WINNING THE FUTURE

SHARPENING OUR

F⦿CUS

SHRP2 Element C08 (Volume 2)
Scenario Development Process

ARC
ATLANTA REGIONAL COMMISSION

Prepared for USDOT / Federal Highway Administration
SHRP2 Round 5 Implementation Grant
August 2016

PlanWorks
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Table of Contents

Background

ARC, as a Lead Adopter in the SHRP2 Implementation Assistance Program Round 5, executed an 18 month work plan that created a vision for the Atlanta Region following the SHRP2 C08 Report "Linking Community Visioning and Highway Capacity Planning" and associated interactive Vision Guide website PlanWorks. During this vision development process, two other SHRP2 bundle products were integrated into the process by (1) incorporating performance measures at key decision points in the planning process (CO2- Performance Measurement for Highway Capacity Decision Making) and (2) involving freight stakeholders in the process as identified by the report "Integrating Freight Considerations into the Highway Capacity Planning Process: Practitioner's Guide" (C15). The outcome was a regional vision and strategies developed through a transparent and replicable planning process.

PREPARING THE VISION
Why are we doing this?
↓
What has been done?
↓
What is important?
↓
What are our resources?
↓
Who will we involve?
↓
What is our approach?
↓
APPROVE SCOPE

CREATING THE VISION
Where are we now?
↓
Where are we going?
↓
APPROVE GOALS
↓
Where do we want to be?
↓
How will we get there?
↓
APPROVE GOALS

IMPLEMENTING THE VISION
How to realize our vision?
↓
How will we stay on track?
↓
APPROVE INDICATORS & COMMITMENTS
↓
What have we accomplished?
↓
How to maintain our vision?
↓
ADOPT UPDATE PROCESS

FHWA PlanWorks Vision Guide

The SHRP2 (Strategic Highway Research Program) was created to find strategic solutions to three transportation challenges the nation is facing: improving highway safety, reducing congestion, and improving methods for renewing roads and bridges. Research has been focused in four areas: safety, renewal, reliability, and capacity. This effort will follow planning process bundles under the Capacity research area. The tools integrate environmental, economic, and community requirements into the analysis, planning, and design for new highway capacity.

This visioning effort built upon a policy foundation laid out in the 2016 iteration of *The Atlanta Region's Plan*. The long-range plan, adopted in February 2016, constructed an interdisciplinary policy framework for "winning the future". The 2016 Policy Framework allows ARC, working with other key organizations in the Atlanta Region, to advance policy objectives and work together to meet the region's tough challenges. *The Atlanta Region's Plan* also meets federal regulations for MPO long-range transportation planning and state mandates for regional commissions and comprehensive plans.

The purpose of the visioning effort was to implement the Round 5 bundle of SHRP2 products and meet the following agency-specific objectives:

- Identify a model approach for generating consensus about long-range goals and accompanying transportation investments through the use of the SHRP2 suite of visioning tools and other FHWA products;
- Promote fuller integration of freight considerations into the next iteration of *The Atlanta Region's Plan* through direct outreach to new stakeholders, including those in the Piedmont Megaregion; and
- Use enhanced performance measures to track progress, measure impact, and promote actions that yield desired results.

In terms of planning processes, this implementation assistance grant was used as a way to sharpen our focus and create more consensus for a shared vision of what "winning the future" looks like in the Atlanta Region. By starting the process of visioning now, we added front-end resources to the next long range plan update. By the time we adopt the 2020 long-range plan update, we will have a sharper focus on the key drivers that could potentially impact our ability to win the future. Similarly, we will be well-positioned to further enhance our ability to construct a long-range plan that reflects the region's stated policies and matches clear investment priorities with measurable progress toward our larger goals.

How the specific SHRP2 planning process bundle process bundles were used is shown below, along with the key deliverables produced by ARC under each. All contractual task obligations have been fulfilled and documented, although the titles and contents of certain deliverables have changed since *CO8 Volume 1: Vision, Approach & Stakeholder Plan* was prepared in February 2016 (the chronologically first of the nine documents listed).

SHRP2 Bundle	Description and Deliverables
C02 **Performance Measures for Highway Capacity Decision-Making**	ARC used this product to expand the list of performance factors used in transportation decision-making during long-range planning. Performance measures were tailored to help the regional policymakers and others better understand the potential outcomes of planning decisions. By focusing on the practical application of performance metrics, ARC can better articulate the linkages between transportation, communities, and the economy. **CO2 Volume 1: Best Practices in Performance Measurement for Transportation Decision Making** **CO2 Volume 2: Incorporating Performance Measurement into the Planning Process** **TIP Project Evaluation Framework** *(supplemental related material; not a core deliverable)*
C08 **Transportation Visioning for Communities**	ARC worked with key partners and member governments to develop a vision for the Atlanta region. ARC integrated new approaches to scenario planning into *The Atlanta Region's Plan*. Innovative stakeholder engagement techniques were applied, including regional surveys. Scenario planning used the region's vision as a starting point for solutions and measuring performance. **C08 Volume 1: Vision, Approach & Stakeholder Engagement Plan** **C08 Volume 2: Scenario Development Process** **C08 Volume 3: Scenario Testing Procedures and Results** **C08 Volume 4: Addressing Uncertainty and Change in the Planning Process**
C15 **Integrating Freight Considerations into Highway Capacity Planning Process**	ARC concurrently finalized an update to *The Atlanta Region Freight Mobility Plan*. This planning endeavor ran in parallel to the long-range planning effort. Use of the C15 product brought freight stakeholders more fully into *The Atlanta's Region's Plan* development process. Collaboration with freight stakeholders was widened to incorporate adjacent MPOs, Georgia DOT, and key stakeholders in the Piedmont Megaregion. **C15 Volume 1: Improving the Integration of Freight into the Planning Process** **Regional Models of Cooperation Peer Exchange Summary Report: Freight Planning and Regional Cooperation in the Piedmont Atlantic Megaregion** *(supplemental related material; not a core deliverable)*

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Preparing the Vision

Before ARC could begin building alternate futures through scenario planning, the groundwork had to be laid. Following the first column—Preparing the Vision—ARC assessed the need for scenario planning, previous work that had been done, the available resources, and potential stakeholders. The work done in the Preparing the Vision phase is all documented in the Vision, Approach and Stakeholder Engagement Plan.

Building upon a policy foundation laid out in *The Atlanta Region's Plan*, ARC staff planned to examine specifics of the regional vision, explore types of societal changes, and adjust the plan to refine goals. Using ARC's past scenario planning work as the foundation, staff looked for sketch tools that could be used to tell stories about the future and ultimately improve regional policies.

In addition to examining past activities and identifying tools, ARC prepared the vision by identifying an engagement plan to be used throughout the visioning process. ARC included a diverse cross-section of stakeholders through the creation of a Stakeholder Advisory Committee (SAC). The SAC met three times throughout the process to: (1) ensure SHRP2's ongoing alignment with regional needs and desires, (2) evaluate scenario impacts, and (3) hone policies. ARC also conducted extensive Board and Committee engagement and, eventually, plans to facilitate conversations with the general public. For more details on Preparing the Vision, including stakeholder engagement and background assessments, see the Vision, Approach and Stakeholder Engagement Plan.

Once the approach was in place, ARC began the process of creating the vision.

Exploratory Scenario Planning

To create desirable and resilient communities regardless of potential disruptions, ARC implemented an exploratory scenario planning approach, a strategic planning method frequently used in the corporate world to better understand future uncertainties. Exploratory scenario planning aims to build community resilience by considering a variety of potential alternate futures and planning for the uncertainty embedded within those futures.

As recommended in Linking Community Visioning and Highway Capacity Planning, ARC's planning process emphasized engagement. Exploratory scenario planning focuses on planning for contingencies and incorporating rapid changes, and communicating those needs to policymakers is difficult when a long range plan is only adopted every four years. To convey the importance of keeping up with global challenges and technological changes on a minute-by-minute rather than decade-by-decade basis, ARC developed a scenario development process approach that would rely heavily on stakeholder engagement and technical analysis. The process emphasized the uncertainty of the future, and, therefore, the importance of creating a region that can weather massive changes across the spectrum of possible alternate futures.

The scenario planning process also yielded an online visualization tool developed to speak to policymakers, planners, and the general public alike. The tool, which is detailed at the end of this document and in *Appendix A: Online Scenario Visualization Tool*, will assist ARC as the next long-range planning process begins.

While ARC's process aimed to ensure the continuity of an existing vision rather than develop a new one, the Creating the Vision guide in C08 was adapted to guide both the technical and stakeholder aspects of scenario development and will provide the rubric for this report.

Creating the Vision

Unlike the traditional visioning process outlined in C08, ARC chose a scenario planning approach that highlighted a number of potential futures. Sweeping alternate futures that crudely represented divergent yet plausible outcomes allowed ARC to hone in on the values that mattered and to forge a future path that would guarantee a thriving region under dynamic conditions. ARC recognizes that no single future outlined in 2016 will become the reality of 2050. Rather, by creating four dramatically different and divergent scenarios, there is a diversity of possible outcomes and disruptors.

Where are we now?

Where are we going?

Where do we want to be?

How do we get there?

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The Atlanta Region's Plan, Metro Atlanta's long-range blueprint, was adopted in February 2016. In developing the plan, ARC explored regional growth trends and forecasts and assessed current conditions. While every plan update leaves certain questions unresolved due to late-emerging trends or insufficient data, *The Atlanta Region's Plan* ultimately had to rely on present day realities to plan for tomorrow's investments.

The $85 billion in transportation investments outlined in the Regional Transportation Plan reflect the current needs for all travelers—drivers, transit riders, bicyclists and pedestrians, the goods movement industry, and individuals with specialized needs. It examines where we are now and how we should spend our transportation dollars, focus our community resources and development, and foster our human capital moving forward.

Using *The Atlanta Region's Plan* as a guiding document, our investments aim to accomplish a central goal: Win The Future. According to *The Atlanta Region's Plan*, Winning The Future relies on the provision of world-class infrastructure, the building of a competitive economy, and the development of healthy livable communities.

Fortunately, the three overarching goals allow for flexibility in delivery as the region evolves; world-class infrastructure and a competitive economy may manifest differently in 2050 than the 2016 plan predicts. With the opportunity to rewrite *The Atlanta Region's Plan* every four years, an evolving and uncertain world should play into the future priorities. Keeping *The Atlanta Region's Plan* as our benchmark and "Winning the Future" as our goal, we must account for a dynamic world. Through visioning and scenario planning, we can explore a variety of places the region might be going within the context of where we currently are.

WHERE ARE WE GOING?

Through the creation of multiple, alternate futures, we will be prepared for a variety of potential outcomes and be ready to make the appropriate adaptations to continue to "Win The Future". Keeping the potential for a dynamic future in mind, ARC undertook an exploratory scenario planning approach to analyze the trends that have the potential to disrupt the way that the Atlanta region lives and travels. To analyze key trends, ARC first had to identify potential drivers of change that may impact future outcomes. To identify the factors that are most likely to disrupt the future, ARC implemented a STEEP (social, technology, economy, ecology, policy) framework to sort through the external environment and organize the chaos of influencing factors. STEEP frameworks are frequently used by businesses and marketing firms to explore external factors that may impact the long-term viability and strategic planning of a company. By analyzing external factors along a STEEP framework, ARC, like the many businesses implementing the approach, was able to consider a wide range of factors without the risk of succumbing to information overload.

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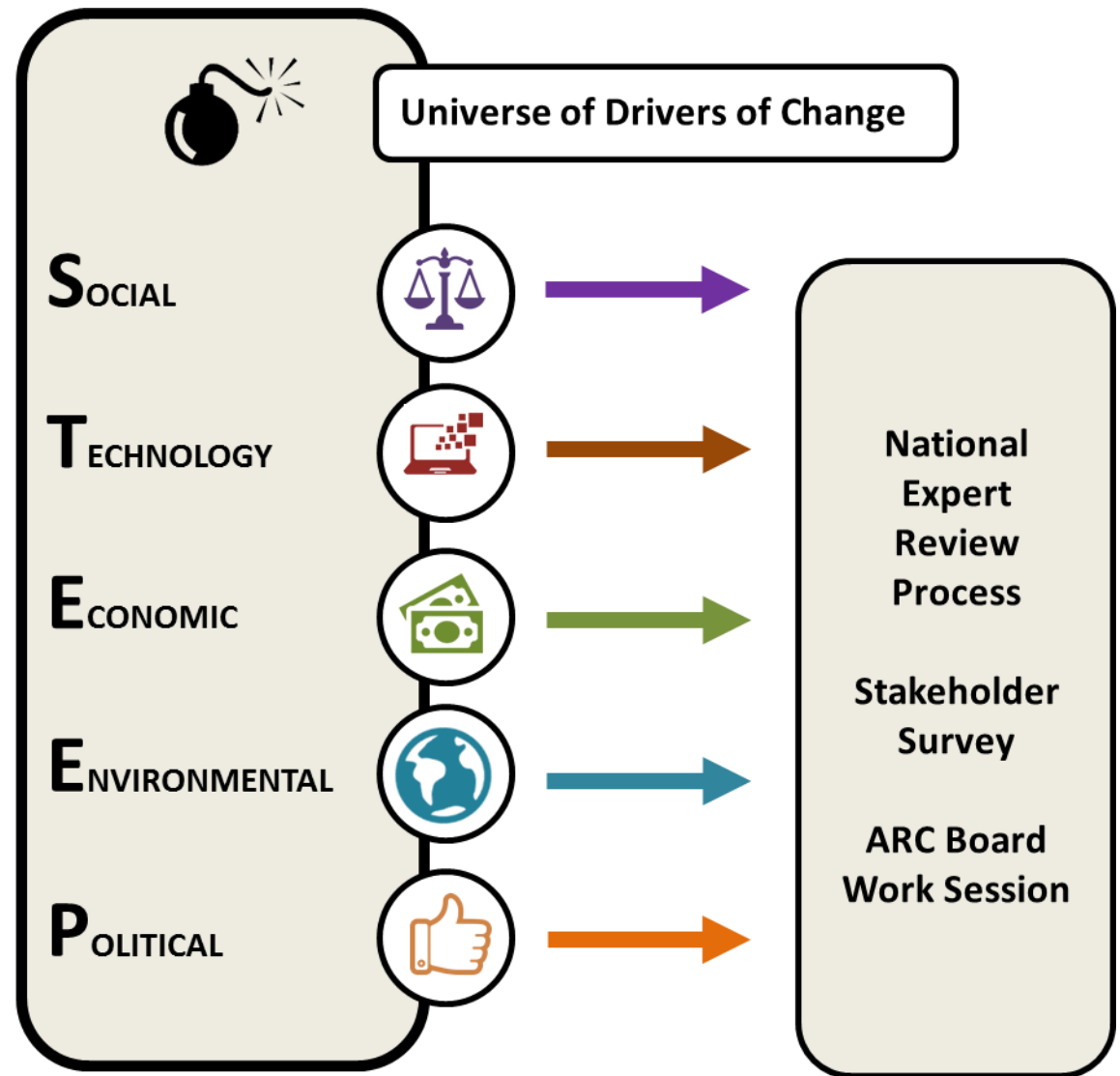
Setting the Stage

First, using background research on trends shaping Atlanta, the country, and the world, ARC staff identified a list of STEEP factors that had the potential to specifically influence the Atlanta Region. When selecting the STEEP factors, staff was careful to include factors that were both exogenous (originating outside the region, with limited internal ability to change) and endogenous (originating inside the region, with regional ability to change), foreseeing the need to allow policy makers to consider where they could play a role in shaping the future versus where the region needs to aim for adaptation.

A representative sampling of STEEP factors that ARC staff considered is illustrated below.

Social and Demographic	Technology	Economic	Environment & Energy	Policy and Government
• Aging of Population • Spatial, Racial, and Economic Inequity • Telecommuting • Online Shopping	• Adoption of ADA's and Autonomous/Connected Vehicles • Use and Affordability of Ride-share and Car-share Options • Advanced ITS • Alternative Fuel Vehicles	• Emerging Global Middle Class • Jobs in Service- and Technology-based Industries requiring Specialized Education • Increase in East Coast Port Traffic	• Natural Resource Constraints • Intensity and Unpredictability of Weather Conditions • External Factors Influencing Local Water Supply	• Alternative Financing Options & Long-Term Funding Sustainability • Privatization and PPP's in Transportation Financing • Climate Change Regulations at the Federal, State, & Local Level • Congestion Road Pricing & VMT Taxes

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From ARC's expansive list of STEEP factors, staff needed to further narrow the scope by selecting the most influential of the factors. To winnow the list down, ARC introduced a panel of key stakeholders and national experts to weigh in on the most influential of the STEEP factors. To engage stakeholders, ARC relied on a two-round online survey process to refine the STEEP factors that would ultimately represent the disruptors expected to impact the Atlanta region. Using an iterative process, the surveys were distributed to experts in an effort to obtain opinions and reach consensus on nine key drivers of change.

The first online survey was distributed to sixty academics, futurists, and national experts. After collecting those answers and further refining the feedback, a second survey for local stakeholders was distributed. After comparing and aggregating the feedback from both surveys, ARC engaged the SAC for further refinement of the drivers. The surveys, list of invited participants and notes from the SAC meeting where the drivers and trends were discussed can be found in *Appendix B: Stakeholder Engagement.* The presentation outlining trends and forecasts is provided in *Appendix C: Trends and Forecasts*.

Universe of Drivers of Change

SOCIAL

TECHNOLOGY

ECONOMIC

ENVIRONMENTAL

POLITICAL

National Expert Review Process

Stakeholder Survey

ARC Board Work Session

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Nine key drivers of change were ultimately selected from the exhaustive list of influencing factors. The nine drivers of change are shown below. After the nine drivers were selected, they were vetted by the SAC.

Autonomous Vehicles

Spatial, Racial and Economic Equity

Climate Change Regulations

Aging of the Population

Transportation Finance Structure

Water Supply

Intelligent Infrastructure & Technology

Ridehailing Services

Port Traffic

As the nine drivers of change were selected, ARC began to explore sketch planning tools to assist with modeling the alternate scenarios. A sketch tool was required because ARC's scenario development process emphasizes the importance of fluidity in the planning process. A model with a longer run-time and more difficult coding would inhibit ARC's ability to plan nimbly.

Based on recommendations from key experts and ARC's goals, Impacts 2050—a scenario-analysis modeling tool, representing regional links between population, land use, employment, and transportation—was identified due to its limited run-time and ability to model across a variety of sociodemographic factors. Impacts 2050 is a tool that came out of the Transportation Research Board's (TRB) National Cooperative Highway Research Program (NCHRP) Report 750, Volume 6, which explores the effects of socio-demographics on future travel demand at the regional level through the year 2050. Atlanta was used as one of the test cases for Impacts 2050. With that in mind and its niche ability to look at transportation and associated sociodemographics, ARC decided to use Impacts 2050 as a starting point for the region's scenario planning needs.

NCHRP 750

Volume 1: FREIGHT
SCENARIO PLANNING FOR FREIGHT
TRANSPORTATION INFRASTRUCTURE INVESTMENT

Volume 2: CLIMATE CHANGE
CLIMATE CHANGE, EXTREME WEATHER EVENTS,
AND THE HIGHWAY SYSTEM:
PRACTITIONER'S GUIDE AND RESEARCH REPORT

Volume 3: TECHNOLOGY
EXPEDITING FUTURE TECHNOLOGIES
FOR ENHANCING TRANSPORTATION
SYSTEM PERFORMANCE

Volume 4: SUSTAINABILITY
SUSTAINABILITY AS AN ORGANIZING PRINCIPLE
FOR TRANSPORTATION AGENCIES

Volume 5: ENERGY AND FUELS
PREPARING STATE TRANSPORTATION AGENCIES
FOR AN UNCERTAIN ENERGY FUTURE

Volume 6: DEMOGRAPHICS
THE EFFECTS OF SOCIO-DEMOGRAPHICS ON FUTURE
TRAVEL DEMAND

The Impacts 2050 framework created four pre-specified scenarios: Momentum, Gentle Footprint, Tech Triumphs, Global Chaos. In keeping with the model's structure, ARC planned to use these four scenarios as a starting point for the Atlanta region's own alternate futures.

