lanes and completing the I-4 Beyond the Ultimate and regional expressway system expansions have been key foundations of prior MTPs and would remain very important in the Traditional Trends (due to continued reliance on highway travel) and Climate Consequences (due to the high rate of growth). The reduction in travel in the Disruption Dilemmas and greater system efficiency in the Tech Transformations future could create opportunities to rethink these strategies. Some futures may create opportunities to use street, curb, or parking capacity freed up by shifts in vehicle travel for other purposes, as well as to expand capacity in parts of the region anticipated to experience rapid growth in travel. Reducing vulnerability to risks is important in all futures, particularly Disruption Dilemmas (public health crises) and Climate Consequences (extreme weather events).

Table 14.20 | Roadway Network Strategies

Strategy	Traditional Trends	Disruption Dilemmas	Tech Transformations	Climate Consequences
Maintain roads and bridges in a state of good repair	●	●	●	●
Improve local street network connectivity	●	●	●	●
Expand use of managed lanes (HOV, HOT, express bus)	●	○	●	●
Complete I-4 Beyond the Ultimate and regional expressway system expansion	●	○	○	●
Advance complete streets initiatives	●	●	○	●
Expand capacity in targeted areas	○	○	●	●
Use street, curb, and parking space freed up by potential decline in car travel for other purposes		●	●	
Reduce vulnerability to risks	○	●	○	●

Note: ● = Very Important; ○ = Somewhat Important

TSMO, ITS & Technology

The TSMO, ITS & Technology strategies focus on operational and technology solutions, including options for substituting communications for travel. Table 14.21 lists the eight identified strategies in this category. Continuing to implement TSMO solutions is very important for all four futures because of the ability of operational strategies to provide quick-response solutions to a variety of conditions. Supporting enabling infrastructure for other technologies such as electric vehicle charging stations and broadband connectivity, and helping local governments prepare for expanded use of automated, connected, shared, and electric vehicles and micro-mobility, is important in most futures. Other strategies, such as testing urban air mobility systems, may be important in selected futures.

Table 14.21 | TSMO, ITS & Technology Strategies

Strategy	Traditional Trends	Disruption Dilemmas	Tech Transformations	Climate Consequences
Continue to implement TSMO solutions	●	●	●	●
Facilitate regional broadband deployment	○	●	●	●
Support expanded options for telepresence	○	●	●	●
Expand electric vehicle charging stations	○	●	●	●
Help local governments to prepare for Automated, Connected, Electric, and Shared Vehicles (ACES)	○	●	●	●
Help local governments to prepare for micro-mobility options	○	○	●	●
Adjust speeds to reflect roadway context	○	●	●	○
Test urban air mobility systems			●	

Note: ● = Very Important; ○ = Somewhat Important

Transit & Shared Mobility

The Transit & Shared Mobility strategies are focused on maintaining, expanding, and improving transit and shared mobility systems. As shown in Table 14.22, maintaining transit assets, improving public transportation safety and security, and optimizing LYNX's route structure are very important in all four futures. Expanding LYNX and SunRail hours of service is important in most futures but could be reevaluated in Disruption Dilemmas if there is continued hesitation to use public transit.

Providing more first/last mile options is likely to be important in most futures, although the mix of options such as micro-mobility and mobility as a service could differ based on customer preferences. Supporting disadvantaged riders is important in all futures, but particularly in the Disruption Dilemmas and Tech Transformation futures where there is concern about a growing digital divide.

All futures anticipate some expansion in the number of transit vehicles, drivers, and supporting infrastructure, but from different perspectives. For example, Disruption Dilemmas anticipates more small vehicles to accommodate smaller groups of riders and ease public health concerns, while Climate Consequences anticipates an increase in overall system capacity. Creating regional mobility hubs and enabling emerging technologies such as e-payment, alternative fuels, and automated transit also are significant in all futures, with particular importance in futures more associated with technology adoption or significant system expansion.