MOMENTUM

GLOBAL CHAOS

TECH TRIUMPH

GENTLE FOOTPRINT

By combining a variety of assumptions about each of the key drivers, ARC hoped to emerge with four alternate futures for the region that mirrored the scenarios put forth in Impacts 2050. The first step in developing ARC's four scenarios was revisiting the assumptions made in the NCHRP 750 report and modifying them as necessary.

With the basic framework of the scenarios already in place, ARC sought to expand and vet the concepts. Using an innovative planning exercise, the Project Steering Committee, which was composed of key staff and consultants, was tasked with examining potential event outcomes with respect to each scenario. To executive this process, first, staff developed multiple potential outcomes (framed as events) for each driver. Those events were then printed onto playing cards. The committee members were then divided into four groups, one for each scenario, and given the card decks. The groups were charged

with selecting the cards—each representing a possible outcome— that most closely aligned with their vision of the scenario they were given. After each scenario team selected the drivers/events they thought would realistically align with their future, the freshly formed scenarios were compared and the narratives began to take shape. See *Appendix D: Game Cards of Potential Disruptive Events* for the full set of potential events considered by each group as the basis for the scenario narratives. Spirited discussions emerged from the card exercise, and the conversations helped to transform the NCHRP 750 text into more Atlanta-centric scenarios.

AUTONOMOUS VEHICLES

Autonomous vehicle proving ground trials are generally successful, but minor security glitches have not been eradicated fully. Most people are not concerned and the technology is embraced, although not universally, resulting in a mixed fleet.

PORT TRAFFIC

Normalization of relations with Cuba leads to an economic resurgence where a hybrid communist / capitalist system similar to China takes root. Trade booms and the Port of Savannah becomes our country's new "front door" to Havana.
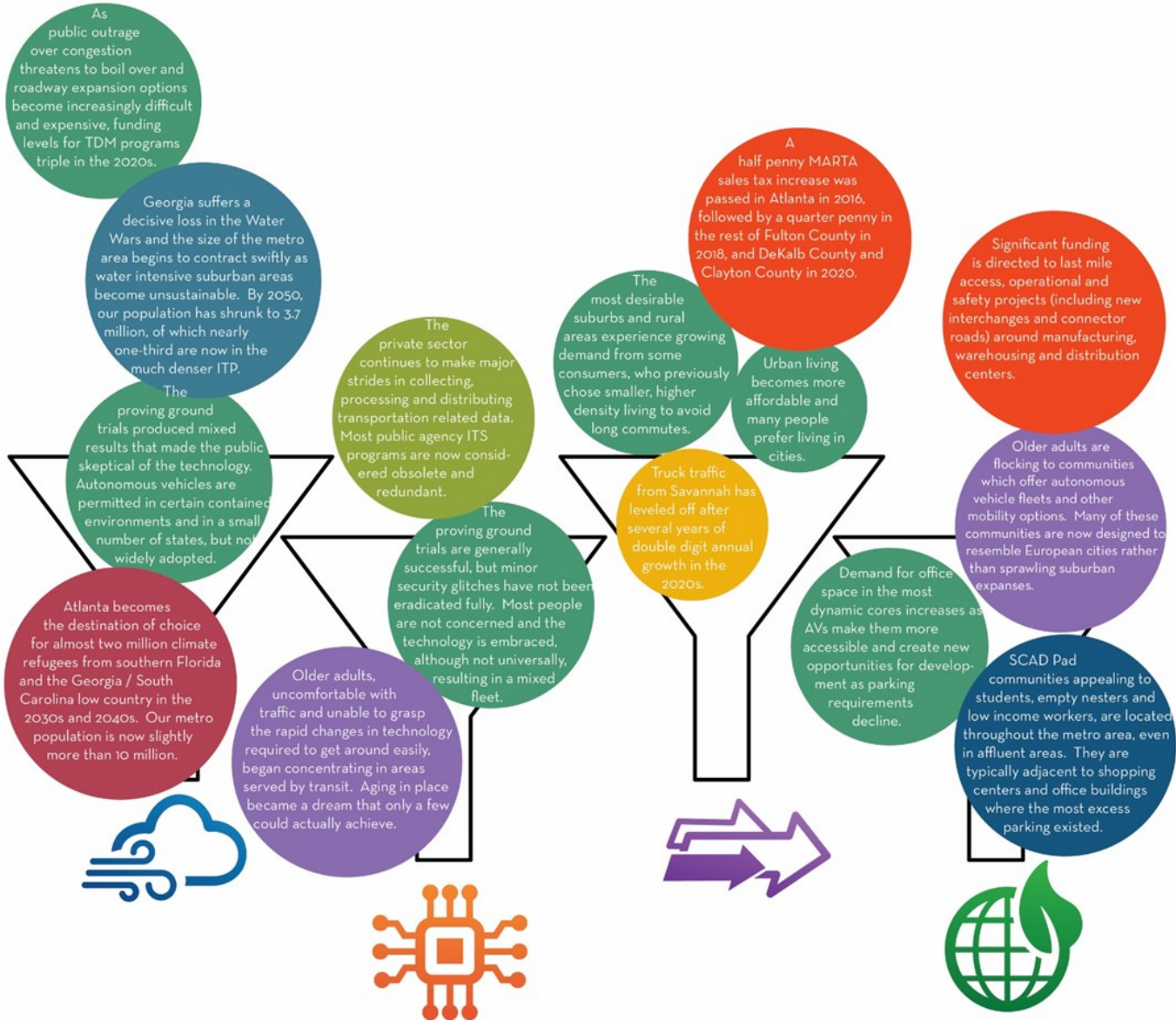
TRANSPORTATION FINANCE

The federal transportation program now focuses exclusively on maintaining the interstate highway system and improving intermodal freight connections. Federal spending is now less than half of its high point and many responsibilities are now devolved to the states to manage.

EQUITY

Technological advances have cut the noise of aircraft engines by up to 80%, making the Aerotropolis area a hotbed for development. Over the past 20 years, nearly 50% of the jobs created and over 30% of houses built in the region were within five miles of the airport.

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As public outrage over congestion threatens to boil over and roadway expansion options become increasingly difficult and expensive, funding levels for TDM programs triple in the 2020s.

Georgia suffers a decisive loss in the Water Wars and the size of the metro area begins to contract swiftly as water intensive suburban areas become unsustainable. By 2050, our population has shrunk to 3.7 million, of which nearly one-third are now in the much denser ITP.

The proving ground trials produced mixed results that made the public skeptical of the technology. Autonomous vehicles are permitted in certain contained environments and in a small number of states, but not widely adopted.

Atlanta becomes the destination of choice for almost two million climate refugees from southern Florida and the Georgia / South Carolina low country in the 2030s and 2040s. Our metro population is now slightly more than 10 million.

The private sector continues to make major strides in collecting, processing and distributing transportation related data. Most public agency ITS programs are now considered obsolete and redundant.

The proving ground trials are generally successful, but minor security glitches have not been eradicated fully. Most people are not concerned and the technology is embraced, although not universally, resulting in a mixed fleet.

Older adults, uncomfortable with traffic and unable to grasp the rapid changes in technology required to get around easily, began concentrating in areas served by transit. Aging in place became a dream that only a few could actually achieve.

The most desirable suburbs and rural areas experience growing demand from some consumers, who previously chose smaller, higher density living to avoid long commutes.

Urban living becomes more affordable and many people prefer living in cities.

A half penny MARTA sales tax increase was passed in Atlanta in 2016, followed by a quarter penny in the rest of Fulton County in 2018, and DeKalb County and Clayton County in 2020.

Truck traffic from Savannah has leveled off after several years of double digit annual growth in the 2020s.

Demand for office space in the most dynamic cores increases as AVs make them more accessible and create new opportunities for development as parking requirements decline.

Significant funding is directed to last mile access, operational and safety projects (including new interchanges and connector roads) around manufacturing, warehousing and distribution centers.

Older adults are flocking to communities which offer autonomous vehicle fleets and other mobility options. Many of these communities are now designed to resemble European cities rather than sprawling suburban expanses.

SCAD Pad communities appealing to students, empty nesters and low income workers, are located throughout the metro area, even in affluent areas. They are typically adjacent to shopping centers and office buildings where the most excess parking existed.

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After selecting the outcomes that best fit each scenario, the work of developing narratives and modeling inputs began. A full narrative encompassing the outcomes of nine drivers and related arcs is key for storytelling and for enhancing the quantitative modeling results. The relationship between the drivers and the scenarios were scrutinized extensively.
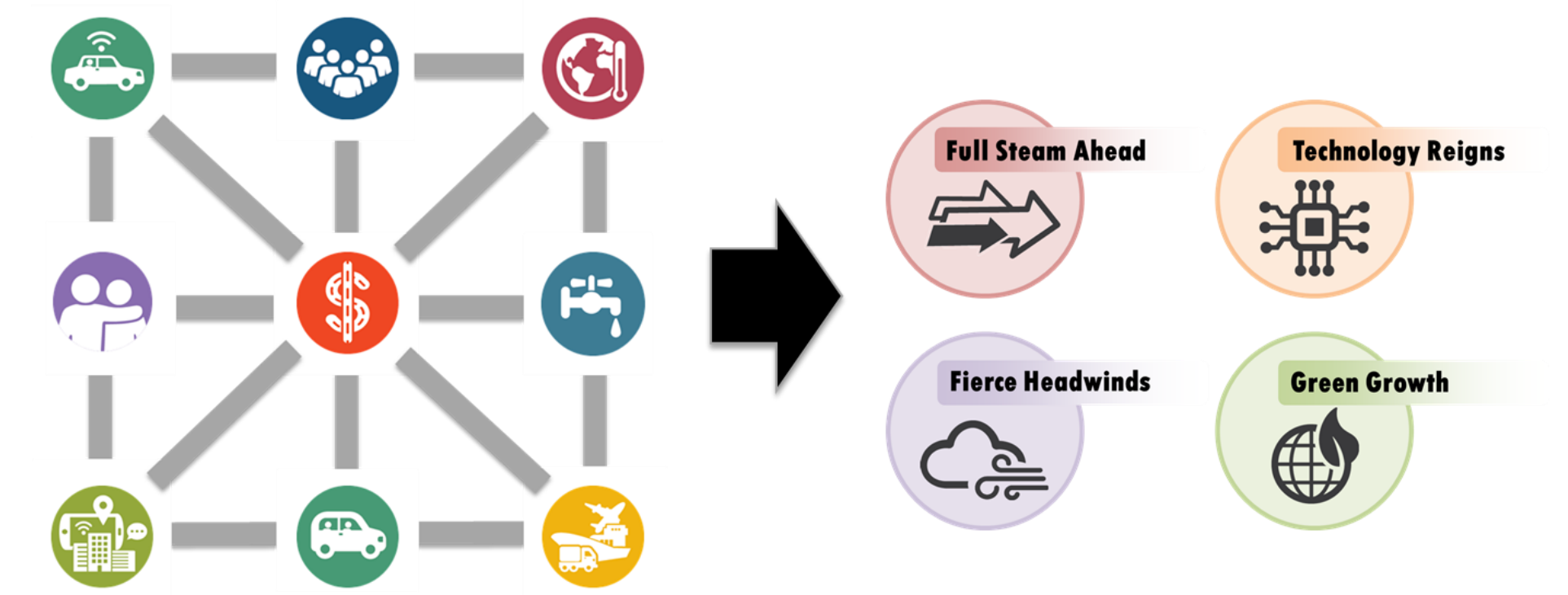
The June 2016 Stakeholder Advisory Committee focused on vetting the potential outcomes for the nine drivers. After the Stakeholder Advisory Committee meeting, ARC's Transportation Coordinating Committee (technical staff) and Transportation & Air Quality Committee (policy committee) continued to analyze the drivers. Both committees played an interactive, simulated game where the members were presented with four plausible outcomes for each driver. Each outcome was tied to one of the four scenarios, but the game did not initially reveal which outcome belonged to which scenario. In the game, technical staff and policymakers were able to run through each driver and use a remote clicker to choose the outcome they believed was most likely to occur. From this, committee members could see whether they leaned more towards one scenario or another. ARC was also able to get a sense of baseline viewpoints about where Atlanta region residents think the world is heading. This exercise was facilitated by ARC to ensure that committee members were comfortable with the overall phrasing and concept before all deliverables, including the online tool, were finalized.
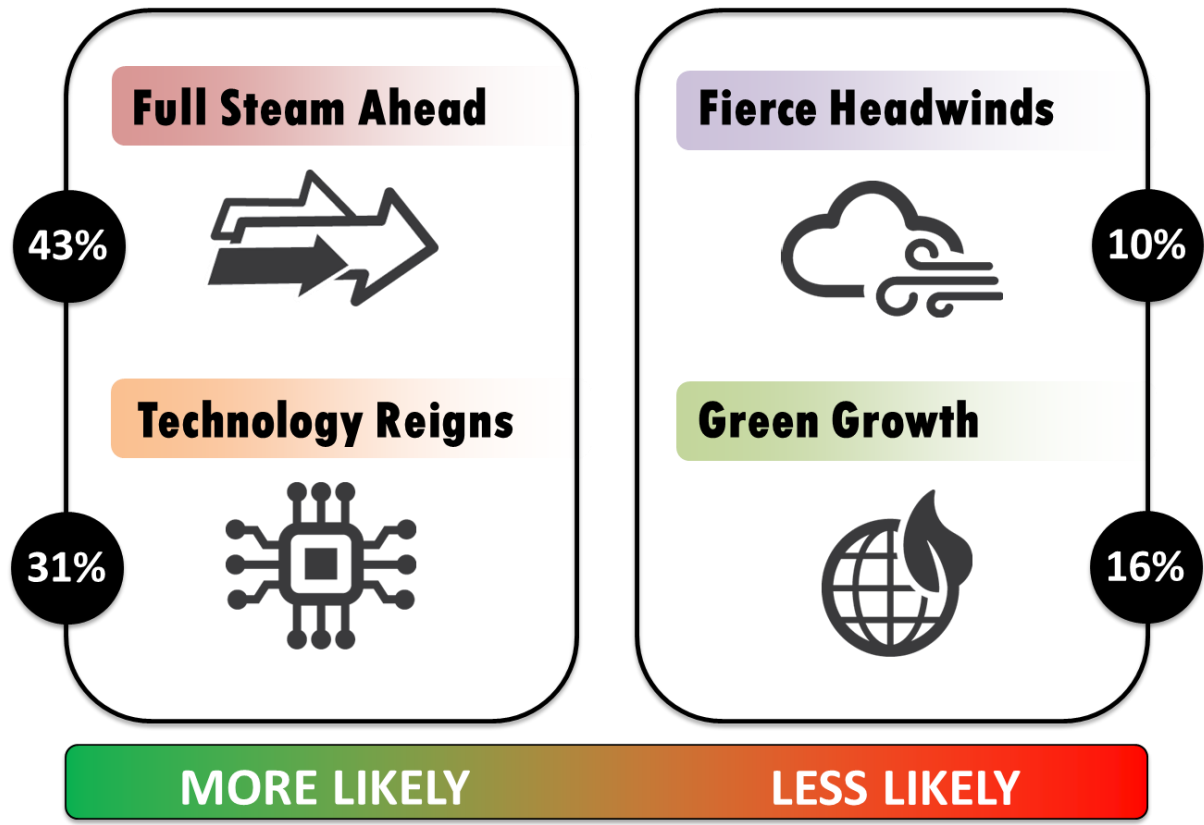
Summary results of scenario beta tests with ARC committees

After the relevant stakeholders reached consensus on the concepts, the committees were given full one-pagers with the associated drivers and asked to provide additional feedback on the plausibility of the scenarios. The full content of the scenario narratives, with final committee input included, can be found in *Appendix E: Scenario Narratives*. Abbreviated versions of Atlanta's four alternate futures are presented below.

Full Steam Ahead
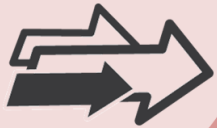
Full Steam Ahead most closely mirrors current forecasts and projections; trends that were present in the first two decades of the 21st century continue at a moderately accelerated pace. Full Steam Ahead is "business as usual" – development patterns are driven by current lifestyle preferences and short term financial return on investment, but the region is slow to respond to significant long term shifts in demographics.

Fierce Headwinds

Global instability effects metro Atlanta in a myriad of ways. Population growth has slowed; the economy is stagnant; extreme weather events are the new normal. Uncertainty necessitates a new course for metro Atlanta.

Technology Reigns
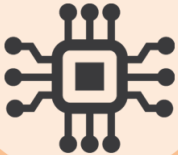
Technological advances vastly improve the quality of life for the metro Atlanta residents who have the means to take advantage of new innovations. Autonomous vehicles, renewable energy, and reliable robots abound. However, the pace of change has yielded negative consequences for some of the region's more marginalized communities as the digital divide grows and automatization replaces jobs for unskilled workers.

Green Growth

Sustainability is on the forefront of public consciousness. With an emphasis on green growth, Metro Atlanta's new economic, social, and transportation priorities reflect strong environmental ethics. Once the poster child for resource-intensive development patterns, Metro Atlanta is now a model for protecting its natural resources.

Modeling the Future

Once the drivers were chosen and the overarching themes of the four futures developed, ARC staff prepared to model the scenarios. Staff intended to use Impacts 2050, the Regional Strategic Planning Model (RSPM), and the Regional Economic Models Inc. (REMI) model together in order to gather more holistic results.

Staff began with Impacts 2050 since it formed the base of the scenarios. Seeing as Impacts 2050 relied on population numbers from 2000, the first step was calibration. The technical team calibrated the model, using the Full Steam Ahead scenario as a baseline, to the population predicted in ARC's Activity-Based Model (ABM). After population was calibrated, ARC staff matched the available inputs from Impacts 2050 to each of the narratives and drivers, yielding appropriate coefficients for each of the inputs. Through inputs and proxies, the team planned to model the four alternate futures.

However, once staff began to analyze the outputs from the calibrated Impacts 2050 model, the results were not plausible; outputs from the calibrated Impacts 2050 model—as indicated by the Momentum scenario—were significantly different from the ABM's trend line. Unable to identify the problem, the use of Impacts 2050 was reduced to two components: providing a four scenario framework and setting the population for other models.

ARC carried forward the region's tailored versions of the four scenarios, planning to use the segmented alternate futures in different sketch models moving forward. This four scenario format, along with the generalized direction and content of the scenarios, framed the Atlanta region specific scenarios. While the scenarios were edited to reflect Atlanta's drivers of change, the four-scenario concept—which ARC carried to other models as well— originated in Impacts 2050.

In addition, the calibrated 2050 population based on ARC's 2015 data served as the baseline in future modeling efforts (RSPM and REMI). In this way, Impacts 2050 laid the groundwork for the scenario planning approach throughout SHRP2. Unable to decipher where the model ran awry, ARC decided to adopt the framework but look to other tools for its analysis. For more information on the use of Impacts 2050, see *C08 Volume 3: Scenario Testing Procedures and Results*.

While Impacts 2050 could not be the primary modeling tool used by ARC, it proved valuable in creating the four scenario framework. Additionally, the calibrated population results from Impacts 2050 formed the foundation of new model runs utilizing other tools. Ultimately, the ability to merge multiple models furthers the state of the scenario planning practice and identifies room for improvement in the Impacts 2050 model as the future progresses.