Finally, two strategies could become significant in certain futures: improving sanitation and customer health screening, and accommodating riders during extreme heat, precipitation, and other weather events.

Table 14.22 | Transit & Shared Mobility Strategies

Strategy	Traditional Trends	Disruption Dilemmas	Tech Transformations	Climate Consequences
Maintain transit asset in a state of good repair	●	●	●	●
Improve public transportation safety and security	●	●	●	●
Optimize LYNX route structure	●	●	●	●
Increase LYNX and SunRail hours and frequency	●	○	●	●
Expand first/last mile options (micro-mobility, mobility as a service)	○	●	●	●
Enhance transportation disadvantaged services	●	●	●	●
Prepare for increased drivers, vehicles, and operations infrastructure	○	●	○	●
Support alternative fuels and automated systems	○	○	●	●
Integrate regional e-payment systems	○	●	●	○
Create regional mobility hubs	○		●	●
Improve sanitation and customer health screening	○	●	○	○
Accommodate riders during extreme heat or precipitation	○	○	○	●

Note: ● = Very Important; ○ = Somewhat Important

Bicycle & Pedestrian

Bicycle & Pedestrian strategies focus on how to support more active transportation options. The six strategies generally are very important in all futures, reflecting the desire to provide expanded transportation options. As shown in Table 14.23, key strategies include increasing the safety, convenience, accessibility, and connectivity of bicycle and pedestrian options, including accommodations on corridors and hubs. Like other categories, a strategy to accommodate riders during extreme heat, precipitation, and other weather events is important in the Climate Consequences future.

Table 14.23 | Bicycle & Pedestrian Strategies

Strategy	Traditional Trends	Disruption Dilemmas	Tech Transformations	Climate Consequences
Improve bicycle/pedestrian safety	●	●	●	●
Improve bicycle/pedestrian access to jobs, housing, services, schools	●	●	●	●
Improve convenience of active transportation for all ages and abilities	●	●	●	●
Improve connectivity of sidewalks and trails; close system gaps	●	●	●	●
Expand bicycle/pedestrian accommodations on roadways and at mobility hubs	●	●	●	●
Improve accommodations for riders during extreme heat and precipitation	○	○	○	●

Note: ● = Very Important; ○ = Somewhat Important

Freight

The Freight strategies focus on supporting freight mobility to, from, and through Central Florida. As shown in Table 14.24, increased truck parking availability is very important in all four futures. Truck parking already is an issue today and is important for the safety and security of both the driver and his or her cargo. Most of the futures suggest greater importance on supporting increased urban/neighborhood goods delivery and increased supply chain resilience, reflecting the increasing role of e-commerce and home delivery of goods. Improving major freight corridors and connectivity to existing freight hubs is very important in Traditional Trends and Climate Consequences due to the strong growth of the economy. Shifts in travel and adoption of new technologies could create opportunities to rethink some freight investment needs in other futures. Emerging technologies are important in all futures, particularly Disruption Dilemmas and Tech Transformations.

Table 14.24 | Freight Strategies

Strategy	Traditional Trends	Disruption Dilemmas	Tech Transformations	Climate Consequences
Increase truck parking availability	●	●	●	●
Support increased urban/neighborhood goods delivery	○	●	●	●
Support increased supply chain resilience	○	●	●	●
Improve connectivity to freight clusters/terminals	●	○	○	●
Increase freight route efficiency/reliability	●	○	○	●
Test/deploy emerging freight technologies	○	●	●	○

Note: ● = Very Important; ○ = Somewhat Important

Interregional Connectivity

The Interregional Connectivity strategies focus on connections between Central Florida and other parts of Florida, other states, and other nations. These connections are closely tied to the region's visitor and trade industries. They are highlighted in this analysis to consider how changes in customer demand and technology could impact use of various modes for long-distance travel. Two strategies - coordinating TSMO with other jurisdictions along the I-4 corridor and completing the Coast-to-Coast Trail - are very important in all futures. Two other strategies - improving multimodal connectivity to the region's airports, seaports, and passenger rail terminals, and preparing for expanded interregional passenger rail service - could be reevaluated if there is a significant long-term shift in travel behavior toward driving for long-distance trips. Expanded interregional highway corridors could become more important in Disruption Dilemmas, as well as in Climate Consequences because of the overall growth in travel. Other options such as hyperloop could become important as well.