Next, ARC turned to RSPM, a performance based planning tool developed for estimating and forecasting purposes, to fulfill the modeling needs of the visioning effort. RSPM's clear documentation and staff's prior experience with the model made it a strong candidate. In addition, ARC was able to contract with Brian Gregor, RSPM's developer, to add autonomous vehicles (one of the identified key drivers of change) as a model input. With RSPM, ARC applied the same tactic of matching available input variables to the scenarios as was used in the Impacts 2050 exercise. Again, relying on the calibrated Impacts 2050 population estimates as a base, ARC manipulated the inputs for each scenario to elicit four distinct alternate futures. The four scenarios relied on assumptions beyond sociodemographic inputs; varying levels of density, transit expansion, road investment, autonomous vehicles, and congestion pricing were applied to each scenario based on the nine drivers of change. See *C08 Volume 3: Scenario Testing Procedures and Results* for a full list of the input variables for RSPM and details on the model.

Since RSPM is geared towards transportation and does not yield econometric outputs, ARC chose to complement RSPM with the REMI model to create a more comprehensive vision of the future. As with RSPM and Impacts 2050, ARC staff matched model inputs to the four scenario narratives. While the resulting runs provided staff with a sweeping econometric picture of what each of the alternate futures may hold, the limited timespan of the grant did now allow staff the time to fully validate and control the model at each stage of the assumptions. Additionally, some of the results were not intuitive because staff could not recalibrate REMI at the national level to reflect drivers that would impact the entire country in such a short time span. Thus, the findings from REMI should be taken as a rough exercise to display trend lines rather than relying on the actual outputs as gospel. See *C08 Volume 3: Scenario Testing Procedures and Results* for a full list of the input variables for REMI and details on the model. Ultimately, the RSPM model runs, the REMI model runs, and the narratives combine to create four distinct alternate futures.

ARC's visioning approach relied on scenario planning, and aspired to envision multiple possible futures in an attempt to develop policies that can help the region win 2050 regardless of the obstacles and drivers that may come Atlanta's way.

Evaluating the four scenarios based on RSPM outputs, REMI trends, and the narratives creates a more complete picture of the alternate futures and enables policy makers to focus on the specific parts of each scenario the region desires. Looking across the available metrics and keeping all three goals in mind, ARC can aim to find the "sweet spot," regardless of future uncertainty.

The first step in deciding where we want to be is analyzing the outcomes of the alternate futures. Due to the lack of validation for the outputs of REMI, ARC staff specifically honed in on the RSPM outputs variables they found to be the most important and relatable. The outcomes chosen for analysis were:

- Vehicle Miles Traveled Daily (per capita)
- Vehicle Hours of Delay (per capita)
- Annual Transit Trips (per capita)
- Annual Walk/Bike Trips (per capita)
- Annual Social Cost of Vehicle Travel (per household)
- Annual Vehicle Operating Cost (per capita)
- Annual CO_2 Emissions (per capita & overall)

The following table and figure presents some of the key outputs from the modeling exercise. A radar diagram is used to compare the scenarios across four key transportation outputs, allowing policy makers to see which futures perform best. More in depth analysis of the scenario outputs is available in *C08 Volume 3: Scenario Testing Procedures and Results*.

	Full Steam Ahead	Fierce Headwinds	Tech Reigns	Green Growth
VMT/Capita	21%	17%	29%	9%
Walk/Bike Trips/ Capita	19%	36%	24%	130%
Transit Trips/ Capita	2%	32%	8%	387%
VHD/Capita	89%	71%	32%	14%
CO_2 Emissions/ Capita	-64%	-58%	-66%	-72%
Vehicle Operating Cost/Capita	-1.5%	38%	-2%	18%

RSPM Results Showing the Percentage Change for Each Output Compared to 2015

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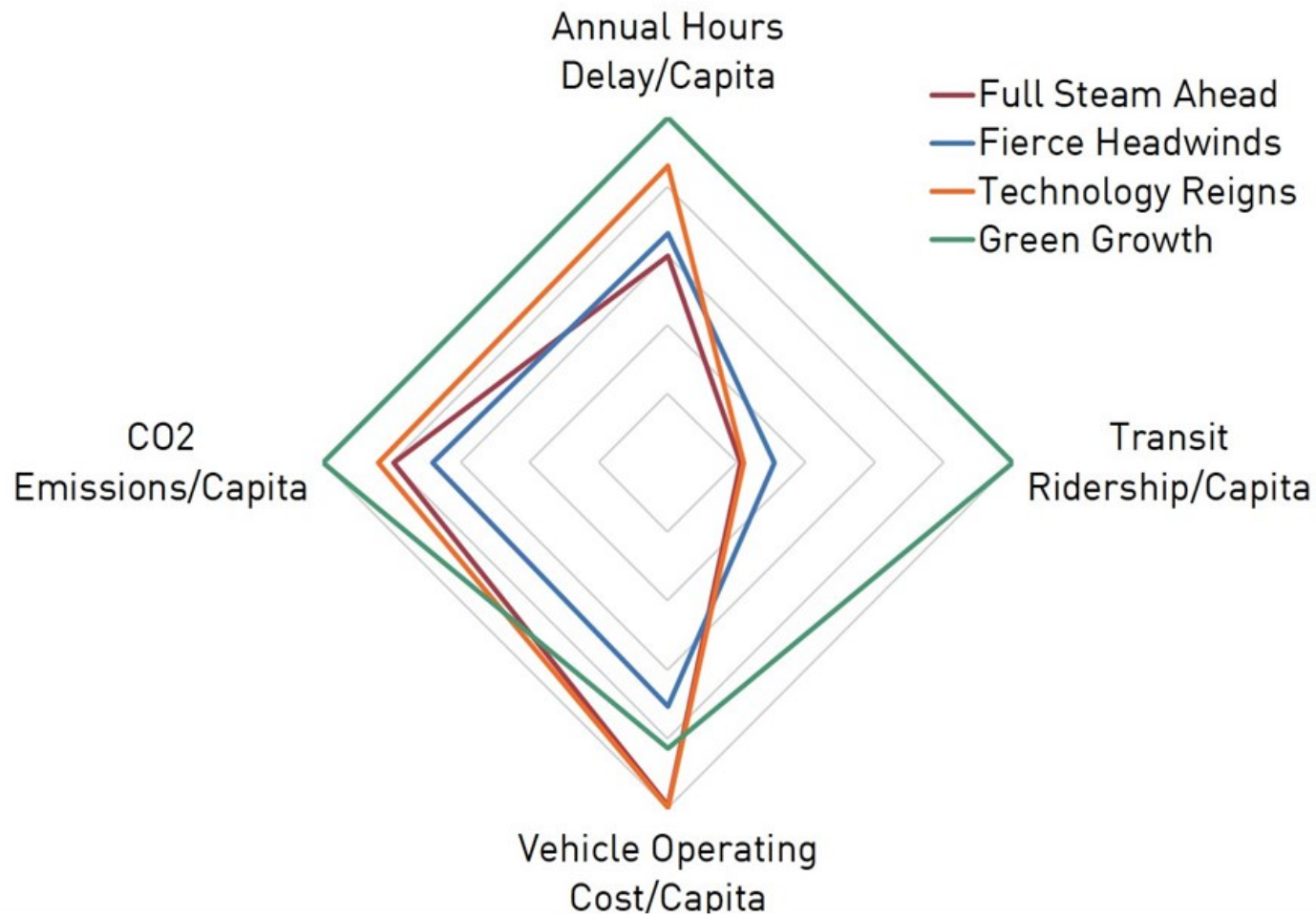
Relative Assessment of the Four Scenarios Across Key Metrics
(furthest axis from center=best performing)

Since none of the alternate futures are truly utopian, the conversations revolved around identifying what drove the changes behind certain metrics. For instance, the high levels of transit ridership and bike/pedestrians trips in Green Growth stood out because they followed high levels of investment in new transit infrastructure coupled with congestion charges. On the other hand, the high levels of CO_2 emissions per capita in Fierce Headwinds—despite increasing use of transit—highlight the importance of improving vehicle technology to yield improvement in air quality. It is difficult to analyze every single metric for each scenario as many factors compound to create specific outcomes; however, the large differences between the four scenarios communicate the fluidity of planning and the region, highlighting the need to adapt and think aggressively about policy options.

However, the results enabled policy makers and stakeholders to focus on certain model outputs in order to isolate the Atlanta region's outcomes they would like to see. When coupled with the narratives, these modeling outputs allowed interested parties to see the full gamut of possible outcomes. By acknowledging the desired end result and the complicated externalities and unintended impacts of each scenario, policy makers could work reverse engineer 2050 by first choosing outcomes they desire and then developing policies, based on the drivers, that will help to achieve those ends. For example, if policy makers desire the 130% increase in annual walk/bike trips seen in the earlier table under the Green Growth scenario, comparing the inputs and outputs will show—among other inputs—a 210% increase in transit revenue miles of service over 2015 investment levels (that is three times the planned investment for year 2040). However, by the same token, policy makers can expect a lower regional domestic product in Green Growth than under Technology Reigns or Momentum. Through the marketplace of outputs and scenarios, policy makers and ARC staff can assign personal or regional values to each of the outputs, signaling the beginning of an implicit cost-benefit analysis and comparison exercise of potential policy interventions.

At ARC's third Stakeholder Advisory Committee in November 2016, staff presented the modeling results. The meeting, which was composed of technical stakeholders, focused on the process of assessment rather than choosing a specific future—a key function of this process. The primary feedback from the committee was on the importance of evaluating the scenarios across a variety of outputs. While the committee supported the RSPM results as a basis for future policy making, they also suggested evaluation and further tool development that could encompass additional metrics (equity, health, environmental, education etc.).

Equity issues were a recurring discussion item from driver selection through output analysis. For each of scenarios, it is difficult to foresee or even quantify equity-related outputs. Despite a lack of modeling tools, ARC must keep equity at the forefront as the region plans for the future. Technology, a major driving force in all four scenarios, is likely to improve the lives of many of the region's residents. However, the downsides (i.e. a widening digital divide) should not be overlooked. Policy makers and technical stakeholders alike emphasized the importance of finding tools that can evaluate the equity impacts of alternate scenarios and of considering a variety of potential repercussions prior to tool development.

The committee's suggestions reinforced the need to seek modeling tools that can direct policy and investments across the planning realm. To ARC's knowledge, a cross-sector tool does not yet exist; however, there is ongoing national work to measure scenario planning effects across the board. Eventually, triangulating the transportation data with econometric trends will allow policy makers to envision the parts of each scenario they want to occur (e.g., the economic development of Tech Triumphs, the equity of Fierce Headwinds, and the environmental outputs and active lifestyles of Green Growth). For the duration of SHRP2, the narratives are a useful tool for further exploration in the absence of diverse modeling tools. By considering economic, mobility/access, environmental and equity measures, ARC can aim to develop a well-rounded future rather than one that exclusively focuses on transportation goals. By considering economic, mobility/access, environmental and equity measures, ARC can aim to develop a well-rounded future rather than one that exclusively focuses on transportation goals.

Through ongoing engagement conversations, the importance of developing policies that will ensure the region's stability in an increasingly turbulent time came to the fore. The working of refining the policies of *The Atlanta Region's Plan* based on the modeling analysis results will continue to drive ARC's work through the next plan update.

With the three overarching goals of *The Atlanta Region's Plan*—healthy livable communities, world class infrastructure, and a competitive economy—guiding the conversation, the scenario planning work allows interested parties to think about what type of future they want regardless of overarching global trends. Then, using the future shaped by desired VMT, CO_2 etc., the region can figure out how to achieve the vision.

HOW WILL WE GET THERE?

Ultimately, discerning the difference between what policy makers want to see happen and what they believe will happen is the key to the scenario planning process. The four sweeping scenarios allow policy makers to consider potential futures, assess their ideal, and develop policy priorities that will get the region where we want to be.

In deciding how we will get where we want to go, a couple of key policy questions drove the discussions:

- What can we control or influence at the local, regional and state levels?
- How do we encourage/discourage certain outcomes?
- By analyzing the factors that can be influenced by policy versus the external factors, policy makers honed in on what actions can be taken to secure the future.

This phase of the scenario planning process laid the groundwork for the next plan update by continuing the conversation, which began with the 2016 version of *The Atlanta Region's Plan* , about choosing how the region will win the future. Using feedback from ongoing community engagement and elected officials, the scheduled 2020 update to *The Atlanta Region's Plan* will aim to put the goals into practice through a guiding policy framework that adapts and refines the policies and goals outlined in the 2016 plan. The guiding document that emerges will transcend planning realms; land use, transportation, workforce, equity and environmental factors will all be included in the guideway to the region's future.

The adopted policy framework, which will be built on the foundation of *The Atlanta Region's Plan*, will aim to drive the Atlanta region towards a desired future by creating resilient communities that will be able to thrive regardless of global turns. Whether facing Fierce Headwinds or promoting Green Growth, the region will be stronger by preparing for a variety of outcomes and promoting policies that align with the metrics that regional stakeholders wish to see.

The vision development process is just the beginning; the crucial next step is integrating the findings from this process with *The Atlanta Region's Plan* to begin future plan development. The integration of findings will help to transition the results of the scenario planning exercise into an implementable vision. *Addressing Uncertainty and Change in the Planning Process* will document the next steps in the process as ARC begins its plan update.

Appendix A

STAKEHOLDER ENGAGEMENT

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The SHRP2 scenario development process included extensive stakeholder engagement with ARC's board and committees (TCC and TAQC) and the Stakeholder Advisory Committee. A regional and national expert survey was also conducted to help to assist with the refinement of the scenario drivers, as referenced in the Scenario Development Process document. In addition, a core team Project Steering Committee met throughout the grant term to keep the technical aspects of the process on track. The timeline below displays the key landmarks in the stakeholder process.
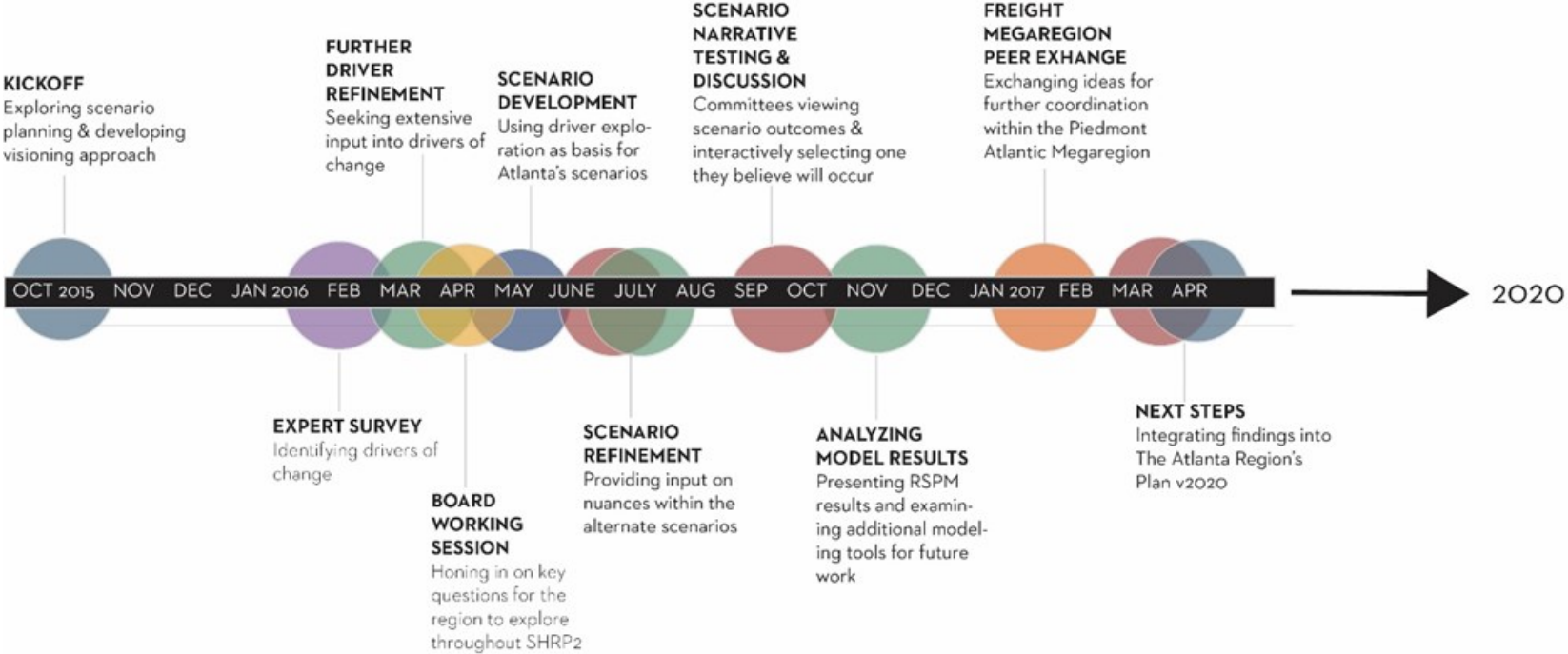
Project Steering Committee

The Project Steering Committee (PSC) formed in support of Sharpening Our Focus included the Project's key ARC staff, GDOT, FHWA, as well as consultants who are helping with the effort. The team roster was:

- John Orr, Manager, Manager, ARC Transportation Mobility and Access Division
- Haley Berry, AICP, Principal Management Analyst/External Affairs Manager, ARC Transportation Mobility and Access Division
- Elizabeth Sanford, AICP, Manager, ARC Community Engagement Division
- Melissa Roberts, Community Engagement Coordinator, ARC Transportation Mobility and Access Division
- Matthew Fowler, Assistant Planning Administrator, Georgia DOT
- Tamara Christion, FHWA
- Claudia Bilotto, AICP, Assistant Vice President, Planning and Environment Manager – GA, WSP | Parsons Brinckerhoff
- Peter Plumeau, Senior Director, Freight Planning and Data, RSG
- Catherine L. Ross, AICP, Director, Center for Quality Growth and Regional Development, Georgia Institute of Technology
- Gerrit-Jan Knaap, Professor and Director, National Center for Smart Growth, University of Maryland
- Uri Avin, FAICP, Research Professor, Director Planning and Design Center, Director, PALS Program, National Center for Smart Growth, University of Maryland
- Terry Moore, Senior Project Director, EcoNorthwest, Portland, Oregon

The PSC, and other staff, met in October 2015 to kick-off the project and begin the process of preparing for the visioning work. The PSC also met in April 2016 to develop the scenarios from the key drivers of change identified through expert surveys and the Stakeholder Advisory Committee. The PSC met for a final time in April 2017 to establish next steps in working towards a refined version of *The Atlanta Region's Plan* that incorporates the findings of the scenario planning exercise. In between those three primary meetings, the PSC convened to benchmark progress and present findings.

Regional and National Expert Survey

The survey was used to identify drivers to guide the scenario development process. Survey invitees included academics and national experts with technical skills in all the areas related to STEEP trends. They were selected based on their national preeminence as scholars and practitioners in the STEEP disciplines.

Rather than meeting, the survey was called on to answer two rounds of surveys related to global and national driving forces that can affect the future of the Atlanta region. Their participation ensured that the drivers selected reflect a diverse review by people with various technical perspectives.

The experts received a Round 1 survey in February 2016 and were joined by the Stakeholder Advisory Panel for the Round 2 survey. The invited experts are listed to the right.

The survey was disseminated twice: once to national and regional experts and once to the Stakeholder Advisory Committee. The second survey featured a more limited list of STEEP factors that was influenced by the results of the first round.