Table 14.25 | Interregional Connectivity Strategies

Strategy	Traditional Trends	Disruption Dilemmas	Tech Transformations	Climate Consequences
Continue I-4 corridor TSMO coordination	●	●	●	●
Support completion of the Coast-to-Coast Trail	●	●	●	●
Expand multimodal connectivity to key hubs	●	○	●	●
Prepare for interregional passenger rail service	●		●	●
Strengthen interregional highway corridor planning	○	●	○	●
Accelerate new connectivity options (e.g., hyperloop, air taxis)	○	○	●	●
Increase freight route efficiency/reliability	●	○	○	●

Note: ● = Very Important; ○ = Somewhat Important

Final Strategies

The final list of strategies is intended as policy guidance to MetroPlan Orlando, its member jurisdictions, and its partner agencies as they collectively work to achieve Central Florida's transportation goals.

MetroPlan Orlando should focus initially on strategies that would be very important in all futures:

- Safety & Security – Continue to advance vision zero initiatives;
- Roadway Network – Maintain pavement and bridges in state of good repair; improve local street network connectivity;
- TSMO, ITS & Technology – Continue to implement TSMO solutions;
- Transit & Shared Mobility – Maintain transit assets in state of good repair; improve public transportation safety and security; optimize LYNX route structure;
- Bicycle & Pedestrian – Improve bicycle and pedestrian safety; improve bicycle and pedestrian access to jobs, housing, services, and schools; improve convenience of active transportation for all ages and abilities; improve connectivity of sidewalks and trails and close system gaps; expand accommodations for bicycles and pedestrians on roadway and at mobility hubs;
- Freight – Increase truck parking availability; and
- Interregional Connectivity – Continue I-4 corridor TSMO coordination; support completion of the Coast-to-Coast Trail.

These strategies all support investments in safety, asset management, and modal services and operations that would be valuable to Central Florida's residents, visitors, and businesses in all potential futures.

Of the remaining strategies that are very or somewhat important in some, but not all, futures, MetroPlan Orlando should emphasize strategies that could help shape the future in a positive direction:

- Roadway Network – Repurpose available street, curb, and parking capacity in areas where vehicle travel is declining for other purposes, including active transportation/micro-mobility, retail and dining, and recreation;
- Transit & Shared Mobility – Optimize and proactively invest in expanding transit operations and workforce capacity; and
- All modes – Research, test, and facilitate deployment of promising automated and connected vehicle technologies.

Finally, MetroPlan Orlando should emphasize strategies that could help reduce and mitigate significant risks, including:

- All modes – Proactively invest in parts of the region that are anticipated to experience a significant increase in travel due to new development or technologies to mitigate future growth in congestion;
- Transit & Shared Mobility – Expand sanitation and customer health screening;
- All modes – Reduce vulnerability of infrastructure to extreme weather and other risks, including accommodations for customers during extreme heat and precipitation;
- Safety & Security – Mitigate cybersecurity and data security risks; and
- All modes – Increase broadband access for populations of all income levels and geographic areas.

MetroPlan Orlando should monitor changing conditions over time to determine if the region is trending toward one or more specific futures and adjust MTP implementation to emphasize the strategies that would be most relevant for the specific future.

The strategies point toward a new approach to planning for and managing the regional transportation system (Table 14.26). The strategies can help:

- Redefine and re-scope needs, particularly for greater emphasis on safety and operational improvements;
- Rethink priorities among projects for advancement into the Transportation Improvement Program (TIP);
- Identify new areas of research for MetroPlan Orlando, such as pilot tests of new technologies;
- Develop new or enhanced partnerships for MetroPlan Orlando, including collaboration with public health, environmental resource, and economic development entities; and
- Spotlight how MetroPlan Orlando can better support local governments and other partners in moving toward a collective transportation vision.