Joe Coughlin, MIT AgeLab	D'Vera Cohn, Pew Research Center
Sandy Markwood, N4A	Angela Glover-Blackwell, PolicyLink
Jane Hardin, Community Transportation Association of America	Jacky Grimshaaw, Center for Neighborhood Technology
Jana Lynott, AARP Public Policy Institute	Paula Dowell, Cambridge Systematics
Larry Frank, University of British Columbia	Dennis Lockhart, Federal Reserve
Bruce Katz, Brookings	Rajeev Dhawan, Georgia State University
Mai Nguyen, UNC DCRP	Jannine Miller, Center of Innovation for Logistics
Norman Krumholz, Levin College Urban Affairs Professor	Joanna Lahey, Texas A&M University
Kari Watkins, Georgia Institute of Technology	Linda Dodge, USDOT
Megan Smith, US Chief Technology Officer	Michael Mattmiller, City of Seattle
Henrik Christensen, Georgia Institute of Technology	Sebastian Thrun, Georgia Institute of Technology
Barry Drake, Georgia Tech Research Institute	Michael Thompson, National Center for Atmospheric Research
Kevin Greiner, Gas South	Dennis Creech, SouthFace
Chuck Darville, GA Power/Southern Company	Chris Leinberger, Brookings
Gabe Klein, CityFi	Janette Sadik-Khan, Bloomberg Philanthropies
Mariia Zimmerman, MZ Strategies	Emil Runge, City of Atlanta
Toby Carr, State of Georgia	Chris Carr, State of Georgia
Keith Golden, State of Georgia	Robert Puentes, Brookings
Richard Florida, University of Toronto	Chris Caplice, Center for Transportation and Logistics, MIT
Susan Zielinkski, University of Michigan	Samuel Schwartz, Sam Schwartz Engineering
Glen Hiemstra, Futurist	Sandy Teagle, Emergent Futures
Paul Higgins, Emergent Futures	Gerd Leonhard, The Futures Agency
Manu Fernandez, Human Scale Cities	Robert Reich, UC Berkeley
Stowe Boyd, Gigaom Research	Martin Borjesson, Futureamb
Neil Pederson, TRB	James Crites, TRB
Bob Poole, Reason Foundation	John Crittenden, Georgia Institute of Technology
John Abraham, HBA Specto	

Phase I Delphi--Demographic & Social Drivers: Impact Ranking
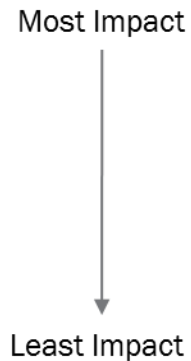
Most Impact

↓

Least Impact

- Aging of Population

- Spatial, Racial, and Economic Inequity, including Suburbanization of Poverty

- Telecommuting

- Online Shopping

1 (Most Impact)> 4 (Least Impact)

Answer Options	1	2	3	4	Rating Average
Aging of Population	7	7	1	1	1.75
Spatial, Racial, and Economic Inequity, including Suburbanization of Poverty	5	4	6	1	2.19
Telecommuting	3	2	3	8	3.00
Online Shopping	1	3	6	6	3.06

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Stakeholders-- Demographic & Social Drivers: Impact Ranking

Most Impact

↓

Least Impact

- Aging of Population

- Spatial, Racial, and Economic Inequity, including Suburbanization of Poverty

- Telecommuting

- Online Shopping

This represents NO Change from the national survey

1 (Most Impact)> 4 (Least Impact)

Answer Options	1	2	3	4	Rating Average
Aging of Population	20	18	5	1	1.70
Spatial, Racial, and Economic Inequity,	15	12	6	11	2.30
Telecommuting	7	8	16	13	2.80
Online Shopping	2	6	17	19	3.20

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Phase I Delphi--Economic Drivers: Impact Ranking

Most Impact

↓

Least Impact

- Emerging Global Middle Class

- Jobs in Service- and Technology-based Industries Requiring Specialized Education

- Increase in East Coast Port Traffic

1 (Most Impact)> 4 (Least Impact)

Answer Options	1	2	3	Rating Average
Emerging Global Middle Class	7	5	4	1.81
Jobs in Service- and Technology-based Industries Requiring Specialized Education	5	6	5	2.00
Increase in East Coast Port Traffic	4	5	7	2.19

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Stakeholders--Economic Drivers: Impact Ranking

Most Impact

↓

Least Impact

- Jobs in Service- and Technology-based Industries Requiring Specialized Education

- Increase in East Coast Port Traffic

- Emerging Global Middle Class

Key difference: PHASE I DELPHI respondents chose "Emerging Global Middle Class" as having the most impact.

1 (Most Impact)> 4 (Least Impact)

Answer Options	1	2	3	Rating Average
Jobs in Service- and Technology-based Industries Requiring Specialized Education	18	16	10	1.82
Increase in East Coast Port Traffic	13	17	14	2.02
Emerging Global Middle Class	13	11	20	2.16

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Phase I Delphi -Technology Drivers: Impact Ranking

Most Impact

Least Impact

- Adoption of Advanced Driver Assistance Systems (ADASs) and Autonomous/Connected Vehicles

- Use and Affordability of Ride-share and Car-share Options

- Advanced Intelligent Transportation System (ITS), including "Intelligent" Infrastructure

- Alternative Fuel Vehicles, including Long Range Electric

1 (Most Impact)> 4 (Least Impact)

Answer Options	1	2	3	4	Rating Average
Adoption of Advanced Driver Assistance Systems (ADASs) and Autonomous/Connected Vehicles	7	3	3	3	2.13
Use and Affordability of Ride-share and Car-share Options	3	6	5	2	2.38
Advanced Intelligent Transportation System (ITS), including "Intelligent" Infrastructure	3	6	3	4	2.50
Alternative Fuel Vehicles, including Long Range Electric	3	1	5	7	3.00

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Stakeholders-Technology Drivers: Impact Ranking

Most Impact

↓

Least Impact

- Adoption of Advanced Driver Assistance Systems (ADASs) and Autonomous/Connected Vehicles

- Advanced Intelligent Transportation System (ITS), including "Intelligent" Infrastructure

- Use and Affordability of Ride-share and Car-share Options

- Alternative Fuel Vehicles, including Long Range Electric

Very LITTLE difference – the 2nd and 3rd options switched.

1 (Most Impact)> 4 (Least Impact)

Answer Options	1	2	3	4	Rating Average
Adoption of Advanced Driver Assistance Systems (ADASs) and Autonomous/Connected Vehicles	23	9	7	5	1.86
Advanced Intelligent Transportation System (ITS), including "Intelligent" Infrastructure	12	13	7	12	2.43
Use and Affordability of Ride-share and Car-share Options	7	15	14	8	2.52
Alternative Fuel Vehicles, including Long Range Electric	2	7	16	19	3.18

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Phase I Delphi - Environment & Energy Drivers: Impact Ranking

Most Impact

↓

Least Impact

- Natural Resource Constraints

- Intensity and Unpredictability of Weather Conditions

- External Factors Influencing Local Water Supply

1 (Most Impact)> 4 (Least Impact)

Answer Options	1	2	3	Rating Average
Natural Resource Constraints	6	7	3	1.81
Intensity and Unpredictability of Weather Conditions	7	3	6	1.94
External Factors Influencing Local Water Supply	3	6	7	2.25

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Stakeholders- Environment & Energy Drivers: Impact Ranking

Most Impact

↓

Least Impact

- Natural Resource Constraints

- External Factors Influencing Local Water Supply

- Intensity and Unpredictability of Weather Conditions

Very LITTLE difference – the 2nd and 3rd options switched.

1 (Most Impact)> 4 (Least Impact)

Answer Options	1	2	3	Rating Average
Natural Resource Constraints	22	14	8	1.68
External Factors Influencing Local Water Supply	14	15	15	2.02
Intensity and Unpredictability of Weather Conditions	8	15	21	2.30

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Phase I Delphi - Government & Policy Drivers Drivers: Impact Ranking

Most Impact

↓

Least Impact

- Alternative Financing Options and Long-Term Funding Sustainability

- Privatization and Public-Private Partnerships (PPPs) in Transportation Financing

- Climate Change Regulations at the Federal, State, and Local Level

- Congestion Road Pricing and Vehicle Miles Traveled (VMT) Taxes

1 (Most Impact)> 4 (Least Impact)

Answer Options	1	2	3	4	Rating Average
Alternative Financing Options and Long-Term Funding Sustainability	3	5	7	1	2.38
Privatization and Public-Private Partnerships (PPPs) in Transportation Financing	4	5	3	4	2.44
Climate Change Regulations at the Federal, State, and Local Level	5	3	2	6	2.56
Congestion Road Pricing and Vehicle Miles Traveled (VMT) Taxes	4	3	4	5	2.63

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Stakeholders- Government & Policy Drivers Drivers: Impact Ranking

Most Impact

↓

Least Impact

- Congestion Road Pricing and Vehicle Miles Traveled (VMT) Taxes

- Privatization and Public-Private Partnerships (PPPs) in Transportation Financing

- Alternative Financing Options and Long-Term Funding Sustainability

- Climate Change Regulations at the Federal, State, and Local Level

Key difference: PHASE I DELPHI respondents chose "Alternative Financing Options..." as having the most impact.

1 (Most Impact)> 4 (Least Impact)

Answer Options	1	2	3	4	Rating Average
Congestion Road Pricing and Vehicle Miles Traveled (VMT) Taxes	15	15	10	4	2.07
Privatization and Public-Private Partnerships (PPPs) in Transportation Financing	13	8	15	8	2.41
Alternative Financing Options and Long-Term Funding Sustainability	7	18	11	8	2.45
Climate Change Regulations at the Federal, State, and Local Level	9	3	8	24	3.07

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Phase I-Delphi -Most Important Drivers Regardless of "Category"

Aging of Population	68.8%	11
Spatial, Racial, and Economic Inequity, including Suburbanization of Poverty	68.8%	11
Adoption of Advanced Driver Assistance Systems (ADASs) and Autonomous/Connected Vehicles	56.3%	9
Use and Affordability of Ride-share and Car-share Options	43.8%	7
Climate Change Regulations at the Federal, State, and Local Level	37.5%	6
Alternative Fuel Vehicles, including Long Range Electric	31.3%	5
Congestion Road Pricing and Vehicle Miles Traveled (VMT) Taxes	31.3%	5
Natural Resource Constraints	25.0%	4
Alternative Financing Options and the Decrease in Federal Funding	25.0%	4
Telecommuting	18.8%	3
Jobs in Service- and Technology-based Industries Requiring Specialized Education	18.8%	3
Advanced Ubiquitous Intelligent Transportation System (ITS), including "Intelligent" Infrastructure	18.8%	3
Intensity and Unpredictability of Weather Conditions	18.8%	3
Emerging Global Middle Class	12.5%	2
Privatization and Public-Private Partnerships (PPPs) in Transportation Financing	12.5%	2
Online Shopping	6.3%	1
Increasing East Coast Port Traffic	6.3%	1
External Factors Influencing Local Water Supply	0.0%	0

Stakeholders-Most Important Drivers – Regardless of "Category"

Driver	%	Count
Aging of Population	76.7%	33
Adoption of Advanced Driver Assistance Systems (ADASs) and Autonomous/Connected Vehicles	72.1%	31
Advanced Ubiquitous Intelligent Transportation System (ITS), including "Intelligent" Infrastructure	46.5%	20
Spatial, Racial, and Economic Inequity, including Suburbanization of Poverty	41.9%	18
Congestion Road Pricing and Vehicle Miles Traveled (VMT) Taxes	39.5%	17
Use and Affordability of Ride-share and Car-share Options	30.2%	13
Alternative Financing Options and the Decrease in Federal Funding	30.2%	13
Privatization and Public-Private Partnerships (PPPs) in Transportation Financing	27.9%	12
Telecommuting	25.6%	11
Increasing East Coast Port Traffic	20.9%	9
Climate Change Regulations at the Federal, State, and Local Level	18.6%	8
Alternative Fuel Vehicles, including Long Range Electric	14.0%	6
Natural Resource Constraints	14.0%	6
Online Shopping	11.6%	5
Emerging Global Middle Class	11.6%	5
Jobs in Service- and Technology-based Industries Requiring Specialized Education	7.0%	3
External Factors Influencing Local Water Supply	7.0%	3
Intensity and Unpredictability of Weather Conditions	4.7%	2

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Phase I Delphi: Disruption Potential of all Drivers– Regardless of "Category"

Most
Disruption

Adoption of Advanced Driver Assistance Systems (ADASs) and Autonomous/Connected Vehicles

Spatial, Racial, and Economic Inequity, including Suburbanization of Poverty
Aging of Population
Use and Affordability of Ride-share and Car-share Options
Congestion Road Pricing and Vehicle Miles Traveled (VMT) Taxes
Climate Change Regulations at the Federal, State, and Local Level
Natural Resource Constraints

Advanced Ubiquitous Intelligent Transportation System (ITS), including "Intelligent" Infrastructure
Alternative Fuel Vehicles, including Long Range Electric
Intensity and Unpredictability of Weather Conditions
Alternative Financing Options and the Decrease in Federal Funding
Emerging Global Middle Class
Telecommuting

Jobs in Service- and Technology-based Industries Requiring Specialized Education
Privatization and Public-Private Partnerships (PPPs) in Transportation Financing
Online Shopping
Increasing East Coast Port Traffic

Least
Disruption

External Factors Influencing Local Water Supply

Stakeholder-Disruption Potential of all Drivers– Regardless of "Category"

Most Disruption	Adoption of Advanced Driver Assistance Systems (ADASs) and Autonomous/Connected Vehicles
	Aging of Population
	Spatial, Racial, and Economic Inequity, including Suburbanization of Poverty
	Congestion Road Pricing and Vehicle Miles Traveled (VMT) Taxes
	Advanced Ubiquitous Intelligent Transportation System (ITS), including "Intelligent" Infrastructure
	Alternative Financing Options and the Decrease in Federal Funding
	Use and Affordability of Ride-share and Car-share Options
	Privatization and Public-Private Partnerships (PPPs) in Transportation Financing
	Climate Change Regulations at the Federal, State, and Local Level
	Increasing East Coast Port Traffic
	Telecommuting
	Natural Resource Constraints
	Emerging Global Middle Class
	Online Shopping
	External Factors Influencing Local Water Supply
	Jobs in Service- and Technology-based Industries Requiring Specialized Education
	Alternative Fuel Vehicles, including Long Range Electric
Least Disruption	Intensity and Unpredictability of Weather Conditions

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ARC Board Work Session

On April 14th, 2016, ARC held a board working session to introduce the concept of scenario planning and to open the floor to discussion on key items staff should focus on during the SHRP2 process. A summary of the conversation from the event, which highlighted e-tailing and government revenues as key areas for staff focus, is below.

Key Comments

- Stay alert and open to how new trends and developments might affect our planning and thinking. We need to stay objective, independent and alert.
- Help communities face and transition to new realities in the face of dramatic/significant change. Form a safety net by constantly reviewing what is going on.
- Is it even realistic to try and plan out 25 years? Perhaps we should plan for shorter time horizons, faster adjustments. Be more nimble. The advancements of the last 10 years can't compare to the next 30 years. For example, jobs that are in place 10-15 years from now haven't been invented yet.
- Staff need to be able to have ability/flexibility to observe/study innovation and change. Key staff need to go where the innovation is being presented and interact with national thought leaders. We need to keep staff on the cutting edge.
- How can we engage people who are reluctant to change? People will embrace the change when they see the good in it. Can we help people to understand how some change will be beneficial to them (e.g. Uber, autonomous vehicles for older citizens).
- How do we filter new information/trends for credibility?
- We have to make decisions today (e.g. transportation programming) for years into the future, in the face of great uncertainty.
- Faith-based community can help us get people engaged and informed. We should ask their assistance and get them involved in the planning process.
- We just need to look to the demographic changes in the school system for a sense of the future. We are seeing demographic trends in early education that give insight into future trends.

- Where we spend money today impacts the future. We are making decisions today in our plans about where to invest billions of $$ now for problems that may not exist in 10 years. Are we spending money on problems that won't exist by the time we can implement them as a solution? We should narrow our focus.
- We are often faced with trends that have competing or conflicting outcomes.
- Are we looking at our communities and projections for ride-sharing/etc? Are we supporting social interaction around transportation technology? Uber/Lyft/Ridesharing services are beginning to work with transit providers.
- Are we looking at how the national trends are being reflected in or impacting our local communities?
- We need to help legislators understand some of these technological trends and look at what we can do legislatively to be prepared for them, rather than hindering them. We need to work with them to ensure they are ready with policies when the technology is ready.
- We should try to develop different futures and point to how they might impact us (region). For example, develop a vision on autonomous cars/technology and roads/bridges and then show a cost comparison of different futures/ different alternatives.   This would help communicate that change is going to happen and that we have decisions/ choices we can make now.

Questions/suggestions for ARC Staff

- Given the movement toward e-tailing, what is the future of retail and potential impact on future land use policies?
- How might shopping malls be re-used or adapted?
- What is the growth of e-tailing doing to local government tax bases/finances?
- Should we be counting rooftops as a way to gauge retail needs? We are over-retailed in this region. How do we plan in this environment? What is the value of "mixed use"? What is the solution?
- We need to share "disruptive future" presentation with more audiences. We need to increase awareness of developing trends. For example, businesses are locating where targeted employees live.
- There is going to be impacts to local government revenues, for example, sales tax and e-tailing, electric vehicles and the gas tax. These trends may require us to make legislative changes that allow local governments more flexibility/options for revenue generation.
- ARC and local leaders need to explore more potential impacts of trends on local government revenue.
- Be aware: over the next five years, the infrastructure discussion will shift to the power grid.

Stakeholder Advisory Committee

The Stakeholder Advisory Committee (SAC) included select members of the ARC Board and Committees, as well as significant partner organizations in the Atlanta Region. SAC members ensured the project was in line with existing policies and desires of the municipalities, regional partners, and the community.

The SAC was first invited to complete the Round 2 survey. After that, they met three times: to discuss the drivers, to discuss the scenarios, and to discuss the modeling results. Members are listed below.

Kerry Armstrong, ARC Chairman
Tim Lee, Cobb County/ARC Board
Tom Worthan, Douglas County/ARC Board
Richard Oden, Rockdale County/ARC Board
Eric Dial, Town of Tyrone
Emil Runge, City of Atlanta
Ginna Baugh, United Way
Dave Williams, Metro Atlanta Chamber
Leslie Grady, Community Foundation of Greater Atlanta
Jannine Miller, Center for Innovations in Logistics
Jimmy Dills, Georgia Health Policy
Ben Hames, Georgia Department of Economic Development, Workforce Division
Frank Southworth, Georgia Institute of Technology/Freight Advisory Task Force
Cindy VanDyke, Georgia Department of Transportation
Tamara Christion, Federal Highway Administration
James Franklin, Tech Bridge
Saba Long, MARTA
Gerald Givens, UPS
Shirley Franklin, Purpose Built Communities
Craig Lesser, Pendleton Group
Amol Naik, Google/ARC Board
Tino Mantella, Technology Association of Georgia
Carolyn Bourdeaux, Georgia State University, Andrew Young School of Policy Studies

SAC Meeting #1 Summary (March 30, 2016)

Attendees

Frank Southworth, Georgia Tech	Cindy VanDyke, Georgia DOT
Saba Long, MARTA	Carolyn Bourdeaux, Georgia State University
Patricia Mokhtarian, Georgia Tech	Jennifer Graham, Aha Strategy
Ogechi Oparah, Woodruff Arts Center	Catherine Ross, Georgia Tech
Jimmy Dills, GHPC/GSU	Anna Okula, Porter Novelli
John Hammond, ARC	David Haynes, ARC
Jim Skinner, ARC	Mike Carnathan, ARC
Claudia Bilotto, WSP/Parsons Brinckerhoff	Dan Reuter, ARC
Mike Alexander, ARC	Julie Ralston, ARC
John Orr, ARC	Susan Grimes, ARC
David Stuart Cannon	Haley Berry, ARC
Liz Sanford, ARC	

Agenda

- Welcome and Introductions
- Overview of SHRP2 Grant and Implementation Program
- Trends and Forecast
- Survey Results
- Discussion
- Next Steps

Discussion Summary

- Missing 3-D printing/manufacturing as a disruptor- it will massively disrupt the freight and good movement industry. However, do not know then impact for sure because there has been no study yet.
- East coast port traffic- not sure how much of a disruptor it may be because we do not know the way the industry is responding yet.
- Emphasis on secondary economy from baby boomer behavior= second time around.
- Impact of congestion pricing in Georgia may be less than we think.
- Growth in the global middle class- hard to reconcile with the hollowing of the U.S middle class- needs explanation.
- What happens to innovation as the population is aging and the younger generations are putting off having children and having fewer children?
- Climate change- ton down regulation impact? Trend then towards city living?
- What is the impact on land use/spatial form from drivers- technology, demographic changes, and environmental changes?
- What is the time horizon we are considering for the impact? 20 years, 50 years?
- What is disruptive about the autonomous vehicle?
    - Safety/reduction in crashes
    - Reduced congestion levels
    - Able to get more about of infrastructure/more throughput
    - Serves populations of limited mobility- seniors, disabled, children
- What are the disparities going to be with the autonomous vehicles or mobility options? How does the spatial/economic/racial disparity relate to the technology/mobility options?
    - Mobility options and technology- differing levels of service for different populations.
- Freight will be the leader in autonomous vehicles. Platooning is already a big deal in the freight industry. Platoons are a convoy of two or more trucks linked electronically to a lead truck with an active driver in each.
- #1 job posting in Atlanta is truck drivers. With automation- those drivers/jobs will go away.
- Education- how will school location be impacted by these disruptors and shifts in land use and where people live. Online education could change the way we educate children.
- Changing economies of healthcare?