Table 14.26 | Summary of 2045 MTP Approach and Key Strategies

Program Area	Prior MTP Approach	2045 MTP Approach	Key Strategies
Safety & Security	Address known safety risks on roadway system	Improve safety for all users through a system-wide approach	• Advance vision zero initiatives; incorporate safety considerations into all roadway projects • Update emergency evacuation plans • Address cybersecurity and data security risks
Roadway Network	Emphasize reducing congestion and improving throughput	Strategically manage roadway system and right of way, and meet changing mobility needs	• Improve local street network connectivity • Adapt roads to accommodate all users, including "complete street" strategies where appropriate • Expand use of managed lanes on major corridors
TSMO, ITS & Technology	Expand use of Transportation Systems Management and Operations (TSMO) to optimize use of existing infrastructure	Prepare for and expand use of a full range of emerging transportation technologies to improve safety, efficiency, and reliability	• Continue regional commitment to TSMO • Expand electric vehicle charging station network • Facilitate regional broadband deployment • Help local governments prepare for automated, connected, electric, and shared vehicles, including micromobility
Transit & Shared Mobility	Expand public transportation capacity and connectivity and support market-driven shared mobility services	Optimize use of public and private mobility services to support complete end-to-end trips	• Continue commitment to transit safety and security • Optimize LYNX route structure, hours, and frequency to support access to jobs and services • Expand first/last mile options • Improve coordination on transportation disadvantaged services
Bicycle & Pedestrian	Improve safety and connectivity of pedestrian and bicycle options	Significantly increase safety, connectivity, and convenience of active transportation as an option for all travelers	• Continue commitment to improving bike/ped safety • Improve bike/ped access to jobs and services • Improve connectivity of sidewalks and trails • Expand bike/ped accommodations on roadways and at mobility hubs
Freight	Improve capacity and connectivity of major freight hubs and corridors	Support more complex, dispersed, and resilient supply chains	• Increase efficiency and reliability of key truck routes • Improve connectivity to major freight terminals and clusters • Expand truck parking and staging areas • Support increased urban and home delivery of goods and services
Interregional Connectivity	Expand capacity and connectivity to major rail, sea, air, and spaceports; enhance I-4 corridor.	Enhance long-term connectivity options with other Florida regions	• Expand coordination through Regional TSMO Coalition along the I-4 Corridor • Coordinate with surrounding regions on future of major surface transportation corridors • Expand multimodal connectivity to major air, sea, and spaceports

Lessons Learned and Next Steps

The 2045 MTP was the first time MetroPlan Orlando conducted a comprehensive scenario planning exercise as part of its long-range planning process. Prior MTPs had considered alternative land use or revenue forecasts, but this MTP was the first time MetroPlan Orlando considered a full range of potential changes and uncertainties and used this information to help identify needs, projects, and strategies. Key lessons learned from the scenario planning process include:

- ***Exploratory scenario planning enabled MetroPlan Orlando and its partners to explicitly consider the potential impacts of changing demographic, economic, visitor, land use, technology, and climate trends during the next few decades.*** The alternative futures enabled MetroPlan Orlando to consider the interaction among these trends and how they could shape the future of the region's transportation system in multiple potential directions. The timing of this process was particularly helpful given the tremendous uncertainty in 2020 related to the impacts of the COVID-19 pandemic and economic shocks, which are not yet fully understood. An exploratory scenario planning process enabled MetroPlan Orlando to consider how potential changes in travel behavior, community interaction, and the economy could impact the region's transportation system, without waiting for changes to underlying socioeconomic forecasts or approved local government comprehensive plans.
- ***The alternative futures supported a more comprehensive discussion of potential investment needs in Central Florida.*** Prior MTPs heavily focused on the use of capacity and throughput measures to identify future highway expansion needs. This MTP identified a more comprehensive set of needs across all modes and program areas. The alternative futures helped broaden the needs identification process by identifying different types of investment needs and facilitating a critical review of previously identified needs to determine if those needs would remain relevant under different planning assumptions. This needs identification process required a combination of quantitative analyses using the regional travel demand model and off-model adjustments and a qualitative assessment based on available research and expertise.
- ***The alternative futures also supported identification of long-term strategies.*** For the first time, MTP development included identification of strategies (such as changes in policies, partnerships, and planning processes) to augment the projects identified in the cost-feasible plan. The alternative futures were a key input to strategy development by enabling MetroPlan Orlando and its partners to consider how to prepare for, mitigate, or respond to the risks and uncertainties identified through this process. A robust decision making process helped focus on strategies that are likely to be effective across the full range of futures, as well as strategies that are anticipated to help shape the future in a desired direction or to mitigate risks associated with an undesirable outcome. These strategies became a key foundation of the MTP and supported decisions to establish new programs and funding set asides related to safety, active transportation, and technology.
- ***The alternative futures provided an opportunity to engage partners and the public in MTP development, including partners typically not involved in long-range transportation planning.*** By considering how transportation decisions relate to the future of Central Florida's economy, quality of life, and related topics, the alternative futures provided an opportunity to engage residents and leaders in a conversation about the future of transportation. Social distancing requirements limited traditional engagement opportunities, but MetroPlan Orlando obtained significant input on these topics through its MTP Working Group, online virtual meetings, and social media. The alternative futures were reformatted for these purposes using creative storytelling including "news headlines" from 2045 to help illustrate the potential changes and encourage residents to share what was most important to them.

MetroPlan Orlando has opportunities to continue to incorporate alternative futures and scenario planning into MTP implementation, including the following:

- ***Monitor key indicators of change and identify needed adjustments to MTP implementation.*** MetroPlan Orlando should periodically track key signposts, or indicators of change, to identify if the region is trending toward one or more of the four alternative futures. These indicators could be incorporated in an extended version of MetroPlan Orlando's annual trends report or an MTP implementation report. Based on changes in key trends and indicators and the pace of progress toward MTP goals and performance targets, MetroPlan Orlando should periodically reevaluate its priority strategies and investments to identify potential changes. For example, if indicators show accelerated progress toward the Tech Transformations future, additional emphasis could be put on the strategies and investments associated with that future.
- ***Incorporate scenario planning into other plans and projects.*** MetroPlan Orlando should consider using scenario planning techniques in other regional or corridor planning processes to help understand the impacts of potential changes and ensure recommendations are robust and resilient. The four alternative futures developed for the MTP could become a framework for use in other planning studies.
- ***Help local governments and other regional partners better understand the impacts of potential uncertainties and disruptions***. MetroPlan Orlando can assist local governments, transit providers, and other regional partners in incorporating uncertainty into their planning processes by sharing research on trends and disruptions and encouraging use of scenario planning techniques.
- ***Develop and enhance models and decision support tools to better evaluate the impacts of potential changes in future conditions***. The analysis of the 2045 futures was largely qualitative, aside from the travel impacts estimated through the CFRPM. In preparation for the next MTP update, MetroPlan Orlando should work with FDOT to explore potential CFRPM enhancements to facilitate scenario planning, such as exploratory modeling and sensitivity testing capabilities. MetroPlan also should consider tools to help project safety, asset condition, and reliability to better understand impacts and potential choices in future updates.
- ***Continue proactive coordination with FDOT, transit providers, local governments, and other partners to coordinate decisions and investments to accomplish the 2045 MTP goals.*** Because the MTP goals and transportation system performance targets reflect the cumulative impacts of decisions by multiple partners, MetroPlan Orlando must continue to convene and collaborate with partners to accomplish the MTP vision and goals.

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