- Question- is it a driver or disruptor or is it a problem that we have to solve? In other words, what is the difference between a trend and a disruptor? Example: Is poverty a trend or disruptor? Is it a trend until it is a disruptor?
- How will jobs look? We are a very service oriented economy.
    - And, to follow up- how does education need to adapt to meet the economic job labor needs- current and future?
- Expensive to adopt VMT taxes. There will be more congestion pricing; however, it will not take away from what is free today.
- Antidotal note on congestion pricing- as for the impact on economy- people are able to get an extra trip in for the day. It is benefitting the service industry.
- At what point do we tackle the transportation/infrastructure problem?
- Advancements in medical service technology (genetic testing)?

Overarching Themes Emerge

- Mobility options are changing/expanding- autonomous vehicles, ridesharing
- Business model disrupting transportation logistics
- Migration patterns have gotten more complicated and impactful.

Attendees

Frank Southworth, Georgia Tech	Doug Hooker, ARC
Saba Long, Obelisk Strategies	Scott Haggard, ARC
Amit Kumar, Georgia Tech	Jim Skinner, ARC
James Franklin, TechBridge	Patrick Hall, ARC
Jimmy Dills, GHPC/GSU	John Orr, ARC
Ben Hames, GDED, Workforce	Julie Ralston, ARC
Christy Jeon, WSP/Parsons Brinckerhoff	Paul Donsky, ARC
Claudia Bilotto, WSP/Parsons Brinckerhoff	David Haynes, ARC
Carolyn Bourdeaux, Georgia State University Catherine Ross, Georgia Tech	Haley Berry, ARC Daniel Studdard, ARC
Tyronda Minter, Community Foundation for Greater Atlanta	Shayna Pollock, ARC Liz Sanford, ARC

Agenda

- Welcome and Introductions
- Progress made since March Stakeholder Meeting
- The Four Scenarios
- Evaluation Framework
- Discussion
- Next Steps

Discussion Summary

- Modeling Inputs/Other Disruptors
  - Historical telephone adoption data can be used as a baseline for a more nuanced look at technology adoption rates in elderly populations. Data from previous technological changes can help to inform and refine the scenarios.
  - Should explore future water needs using demographic values.
  - Should include proxies for political polarization/conservative vs. liberal control of government.
  - The 9 key drivers seem more like overlays to each other than independent disruptors; they should be modeled in a variety of ways to predict how they interface with one another.
  - 3-D printing/manufacturing could become a huge freight disruptor; it has the capacity to disrupt the freight and good movement/warehousing industry by localizing production. Coupling these changes with a more diffuse energy supply (solar panels, smaller nuclear facilities etc.) may change the entire industry and significantly alter trip generation.
  - Who (which sectors of the population) are embracing the technology and who isn't? Should consider the scale and impact of emerging technologies (how fast and who embraces it).
- Evaluating Future Impacts and Regional Relevance
  - Equity-technology changes may adversely impact at-risk communities. How can policies inform inclusivity as the job market moves away from low-skilled labor and the cost of new technology adoption is prohibitive for many households? For example, solar power may not be available to low-income households because they are unlikely to own the assets (land or buildings) that will host the power the generation.
  - Health-would be interesting to know how autonomous vehicles with door-to-door service will change our health outcomes through their impacts on active transportation use.
  - Environmental- it is important to model the economic changes that may come from a carbon tax.
- Policy Goals
  - In developing policies, a clear distinction between unalterable realities and the potential for proactive policy changes should be made. (i.e. An aging population is a demographic fact that policy is unlikely to change; however, local leaders have the ability to change funding levels, which may alter the way elderly populations live.)

- Once potential policy interventions are developed, it would be interesting to run the scenarios under the assumption that the policy changes will be made. The scenarios with and without policy intervention can then be compared. By comparing multiple outcomes, these scenarios can also be used to highlight the differences between reactive and proactive policy implementation.

Overarching Themes

- Focusing on promoting equity (health, environmental, economic, etc.) despite future changes will be critical.
- Political leaders need to be aware of what they can do proactively to avoid adverse impacts in the future.

SAC Meeting #3 Summary (November 7, 2016)

Attendees

Frank Southworth, Georgia Tech	Patrick Hall, ARC
Jimmy Dills, GHPC/GSU	Julie Ralston, ARC
Amit Kumar, Georgia Tech	Paul Donsky, ARC
Anna Okula, Porter Novelli	David Haynes, ARC
Christy Jeon, WSP/Parsons Brinckerhoff	Haley Berry, ARC
Melissa Roberts, ARC	Shayna Pollock, ARC
Marquitrice Mangham, ARC	Liz Sanford, ARC
Claudia Bilotto, WSP/Parsons Brinckerhoff	Daniel Studdard, ARC
Mike Carnathan, ARC	Kyung-Hwa Kim, ARC
Cain Williamson, ARC	

Agenda

- Welcome
- Overview of Progress since our last meeting
- Alternative Futures Discussion
  - Analysis and Discussion
  - Additional Implications
  - Areas of Focus for Planning and Policy
- Next Steps
  - Future Visualization Game
  - Identify Additional Forecasting Tools/Techniques
  - Final Stakeholder and Consultant Work Session
  - ARC Board and Committees Work Session
  - Lessons Learned

Alternative Futures Discussion Summary

- Full Steam Ahead-
  - The most likely scenario to occur within the context of the four scenarios.
  - 19% increase for walking and biking in the Full Steam Ahead scenario seems like a lot. That is because of an increase in density in the assumptions- as places become more dense- more likely to be mixed use and increase walking and biking.
- Question- does transit consider the managed lane investment? It is hard to reflect managed lanes in RSPM; however, the results from RSPM follow closely with the ABM, which has a robust managed lane network.
- Density implications-
  - How will MARTA capitalize on increased density around the region? It is important to capture the impact of changing densification on transportation infrastructure.
- Technology Reigns-
  - Assumes 100% autonomous vehicle adoption.
  - This scenario had the most positive economic impact on the region based on the REMI modeling results.
  - This scenario seems the most inequitable - what metric may begin to show what is described in the narrative (inequities)? What happens to low-wage workers when it becomes all automated?
  - How do autonomous vehicles help/increase transit ridership?
- Consider looking at transportation costs per capita rather than vehicle costs per capita. Who is operating it and how? Will have to make some assumptions about revenue costs/mile.
- Considerations for after SHRP2-
  - Define what it means to double transit, using the ABM. (build out each scenario as appropriate to model in the ABM).
  - Define autonomous freight traffic in the model.
  - Attempt to reflect extreme weather events in the model and their impacts
  - Consider another name for Ecotopia as it comes across as the fantasy scenario that isn't likely to happen. Consider Green Growth.
  - For vehicle operating costs, show more of the true costs between the scenarios.
  - Pricing of autonomous vehicles

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- Policy discussion
    - Biggest transportation impacts are based on a dramatic/big land use change/impact. This is not transparent in the model results and may need to be more obvious. How do you approach this discussion with policymakers? How do these land use changes impact local government?
    - Policy Foresight- How can policy be used to influence scenario outcomes?
    - Land use policy/changes
    - Role of the public and private sectors in vehicle ownership? What is the nature of vehicle ownership? Asset ownership? How do you provide mobility?
- Gaming Tool Ideas-
    - For future consideration - additional outputs could be considered to consider a broader set of outcomes, i.e. life expectancy.
    - Who is the target audience for the gaming tool- decision makers? Other?
    - Add user questions- who are you- elected official, general public? Then the tool could show different users what outcomes they would have influence/control over.
    - Consider sending out to high schools

ARC Committees (TCC and TAQC)

Throughout the SHRP2 grant, ARC staff presented to TCC and TAQC on the scenario development process. Three key meetings were held to refine the scenarios, to discuss the scenario outcomes, and to develop next steps.

Refine Scenarios

During scenario refinement, ARC staff provided the overview of the scenario planning process and highlighted Atlanta's four scenarios in broad terms. In this phase, members paid specific attention to the interactions between technology and equity.

Discuss Scenario Outcomes

During this step, committee members were invited to "beta test" the online scenario visualization tool during the meeting by voting for one of the statements under each driver. The committee members had specific feedback on the tool and suggested ways to refine a few of the scenarios to make them more realistic.

Develop Next Steps

Freight Megaregion Peer Exchange

With assistance for FHWA, ARC and the Georgia Tech Center for Quality Growth and Regional Development hosted the Freight Planning and Regional Cooperation in the Piedmont Atlantic Megaregion Peer Exchange on January 31-February 1, 2017. Multiple MPOs and DOTs from throughout the Piedmont Atlantic Megaregion (Alabama, Georgia, Tennessee, North Carolina, and South Carolina) were in attendance.

The Peer Exchange sought to:

- Exchange information on freight planning developments in the public and private sectors
- Discuss topics of mutual interest to agencies and stakeholders in the megaregion (e.g., freight and other topics)
- Explore opportunities for better cooperation between public agencies and private sector freight providers and consumers in the megaregion
- Develop a framework for ongoing collaboration.

The first day of the peer exchange focused on private sector collaboration, and the second day focused on ongoing planning and cooperation. The second day included a presentation on the SHRP2 visioning work as port traffic and autonomous vehicles, both key future players in goods movement, were both included as drivers of change.

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Appendix B

TRENDS AND FORECASTS

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TRENDS & FORECASTS

Creating the Vision: Alternative Futures for the Atlanta Region

Stakeholder Advisory Committee

March 30, 2016

Atlanta region's growth far exceeds that of both the state and nation, and is among the fastest in the nation

Legend: ■ United States ■ Georgia ■ 20-County

Bar chart data:

Period	United States	Georgia	20-County
1990-2015	28%	54%	82%
2000-2015	13%	22%	31%
2010-2015	3%	3%	5%
2015-2040	17%	26%	41%

2015 Population
US: 321 M
Georgia: 10.1
20-County: 5.6 M
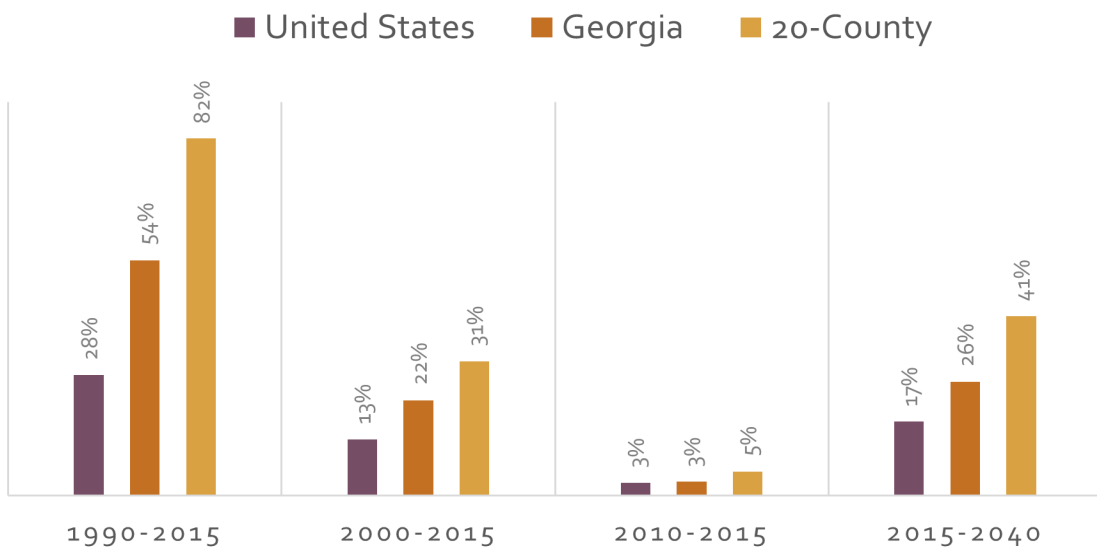
2040 Population
US: 374 M
Georgia: 12.7 M
20-County: 8.1 M

Source: U.S. Census, ARC

1 Million

Number of new residents added to the region in the 2000s. The region ranks 7th in most new residents since 2010. While growth rate has slowed down in the recent years, Atlanta's population is expected to continue to outpace the state and the country for decades to come.

While regional population growth will be strong, the region will have a smaller share of working age people.

U.S. median age is projected to rise to 42 by 2065

The rapid increase in median age reflects the rising proportions of seniors due to lower birthrates and increased longevity.

Census projects that by 2060, the life expectancy for an average American will be almost 86.

Source: Pew Research Center

DEMOGRAPHIC & SOCIETAL FACTORS
Aging of Population; Spatial, Racial, and Economic Inequity; Online Shopping; Telecommuting
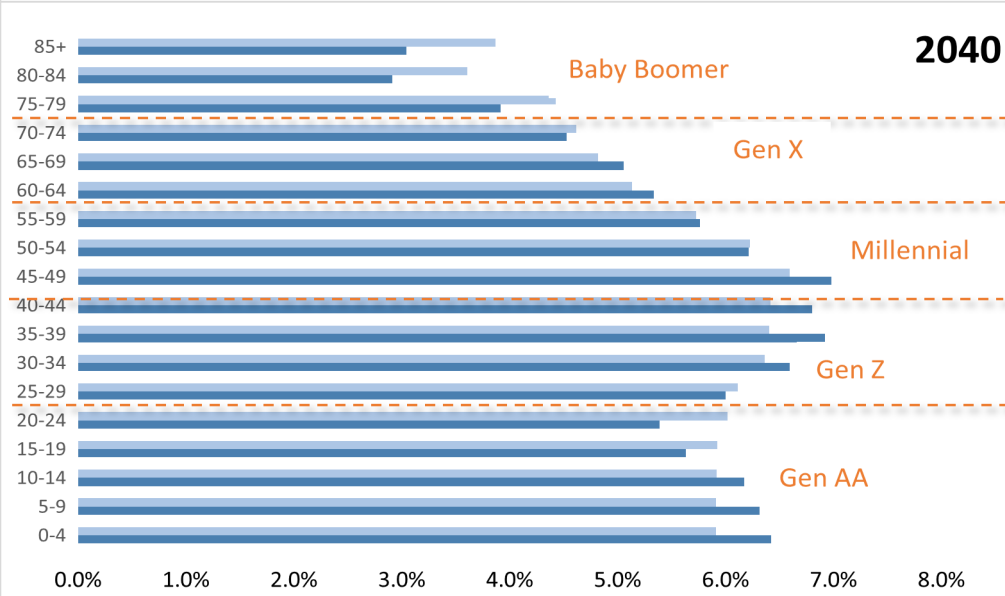
2

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More Americans Face Economic, Racial and Spatial Inequity

Change in Black Concentration of Poverty since 2000
(Metropolitan and Micropolitan Areas)

Black Concentration of Poverty Change
- Less than -10%
- -10% to -5%
- -5% to 0%
- 0 to 5%
- 5% to 10%
- More than 10%

Source: The Century Foundation Study, US Census
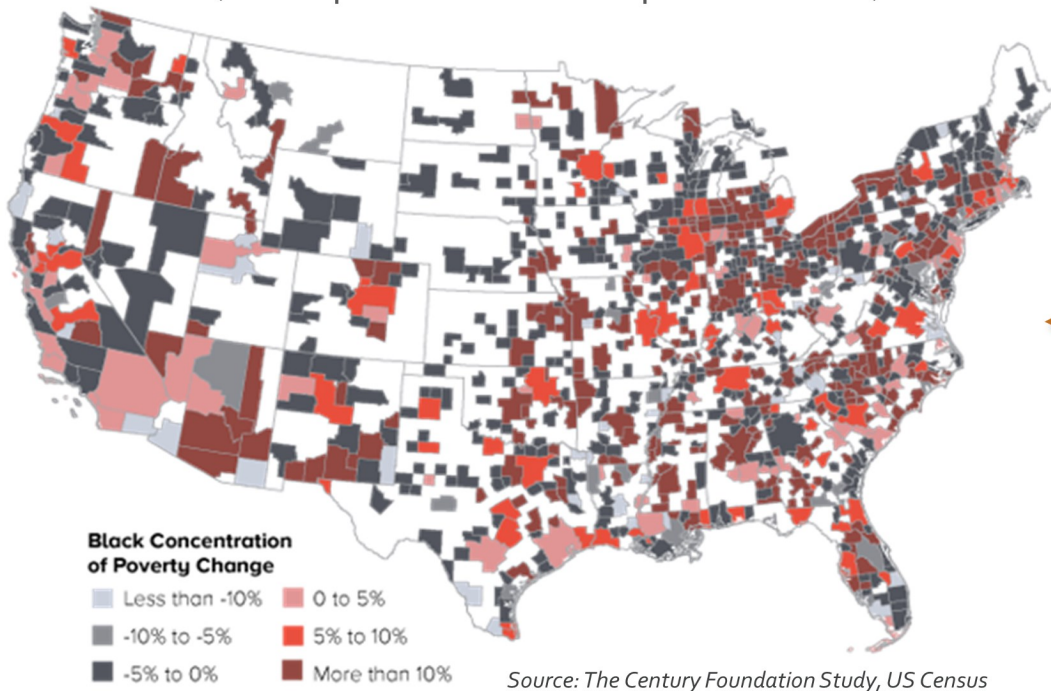
Nationwide, number of people living in "concentrated" poverty, or neighborhoods with high poverty rates, has nearly doubled from 7.2 million in 2000 to 13.8 million people by 2013 - the highest figure in history. Concentrated poverty grew much faster in small and medium sized metros (e.g., Syracuse, Dayton) while concentrated poverty saw a decline in larger metros (e.g., Atlanta, LA, Washington D.C).

-3.1% Decline in concentrated poverty in metro Atlanta since 2000

Atlanta Region: % Population in Poverty

Poverty: % Population in poverty
- 38.3 to 100
- 23.1 to 37.7
- 11.7 to 22.9
- 0 to 11.5
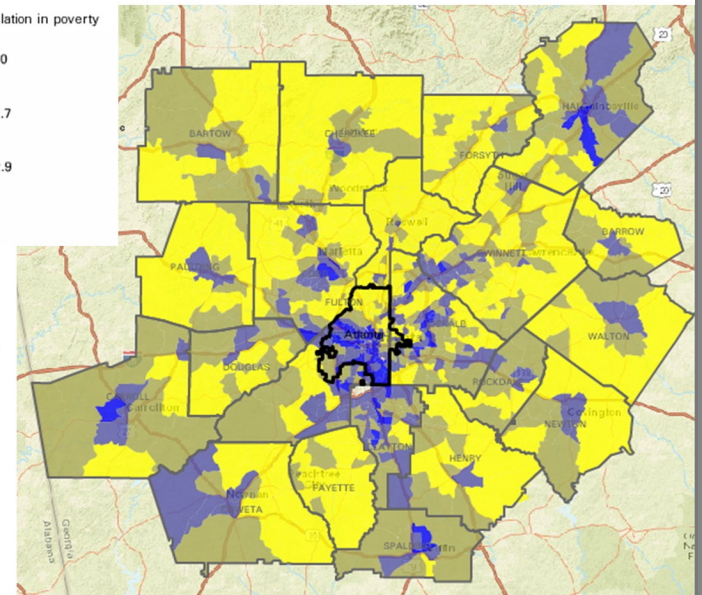
Source: ACS 2010-2014 via Neighborhood Nexus

1 in 4 Black & 1 in 6 Hispanic Americans live in high-poverty neighborhoods, compared to just 1 in 13 of their white counterparts

As with other regions, high concentrations of poverty in the Atlanta region are no longer exclusive to the urban core, but have also spread to the suburbs

DEMOGRAPHIC & SOCIETAL FACTORS
Aging of Population; Spatial, Racial, and Economic Inequity; Online Shopping; Telecommuting

3

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How Atlanta Region Compares to the Nation in Age

2015

Eisenhowers/Silents

Baby Boomer

Gen X

Millennial

Gen Z

(85+, 80-84, 75-79, 70-74, 65-69, 60-64, 55-59, 50-54, 45-49, 40-44, 35-39, 30-34, 25-29, 20-24, 15-19, 10-14, 5-9, 0-4 / 0.0% 1.0% 2.0% 3.0% 4.0% 5.0% 6.0% 7.0% 8.0%)
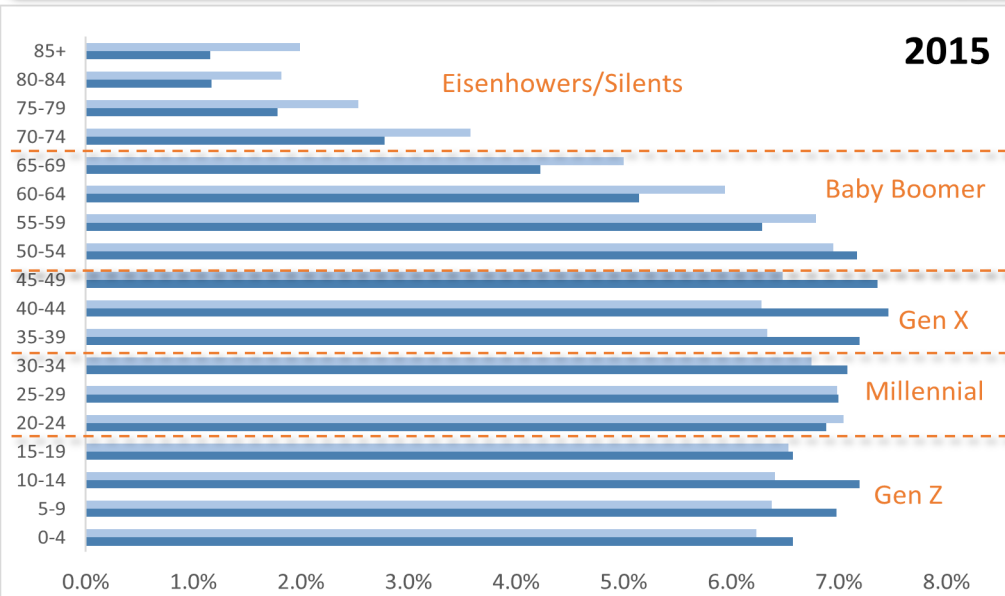
(Percentage of Total Population)
- United States ■ 20-County

Source: U.S. Census, ARC

Atlanta, very young now, will look more like the nation in older groups by 2040 but will be less like the nation in younger groups. The region currently has the lowest share of population over the age of 65, but this is the fastest-growing age group.

2040

Baby Boomer

Gen X

Millennial

Gen Z

Gen AA

(85+, 80-84, 75-79, 70-74, 65-69, 60-64, 55-59, 50-54, 45-49, 40-44, 35-39, 30-34, 25-29, 20-24, 15-19, 10-14, 5-9, 0-4 / 0.0% 1.0% 2.0% 3.0% 4.0% 5.0% 6.0% 7.0% 8.0%)

1.5 Million

Number of people in the 20-county area over the age of 65 by 2040, roughly making up 20% of the population

29%

Share in 2040 of metro Atlanta's population under the age of 20, making it one of the youngest metro areas in the Southeast and the nation.

DEMOGRAPHIC & SOCIETAL FACTORS
Aging of Population; Spatial, Racial, and Economic Inequity; Online Shopping; Telecommuting

4

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Working at Home is on the Rise

4.2 Million
Increase in number of Americans who worked from home between 1997 and 2010

Characteristics of a Home-Based Worker:
More likely in the private sector, and growing quickly in computer, engineering, and science sectors – 70% growth between 2000 and 2010

Source: U.S. Census

20-County Share of Telecommuters
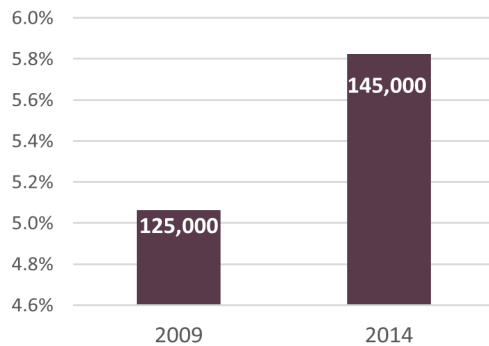
In 2014, nearly 145,000 (5.8%) workers in the Atlanta region telecommuted least one day a week – 20,000 more than 5 years earlier.

A strong desire for teleworking in the region is reflected in the ARC's Region's Plan Survey. 77% of the participants want to telework at least 2 days a week.

If it is possible for you, how many days a week, on average, would you like to telework?

WEEK ONE						
Sun	Mon	Tues	Wed	Thrs	Fri	Sat
0 Days	1 Day	2 Days	3 Days	4 Days	5+ Days	
10%	13%	26%	20%	8%	23%	

U.S. E-Commerce Sales Predictions

eMarketer Projections   Forester Research Projections
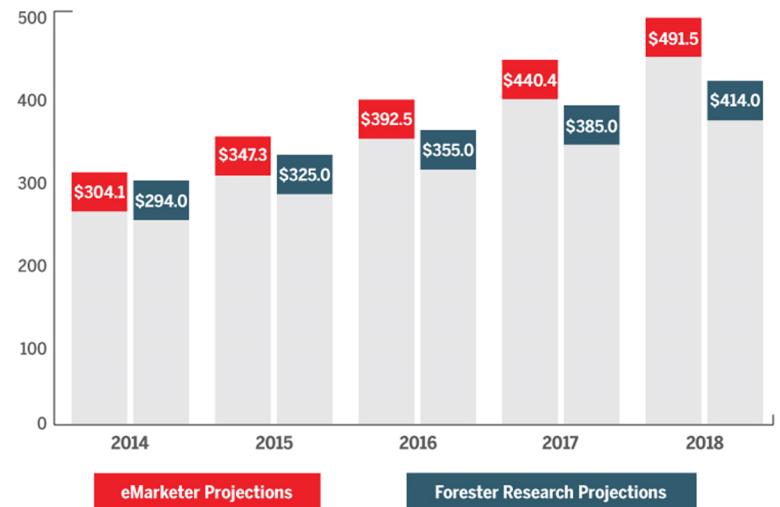
Source: eMarketer, Forrester Research

Every year, more than 100 million Americans shop online, according to Forrester Research. By 2018, online sales are expected grow to over $400 billion and account for 11% of total sales in the U.S.

DEMOGRAPHIC & SOCIETAL FACTORS
Aging of Population; Spatial, Racial, and Economic Inequity; Online Shopping; Telecommuting

5

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64

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A Surge in the Global Middle Class

Population (millions) chart showing Poor, Middle Class, and Rich categories from 2000 to 2030.

Source: Brookings Institute
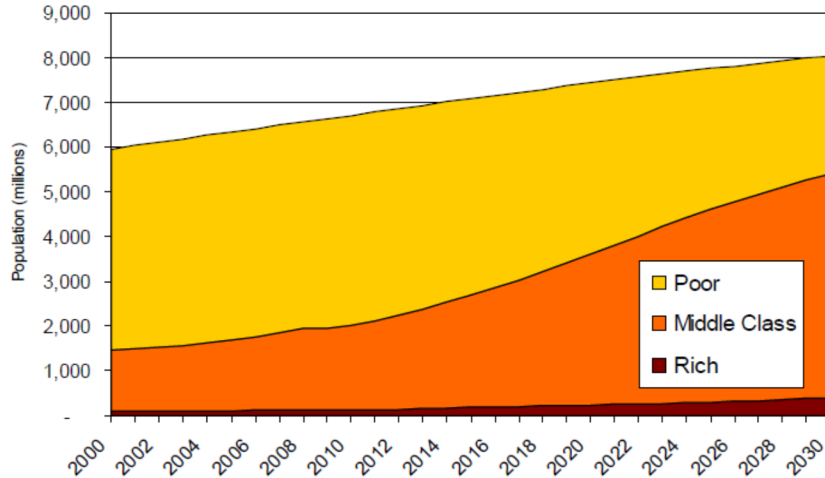
3 Billion

Growth in global middle class expected in the next 2 decades. Middle classes are an important driver of growth because they are a major generator of demand in the global economy.

75%

Share of U.S. jobs in the service industry today. Service industry is projected to generate 9.8 million new jobs in the next 10 years.

Fast-Growing Jobs in Service and Technology

U.S. Projected Growth STEM vs. Non-STEM Jobs

- Non-STEM Jobs
- STEM Jobs

6.4% 8.8%

2014-2024
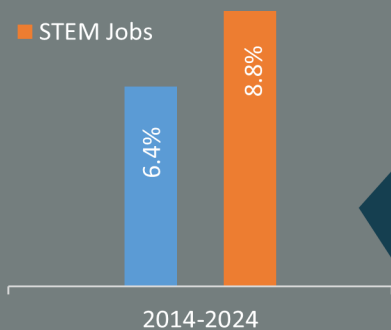
7.9 Million

Number of Science, Technology, Engineering, and Mathematics (STEM) workers in the U.S. in 2014 – about 1 in 20. STEM jobs have grown 3 times as fast as non-STEM jobs in the last decade. STEM job growth will continue to outpace non-STEM jobs.

STEM Workers

STEM workers earn about 25% more than non-STEM workers and over 2/3 of STEM workers have at least a college degree.

U.S. Service-based Job Trends

Millions (2006–2015)
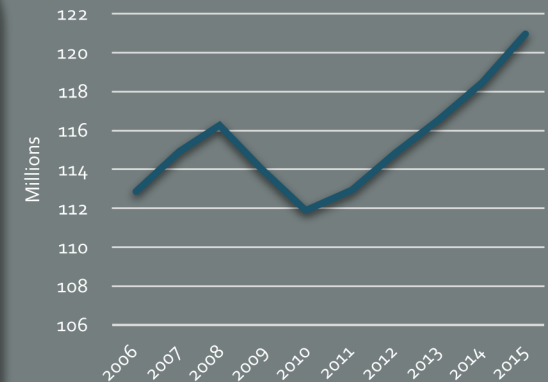
Source: Bureau of Labor Statistics

ECONOMICS
Emerging Global Middle Class; Jobs in Service and Technology-based Industries Requiring Specialized Education

6

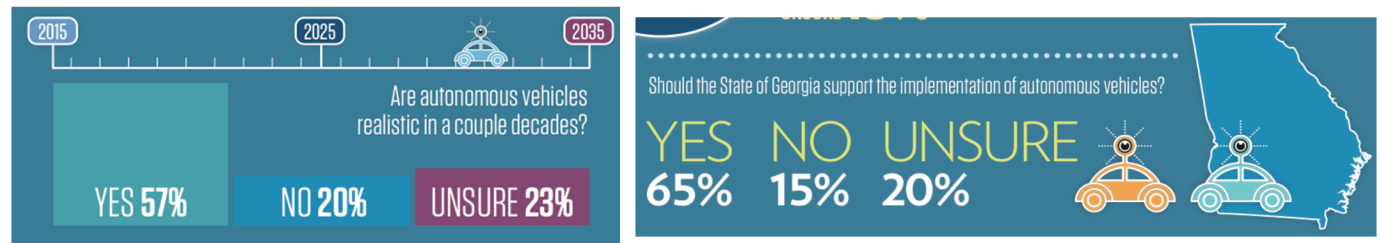# Atlanta Region Continues to Outperform the Nation in Job Growth

Atlanta MSA vs. U.S.

Year-Over-Year % Change: Total Employment 2008-Present ■ ATL ■ US

> Job openings suggest a recent trend in the demand for more technical expertise in the labor force. In 2015, software developer was the most demanded occupation for the region.

Top Occupations in Atlanta Region

Occupation	
Software Developers, Applications	12,531
Heavy and Tractor-Trailer Truck Drivers	7,523
Registered Nurses	7,181
Retail Salespersons	5,105
Sales Representatives, Wholesale and...	4,995
Computer Systems Analysts	3,980
First-Line Supervisors of Retail Sales Workers	3,270
Managers, All Other	3,161
Business Intelligence Analysts	3,138
Customer Service Representatives	2,958

(Job Postings during 6 months in 2015)

Source: Burning Glass

20-County Employment Growth 2015- 2040

Industry	Growth
Public Admin	28.5%
Other Services	13.3%
Food Service	36.5%
Arts/Entertainment	32.7%
Health Care	52.7%
Educational	69.9%
Admin Mgmt	33.5%
Management of...	10.6%
Scientific/Technical...	46.8%
Real Estate	40.3%
Finance/Insurance	22.1%
Information	11.8%
Warehousing	7.0%
Retail Trade	29.7%
Wholesale Trade	23.0%
Manufacturing	7.7%
Construction	90.3%
Utilities	-21.5%
Mining/Oil and Gas	65.5%
Ag Forestry Fishing	-14.3%

37%
Job growth projected in the region between 2015 to 2040 - from 2.9 million to 3.96 million. Educational Services is expected to add more than 160,000 jobs, the highest growth (53%) in the region.

Source: U.S. BLS, ARC

ECONOMICS
Emerging Global Middle Class; Jobs in Service and Technology-based Industries Requiring Specialized Education

7

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Government agencies and private industries are increasingly investing technological advances in transportation

U.S.DOT and National Highway Traffic Safety Administration have been pursuing vehicle-to-vehicle communication technology to enhance safety and reduce congestion. In 2014, the DOT released the ITS Strategic Plan which details features of the Advanced Driver Assistance Systems (ADAS) that are increasingly included in passenger vehicles.

Local Perspective on Autonomous Vehicles

According to the Region's Plan Survey, the majority of survey participants appear to support the implementation of autonomous vehicles, and believe that this could happen in the not-too-distant future.

2015 2025 2035

Are autonomous vehicles realistic in a couple decades?

YES **57%**   NO **20%**   UNSURE **23%**

Should the State of Georgia support the implementation of autonomous vehicles?

YES **65%**   NO **15%**   UNSURE **20%**

Predictions by Industry Experts...

250 Million

Number of connected vehicles on the road by the end of the decade. 1 in 5 cars will have wireless connectivity by 2020. (Gartner Inc)

$200 Billion

Market value of ADAS by 2024, growing from $11.1 billion in 2014 to $91.9 billion by 2020 (ABI Research)

IBM interviewed 175 auto executives who generally agreed that by 2025, while cars will become more personalized for drivers, fully autonomous vehicles will not be commonplace.
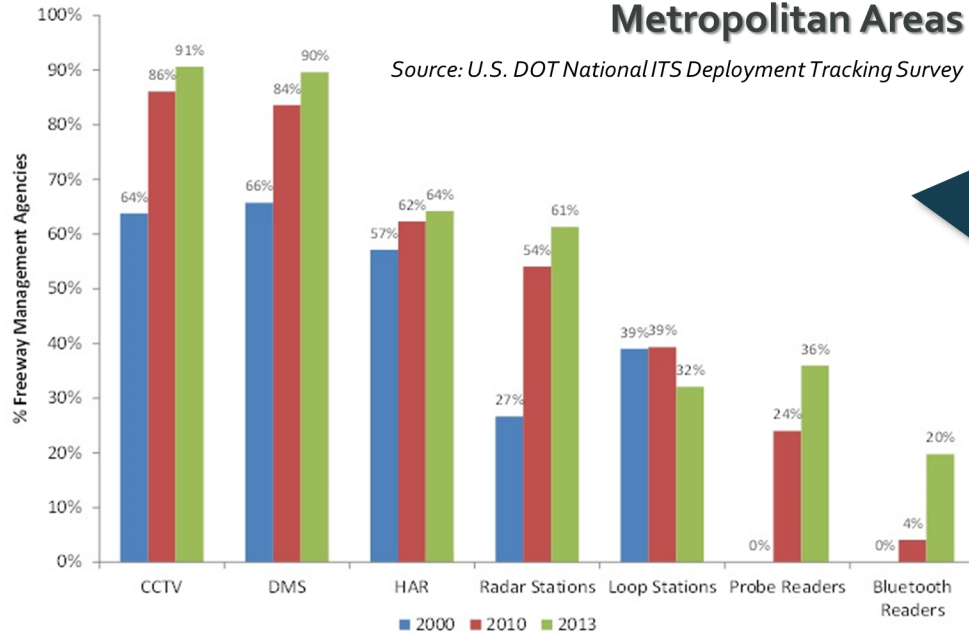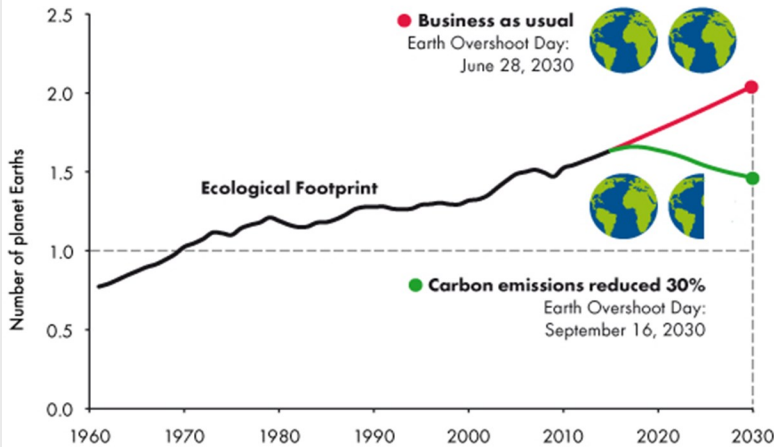
TECHNOLOGY
Adoption of ADASs and Autonomous/Connected Vehicles; Use and Affordability of Ride-share/Car-share Options; Advanced ITS

8

Car-sharing services provide new options for millions of Americans

U.S. Car-sharing Membership Growth:
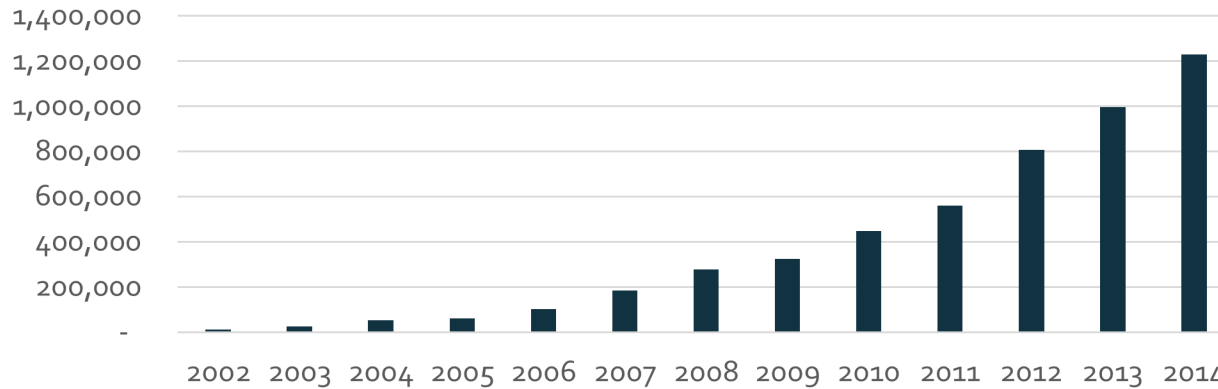
1.2 Million

Number of members in U.S. car-sharing programs sharing over 17,000 vehicles as of January 2014

Source: Transportation Sustainability Research Center of University of California Berkeley

Availability of Technology- Enabled Transportation Services in the City of Atlanta (as of February 2015)

Ride-sourcing	Round-trip car-sharing	One-way Cars-haring	Peer-to-peer car-sharing	Ridesharing	Taxi hailing	Bike-sharing	Open Static Data	Real-time information	Multi-modal apps	Virtual Ticketing
(2) Lyft, Uber	(2) Zipcar, Enterprise	(0) none	(1) RelayRides	(0) none	(1) Curb	(0) none	(2) Google Transit, GTFS	(3) Moovit, Transit App, Transit Authority	(1) Ridescout	(0) none

Source: U.S. Public Interest Research Group

21th — Ranking of City of Atlanta (Out of 70 U.S. cities) in technology-enabled services - 7 services with 12 providers

TECHNOLOGY
Adoption of ADASs and Autonomous/Connected Vehicles; Use and Affordability of Ride-share/Car-share Options; Advanced ITS

9

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68

ITS is expanding to make use of vehicle technology and advanced data collection to increase safety, mobility and fuel efficiency

Technologies Adopted by Freeway Agencies in Metropolitan Areas

Source: U.S. DOT National ITS Deployment Tracking Survey

Legend: ■ 2000 ■ 2010 ■ 2013

Adoption of CCTV and Dynamic Message Signs by freeway agencies has expanded drastically since 2000; these technologies are well on their way to 100% adoption in the near future. The data on adoption of sensor technologies show a movement away from the traditional loop stations to more high-tech alternatives like radar detectors and probe readers (e.g., Bluetooth).

Regional trends show that year-by-year ITS deployment may vary but the general trajectory is upward.

Get directions, recommendations, other info related to your location
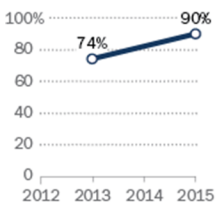
9 in 10
Number of smartphone owners who use their devices to get location-based information based on Pew Research Survey

18-County ITS Deployment Trends

Legend:
■ No. of Highway Emergency Response Operator (HERO) Vehicles
■ No. of Ramp Meters
■ No. of Changeable Message Signs
■ No. of Video Traffic Detection Cameras
■ No. of Surveillance Cameras
■ Miles of Surveillance (Fiberoptic Cable)

Source: GDOT

TECHNOLOGY
Adoption of ADASs and Autonomous/Connected Vehicles; Use and Affordability of Ride-share/Car-share Options; Advanced ITS

10

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Our Demand for Resources Increasingly Exceeds Earth's Biocapacity

How many Earths does it take to support humanity?

- **Business as usual**
  Earth Overshoot Day:
  June 28, 2030
- Ecological Footprint
- **Carbon emissions reduced 30%**
  Earth Overshoot Day:
  September 16, 2030

1.5

Earth's worth of renewable resources we consumed in 2015. This human demand-to-planet ratio has increased 2.5 times since 1961.

Source: Global Footprint Network

Ecological Footprint

Measures how much land and water humans require to produce the resources we consume and to absorb CO2 emissions

- 1.3 Laos
- 1.2 Indonesia
- 1.3 Philippines
- 4.9 Malaysia
- 1 Cambodia
- 10.7 United Arab Emirates
- 8 USA
- 5.3 Singapore
- 2.4 Thailand
- 2.2 China
- 1.8 Myanmar
- 1.4 Vietnam

2013 Energy Consumption per Capita (Million BTU)

US	GA
307	280
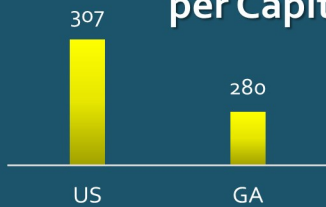
34th

GA's rank in total energy consumption per capita. This rate is significantly below the national average.

1/3

Share of CO2 emissions responsible by the transportation sector. The long trend of increased CO2 emissions in the region is on the decline, and will continue to do so. This decline is more noteworthy on a per-capita basis, consistent with the state's trend.

Region's Absolute and Per Capita Transportation CO2e Emissions
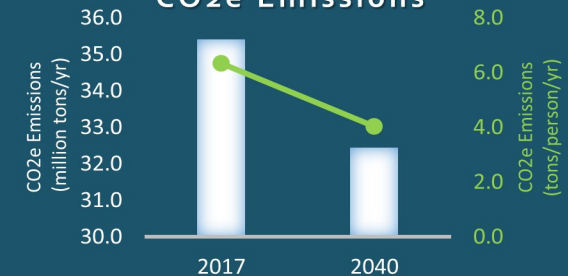
Source: U.S. Energy Information Administration, ARC

ENVIRONMENT AND ENERGY
Natural Resource Constraints; Intensity and Unpredictability of Weather Conditions

11

WINNING THE FUTURE | SHARPENING OUR FOCUS
C08 Volume 2: Scenario Development Process

70

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Last year, every state in the country experienced warmer weather than the 20th century average

Rise in Global Temperature Since 1880

2014:
0.69°C above the global
20th century average

Average global
20th century
temperature:
13.9°C (57.0°F)

Linear trend
of rising
temperatures

+1.0°C
+0.5°C
-0.5°C

1880 1890 1900 1910 1920 1930 1940 1950 1960 1970 1980 1990 2000 2010
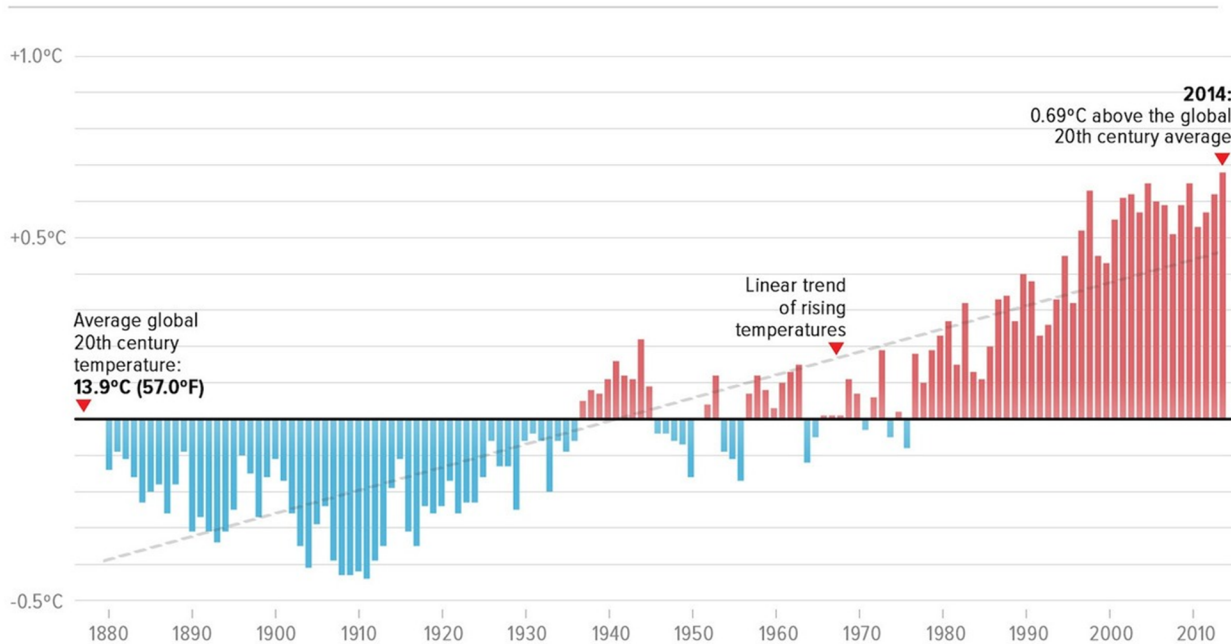
Source: National Oceanic and Atmospheric Administration (NOAA)

2014 was the warmest year on record for U.S and last year was a close second.

0.42 cm

Rise in global sea levels every decade since 1880. Sea levels are expected to continue to rise due to increasing global temperature, thermal expansion and the melting glaciers.

U.S. National Climate Assessment

In 2014, President Obama released the 3rd U.S. National Climate Assessment, in which the Southeast region was identified as exceptionally vulnerable to sea level rise, extreme heat events, hurricanes, and decreased water availability.

ENVIRONMENT AND ENERGY
Natural Resource Constraints; Intensity and Unpredictability of Weather Conditions

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Federal Highway Trust Fund Faces Growing Shortfalls

Federal Highway Trust Fund: Actual and Projected Revenue and Outlays, 2000-2025

Source: Pew Charitable Trust

Legend:
- Revenue
- Projected revenue
- Transfers from general fund
- Actual outlays
- Projected outlays
- Actual end-of-year balance
- Projected end-of-year balance
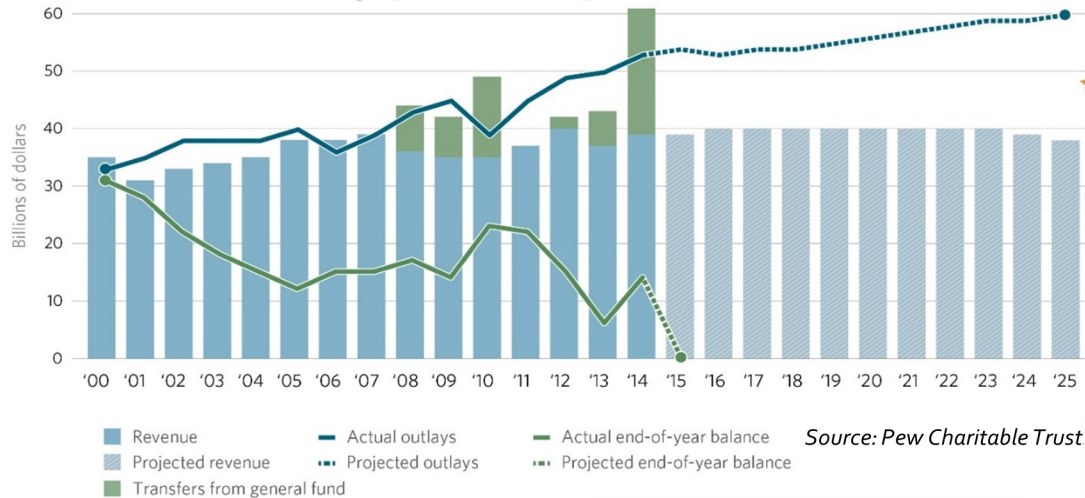
The gap over the last decade between the highway trust revenue and spending is expected to continue to widen. A major reason for this growing shortfall is the decline in gas tax revenue as a result of changing driving habits and increased fuel efficiency.

HOT/Express lanes in the U.S. are rapidly expanding as MAP21 enabled the conversion of existing HOV lanes to HOT lanes.

I-85 HOT Lane Usage

$1.35

$1.72

21,160

18,223

2012   2013

- Average Weekday Trips
- Average Daily Toll

Source: U.S. DOT

In 2008, Atlanta converted an existing 16-mile stretch of HOV2+ lanes on I-85, to HOT lanes. Between 2012 and 2013, the trips on the HOT lanes increased by 16%, triggering the rise in average toll prices from $1.35 to $1.72.

$10
Record high roundtrip cost of HOT lanes in 2015

Express Lanes/HOT and HOV Lanes by State
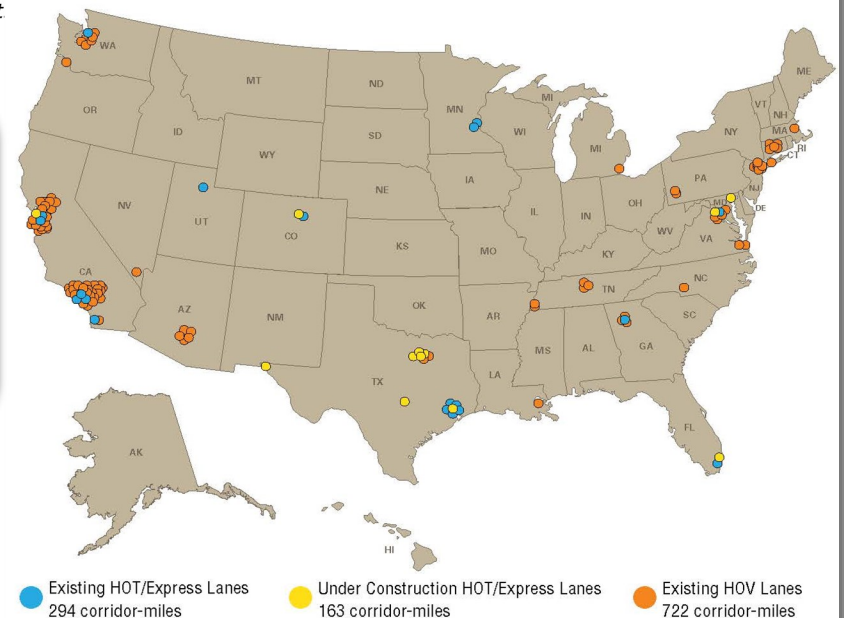
- Existing HOT/Express Lanes — 294 corridor-miles
- Under Construction HOT/Express Lanes — 163 corridor-miles
- Existing HOV Lanes — 722 corridor-miles

Source: Texas A&M Transportation Institute

GOVERNMENT AND POLICY
Alternative Financing Options; PPPs in Transportation Financing; Congestion Road Pricing; Climate Change Regulations

13

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Local governments are viewing PPPs as increasingly viable options

Although a latecomer to PPP financing agreements, GDOT is currently using the strategy to construct the express lanes on the I-75/I-575 corridor (under construction) as well as the reconstruction of the I-285/GA 400 interchange and Collector-Distributor (CD) lanes on GA 400.

Transportation Public-Private Partnerships (PPPs) by State, 1985-2011

Number of PPPs (by state)
- 0
- 1-4
- 5-9
- 10+
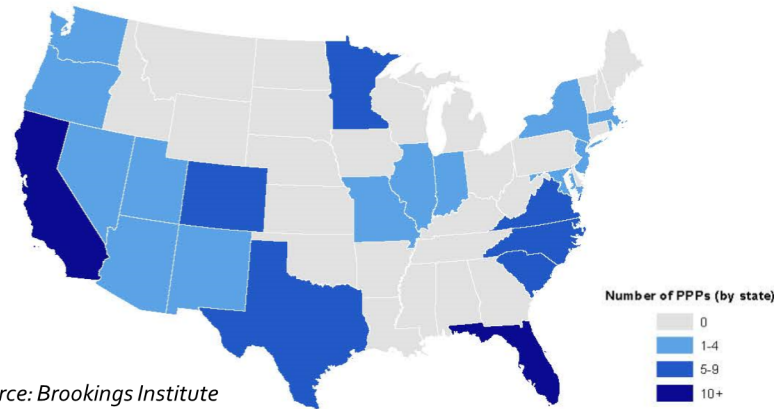
Source: Brookings Institute

Many countries believe that climate is one of the greatest environmental and public health challenges of today

Global Opinions on Climate Change Solutions

Our country should limit greenhouse gas emissions as part of an int'l agreement

Oppose	Support
12%	78%

To reduce the effects of global climate change ...

Technology can solve the problem w/o major changes	People will have to make major lifestyle changes
22%	67%
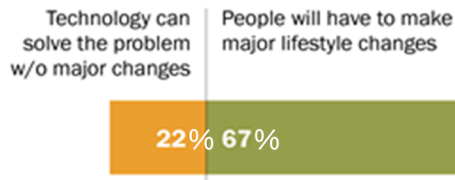
Source: Pew Research Center

A significant majority (78%) of a 2015 Pew survey participants support the idea of their country implementing new policies and regulations to deal with climate change.

Clean Power Plan

President Obama and EPA announced the Clean Power Plan on August 3, 2015, which requires states to significantly reduce the greenhouse gas emissions that come from coal-fired power plants. The Plan provides the first-ever national standards that address carbon pollution from power plants.

GOVERNMENT AND POLICY
Alternative Financing Options; PPPs in Transportation Financing; Congestion Road Pricing; Climate Change Regulations

14

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Appendix C

GAME CARDS OF POTENTIAL DISRUPTIVE EVENTS

AUTONOMOUS
VEHICLES
(The Dream Dies)

The proving ground trials end in disaster and Congress outlaws the operation of autonomous vehicles carrying people on public ROW. Remote drone deliveries are still allowed.

AUTONOMOUS
VEHICLES
(Half Full /
Half Empty)

The proving ground trials are generally successful, but minor security glitches have not been eradicated fully. Most people are not concerned and the technology is embraced, although not universally, resulting in a mixed fleet.

AUTONOMOUS
VEHICLES
(Arrested Potential)

The proving ground trials produced mixed results that made the public skeptical of the technology. Autonomous vehicles are permitted in certain contained environments and in a small number of states, but not widely adopted.
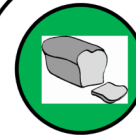
AUTONOMOUS
VEHICLES
(Sliced Bread)

The proving ground trials are successful beyond anybody's expectations and the public is very enthusiastic. Adoption of the technology is nearly universal, but a few nostalgic individuals who simply enjoy driving remain on the roads.

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RIDESHARING / CARSHARING

Under the belief that autonomous vehicles would soon be a reality, the region's TDM programs are allowed to languish throughout much of the 2020s.

RIDESHARING / CARSHARING

As public outrage over congestion threatens to boil over and roadway expansion options become increasingly difficult and expensive, funding levels for TDM programs triple in the 20202s

RIDESHARING / CARSHARING

Major roadway expansion projects, including the managed lane program, are terminated under the assumption that they will no longer be cost effective in a world dominated by autonomous vehicles.

RIDESHARING / CARSHARING

Every regional job center is required to offer free parking to vanpools or carpools with four or more occupants (and simultaneously raise rates on SOV drivers).

RIDESHARING / CARSHARING	ATL Transit (the successor agency to MARTA) forges a unique partnership with Uber to help riders share rides to and from rail stations using their BreezeTwo cards.
RIDESHARING / CARSHARING	Google teams with Uber to corner the market for on-demand trip services. Today, not a single taxi company is in operation in the Atlanta region.
RIDESHARING / CARSHARING	Many large businesses and apartment/condo developments offering access to shared electric vehicles for local trips for their tenants.
RIDESHARING / CARSHARING	The ease and low cost of sharing rides in an impromptu manner has rendered centrally managed large scale carpooling and ridesharing programs antiquated and unnecessary.

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PORT TRAFFIC

Little shift in global shipping routes occurs following the Panama Canal expansion and the deepening of the Port of Savannah. Consumer demand grows at a slow, measured rate.

PORT TRAFFIC

A terrorist attack at the Bailey Yard, the country's largest rail yard, in Nebraska exposes the vulnerability of cross country rail shipping.

PORT TRAFFIC

A debilitating seven month labor strike at the Port of Los Angeles and Port of Long Beach creates a substantial shift in cargo traffic to eastern ports.

PORT TRAFFIC

Increased environmental awareness results in a booming market in locally produced goods. Purchasing an imported version of anything made locally now carries a social stigma, especially among Millenials and Generation Z.

PORT TRAFFIC

Truck traffic from Savannah has leveled off after several years of double digit annual growth in the 2020s.

PORT TRAFFIC

Due to increased freeway congestion and improved rail networks, truck traffic between Savannah and Atlanta is now at a 30 year low.

PORT TRAFFIC

Normalization of relations with Cuba leads to an economic resurgence where a hybrid communist / capitalist system similar to China takes root. Trade booms and the Port of Savannah becomes our country's new "front door" to Havana.

PORT TRAFFIC

Public backlash to increasing volumes of trucks leads to a ban on the development of additional distribution and warehousing facilities in Henry County.
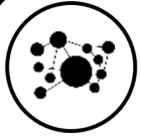
INTELLIGENT INFRASTRUCTURE

Major investments in Vehicle to Infrastructure communications were made in the 2010s and 2020s in anticipation of the advent of autonomous vehicles.
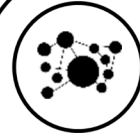
INTELLIGENT INFRASTRUCTURE

Holoworking (a more immersive evolution of the teleworking concept) has enabled almost half of white collar professionals to work from home a majority of the time.
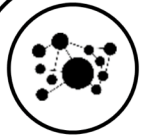
INTELLIGENT INFRASTRUCTURE

The private sector continues to make major strides in collecting, processing and distributing transportation related data. Most public agency ITS programs are now considered obsolete and redundant.
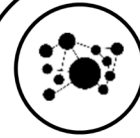
INTELLIGENT INFRASTRUCTURE

Long range electric autos, capable of being driven 500 miles on a single change and which can be recharged in less than 15 minutes are a reality.

INTELLIGENT INFRASTRUCTURE

Young adults rely heavily on technology to substitute for travel whenever possible, but telework is not prevalent due to the fact that most of them access the Internet via mobile devices.
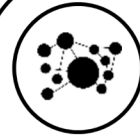
INTELLIGENT INFRASTRUCTURE

Despite its best efforts, Tesla is unable to produce an affordable electric vehicle with a range of more than 200 miles. While popular in urban areas, gas powered vehicles still predominate in rural areas and for long distance travel.

INTELLIGENT INFRASTRUCTURE

Major data breaches within the financial sector led to an epidemic of identify theft in the 2020s. Many wary consumers now live a 21st century version of being "off the grid" by shunning technology which relies on the use of personal information.
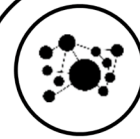
INTELLIGENT INFRASTRUCTURE

China and the U.S. engage in a trade war in which results in our inability to secure a reliable and affordable supply of the rare earth metals necessary for electric vehicle batteries.

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TRANSPORTATION FINANCE

Significant funding is directed to last mile access, operational and safety projects (including new interchanges and connector roads) around manufacturing, warehousing and distribution centers.

TRANSPORTATION FINANCE

The federal transportation program now focuses almost exclusively on ensuring resiliency and reducing the carbon footprint of travel. Funding for major roadway capacity expansions is virtually non-existent.

TRANSPORTATION FINANCE

A combination of gas tax increases and a congestion surcharge program has enabled funding to keep pace with inflation without any additional general fund bailouts.

TRANSPORTATION FINANCE

Prioritization of transportation funds to more eco-friendly modes has resulted in an ATL Transit system serving 12 counties with over 350 bus routes and a rail network encompassing 220 miles of track and 139 stations.

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TRANSPORTATION FINANCE

Almost 100% of available funding is dedicated to ITS and state of good repair projects to ensure the system operates at maximum efficiency.

TRANSPORTATION FINANCE

A comprehensive national high speed rail network results in the inability of airlines to compete effectively along most routes of less than 300 miles. Today, no commercial flights are available between Atlanta and several major SE cities, including Charlotte, Nashville & Savannah.

TRANSPORTATION FINANCE

The federal transportation program now focuses exclusively on maintaining the interstate highway system and improving intermodal freight connections. Federal spending is now less than half of its high point and many responsibilities are now devolved to the states to manage.

TRANSPORTATION FINANCE

Federal gas taxes have risen a few times, but not enough to keep up with the increases in fuel economy.

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TRANSPORTATION FINANCE

The Georgia Constitution's restriction on using motor fuel tax money solely on roads and bridges has been repealed.

TRANSPORTATION FINANCE

A half penny MARTA sales tax increase was passed in Atlanta in 2016, followed by a quarter penny in the rest of Fulton County in 2018, and DeKalb County and Clayton County in 2020.

TRANSPORTATION FINANCE

Cities and counties are allowed to impose a motor fuel tax of up to five cents per gallon and use proceeds for any transportation purpose.

TRANSPORTATION FINANCE

Gwinnett County and Cobb County have eliminated their local transit systems and are now full funding participants in ATL Transit (the successor agency to MARTA).

$

TRANSPORTATION FINANCE

Increased funding for MARTA fails to materialize and the agency is unable to expand its rail network.

AGING OF THE POPULATION

Older adults, uncomfortable with traffic and unable to grasp the rapid changes in technology required to get around easily, began concentrating in areas served by transit. Aging in place became a dream that only a few could actually achieve.

$

TRANSPORTATION FINANCE

Economic stagnation generates a strong anti-tax backlash that results in the failure of every SPLOST vote over the past two decades. Local governments struggle to match federal funds and GDOT and a few CIDs are now virtually the only implementing agencies of note.

AGING OF THE POPULATION

Older adults are flocking to communities which offer autonomous vehicle fleets and other mobility options. Many of these communities are now designed to resemble European cities rather than sprawling suburban expanses.

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AGING OF THE POPULATION	Spurred by medical advances that dramatically slow the aging process, more people are now working well into their 70s and 80s.	AGING OF THE POPULATION	ATL Transit (the successor agency to MARTA) introduces the "At Your Service" autonomous van circulator and shuttle system.
AGING OF THE POPULATION	The number of retirement communities has not grown considerably since the majority of people are opting to "age in place" instead.	AGING OF THE POPULATION	Cutbacks in Medicare and Medicaid funding, combined with the effects of increasingly sedentary lifestyles, has resulted in life expectancies dropping to 72 for men and 76 for women.

AGING OF THE POPULATION	Universal healthcare coverage, which includes free semi-annual physicals, and a strong campaign to introduce exercise breaks into the workplace has extended life spans to 83 years for men and 89 years for women.

AGING OF THE POPULATION	Smaller and more dispersed families results in huge numbers of older adults with no choice but to rely on assisted living centers and nursing homes in their later years.

AGING OF THE POPULATION	The zombie apocalypse finally arrives. Older adults are the first to be sacrificed because they can't run as fast.

AGING OF THE POPULATION	Baby Boomers have continued their reliance on the auto as their primary travel mode, creating widespread concern related to the impacts to congestion and safety that elderly drivers may create.

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CLIMATE CHANGE

Although the overall climate is warmer, the most noticeable change in metro Atlanta is the frequency and intensity of late winter and early spring snow and ice storms. In the past 20 years, there have been 11 major winter weather events during the month of March.
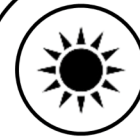
CLIMATE CHANGE

Spurred by a series of natural disasters in areas they represent, skeptical legislators pass climate change legislation which bans the sale of gasoline powered vehicles and requires that 90% of the nation's energy needs are met through renewable sources.

CLIMATE CHANGE

Incremental progress on climate change legislation is made by securing the support of a handful of skeptical members of Congress from districts where wind, geothermal, solar and tidal power generation were able to create significant private sector investment and good jobs.

CLIMATE CHANGE

Although it has been nine years since metro Atlanta last saw any measurable snowfall, average summer temperatures have not increased significantly. No discernible trend towards a drier or warmer summertime climate has yet emerged.

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CLIMATE CHANGE

Atlanta becomes the destination of choice for almost two million climate refugees from southern Florida and the Georgia / South Carolina low country in the 2030s and 2040s. Our metro population is now slightly more than 10 million.

WATER SUPPLY

The Water Wars are still going on, with South Carolina joining the festivities in 2025 over how water releases from Lake Hartwell and Clarks Hill Lake are being managed.

CLIMATE CHANGE

With little to no government involvement or economic impacts, the pace of technological advancements has managed to stabilize the level of greenhouse gases in the atmosphere.

WATER SUPPLY

The region experiences a drought of unprecedented scope and duration. Rainfall totals for the five years between 2029 and 2033 average only 67% of normal, with the worst occurring in 2032, when less than 24 inches of rain is recorded.

WATER SUPPLY The construction of Bellwood Quarry Lake (which opened in Westside Park along the Atlanta Belt Line in 2021) creates a development boom within the city because of the resilience it provides during droughts.

WATER SUPPLY The Atlanta region is limited by court order on the amount of water it can withdraw from Lake Lanier. Because of this, the north side of the region stagnates while the east and southern parts of the region (in the Flint River watershed) see an increase in development activity.

WATER SUPPLY The Water Wars, definitively decided in Georgia's favor in 2018, are a distant memory and the region continues to be good steward of our limited resources, even during droughts.

WATER SUPPLY Georgia suffers a decisive loss in the Water Wars and the size of the metro area begins to contract swiftly as water intensive suburban areas become unsustainable. By 2050, our population has shrunk to 3.7 million, of which nearly one-third are now in the much denser ITP.

EQUITY
Access to shared vehicle programs has enabled many people to have expanded education and job opportunities.

EQUITY
Installation and maintenance of solar panels and green roofs becomes a major growth industry in the region, providing good wages for trained workers.

EQUITY
SCAD Pad communities appealing to students, empty nesters and low income workers, are located throughout the metro area, even in affluent areas. They are typically adjacent to shopping centers and office buildings where the most excess parking existed.

EQUITY
Low cost and reliable robotics, combined with secure automated payment schemes, has decimated the demand for fast food workers and sales clerks.

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EQUITY

Racial, ethnic and social tensions continue to simmer and the fabled regional I-20 dividing line has become even more pronounced. Businesses on the north side are forced to offer up to twice the legal minimum wage to recruit workers to travel extraordinary distances for work.

WILD

HJAIA opens a sixth runway, dedicated solely for use by air cargo companies. This facility lures FedEx to relocate its hub operations from Memphis to Atlanta.

EQUITY

Technological advances have cut the noise of aircraft engines by up to 80%, making the Aerotropolis area a hotbed for development. Over the past 20 years, nearly 50% of the jobs created and over 30% of houses built in the region were within five miles of the airport.

WILD

For three years running in the early 2020s, Atlanta is pegged as having the worst congestion in the country in multiple reports produced by a variety of think tank groups.

Federal law now requires large metropolitan areas over 200,000 people to define and vigorously enforce urban growth boundaries.

Republicans secure the Presidency in 2016 and maintain control of both houses of Congress. Policy decisions at both the national and state levels lean more heavily to the benefit of rural and suburban areas, with the impacts felt for decades later.

To spur economic development in rural areas, the state now reimburses any city or county jurisdiction for up to 10 years of any waived property taxes included in an incentives package to lure businesses and investments meeting established thresholds.

Democrats sweep to power in both Washington and in several statewide Georgia offices in 2016 and 2018 elections. A closely divided state legislature is forced to better balance the needs of all parts of the state and being "anti-Atlanta" is no longer considered acceptable.

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Appendix D

SCENARIO NARRATIVES

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FULL STEAM AHEAD

Metro Atlanta continues to exhibit strong, steady growth. With a population of 9.2 million, the region has overtaken San Francisco, Washington and Houston to become the sixth-largest metro area in the country. Trends that were present in the first two decades of the 21st century continue, though at a moderately accelerated rate.

The young and well-educated, seeking walkable neighborhoods with easy access to transit, are flocking to trendy intown neighborhoods such as Midtown, Inman Park, West End, and Oakland City. The recently-completed Atlanta BeltLine features dense housing and a popular light rail line along its entire 26-mile loop.

A firm commitment to the provision of affordable housing within the city remains elusive, so families in search of affordable housing continue to look primarily outside the Perimeter. Once-rural areas in Forsyth and Bartow counties are now bustling bedroom communities. The rise of Uber, Lyft and other ride-hailing services enables many intown dwellers to get by with one car; however, the average time drivers spend commuting to work each day still continues to increase due to housing and land use patterns.

In-migration greatly surpasses natural population growth as more people are marrying later in life and are having fewer children. Older adults continue to make up an ever-increasing proportion of the region's population, forcing local governments to boost spending on senior centers and specialized transportation services. Many older adults are putting off retirement in order to afford increasing health care costs and keep up with the rising cost of living. And "active living" communities have cropped up across the region, from Cumming to Conyers.

Use of autonomous vehicles is limited to tightly controlled environments. They zoom around the parking lots at Stone Mountain and provide last-mile connectivity from major transit hubs to business centers, but widespread adoption still seems many years away.

As we continue to rely on the existing transportation network, tolling is the preferred method of paying for road construction and maintenance. Managed toll lanes exist along nearly every major highway in the region. A toll is even required to use major arterials like Peachtree Industrial Boulevard and Tara Boulevard.

The forward momentum in the region has positively benefitted the environment. Private-sector investments in alternate energy sources continue to grow, though its progress is modest and limited economic benefits are seen. Periodic dry spells strain Lake Lanier and the Chattahoochee River, but thankfully the Water Wars between Georgia, Florida and Alabama have been resolved.

FULL STEAM AHEAD

Autonomous Vehicles
Human operated vehicles continue to dominate on most roadways due to safety and security concerns. Autonomous vehicles are limited to tightly controlled environments and on certain designated roadways.

Aging of the Population
Longer life expectancies keep adults employed into old age. The desire to stay in their existing homes remains strong in suburban environments, but many wealthy empty nesters have moved into urban areas for ease of travel.

Intelligent Infrastructure/Technology
Gas powered transportation still dominates in rural areas and for long-distance travel, but electric and hydrogen fuel cell vehicles are common in urban areas where supportive infrastructure exists. Fuel prices continue to be volatile, but improvements in technology have kept major increases in check. Teleworking is available to some workers, but it is not widespread.

Spatial, Racial and Economic Equity
Intown, walkable living continues to be trendy, which drives up housing costs. Families in search of affordable housing continue to look outside the Perimeter. The availability of entry level jobs continues to erode due to mechanization and offshoring of industry.

Transportation Finance Structure
Federal and state transportation revenues stabilize, yet tolling of freeways and other major roadways become has common practice as public private partnerships thrive. Focus is on maintaining state of good repair, but transportation spending remains insufficient to keep pace with growth.

Ride-hailing/Carsharing
Congestion and declining roadway expansion has led to increased funding for rideshare/carshare programs. Ridesharing services such as Uber and Lyft are expanded, so fewer young adults have driver's licenses. As a result, the demand for transit growth is also curbed.

Climate Change Regulations
Investment in renewable energy continues to eclipse fossil fuels, but market barriers prevent wind and solar generation from becoming the primary energy sources. Meanwhile, modest progress is made on climate change legislation. Suburban development patterns continue, and the consumer-driven economy remains strong.

Water Supply
Water supply continues to be a concern due to the increasing frequency of dry periods, but legal challenges related to access to sources have been resolved.

Port Traffic
Truck traffic from the Port of Savannah and other ports has increased significantly. The Atlanta Region is the most important freight location in the southeast because of the size of its economy, manufacturing base, and its role as a multistate distribution hub.

WINNING THE FUTURE
A SHARPER FOCUS

2050 ALTERNATE FUTURE

FIERCE HEADWINDS

Conflicts rage across the globe, and America's new policy of isolationism endangers the economy. Extreme weather events occur with increasing frequency, inundating coastal cities with seawater and yielding a drought throughout the Atlanta region. Global uncertainties necessitate a new course for Metro Atlanta.

Global instability effects metro Atlanta in a myriad of ways. Population growth has slowed to a trickle as couples have fewer children and fearful companies hold off on expanding and adding jobs. The local economy is suffering due to a prolonged period of little to no growth. Atlanta-area consumers pull back on spending, afraid that another recession could be right around the corner. Disruptions in oil production lead to skyrocketing fuel prices in the region, long lines, and occasional shortages at area fuel pumps; vehicle operating costs greatly increase.

Meanwhile, the region has lost the tri-state Water Wars. Inability to draw more water from Lake Lanier and Lake Allatoona dampens future growth.

Amid these fierce headwinds, the driving habits of metro Atlanta residents are changing. The sluggish economy and $5 a gallon gas means fewer cars on I-285 and other major highways. More families are downsizing to one vehicle and taking advantage of ride-hailing and car-sharing services. Autonomous vehicles, once seen as the next big thing, have become novelties after several high-profile failures.

As to be expected, the regional economy suffers greatly. Approximately 500,000 fewer people choose to move to the region by 2050, which means fewer jobs and a crippled economy that is about $25 billion below the projected estimate.

While average life expectancies are stable, marginalized communities with limited access to healthcare and healthy foods see a decrease in life expectancy. Delayed retirement due to financial instability keeps older adults employed longer; more young adults are opting for jobs in the "gig" economy, such as driving for Uber. Meanwhile, the region's older adults find it difficult to age in place. Instead, they are moving into assisted-living facilities far from their families and communities.

One bright spot: income inequality in the region begins to close. Metro Atlanta's south side, which has long struggled compared to the more affluent north side, is attracting significant development as home buyers and businesses seek affordable prices and transit options.

And the state's film and TV tax credits continue to fuel job growth and development. Georgia becomes the filmmaking capital of the world, and new studio development spreads throughout the region. Development firms rehab abandoned warehouses along the Atlanta BeltLine's Westside Trail to build massive complexes of studios, shops, restaurants and houses.

It's a sign that, despite the uncertainty, the region is working hard to make lemonade from lemons. The global chaos doesn't make it easy, but the region strives for resilience.

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Alternative Futures | **Fierce Headwinds**

KEY DRIVERS
FIERCE HEADWINDS

Autonomous Vehicles
Autonomous vehicles never match the hype due to several high-profile failures during the early rollout years. Their use is predominantly for novelty, such as within amusement parks or urban city tours.

Aging of the Population
Families are smaller and more dispersed, leading to a high cost of travel. Coupled with the limited availability of autonomous vehicles, most older adults must live in assisted-living centers and nursing homes. While average life expectancies are stable, marginalized communities with limited access to health care and healthy foods are seeing a decrease in life expectancy.

Intelligent Infrastructure/ Technology
An epidemic of computer viruses leads many companies to discourage teleworking. Virtually all vehicles are still powered by gasoline, despite chronic shortages and high costs.

Spatial, Racial and Economic Equity
Regional inequality has decreased as previously disadvantaged communities attract a disproportionately large share of redevelopment due to affordability and transit accessibility. However, struggling far-flung communities have become even more economically challenged. Global instability brings manufacturing back to American soil, but a faltering economy stifles job growth.

Transportation Finance Structure
Most responsibilities of the federal transportation program have been turned over to states and local governments. Tight government budgets result in a limited ability to expand transit and roadway capacity, and sluggish economic growth makes voters resistant to increased taxes for transportation.

Ride-hailing/Carsharing
Fewer people are able to afford to operate their own private vehicles due to high fuel prices caused by disruptions in oil production brought about by global instability. Long distance discretionary travel by auto has decreased dramatically.

Climate Change Regulations
Partisan gridlock and philosophical shifts between elections have resulted in no meaningful progress on climate change legislation. While fossil fuels are increasingly expensive, there is also a lack of meaningful investment in renewable energy. Afraid of an impending recession and high gas prices, Atlanta area consumers pull back on purchasing habits and prioritize living near transit.

Water Supply
The region loses the water wars, resulting in drastic reductions in withdrawals from Lake Lanier and Lake Allatoona. Development in the region has come to a standstill, halting previously rising demand.

Port Traffic
Despite population growth in the region, less consumption by consumers and global economic uncertainties have resulted in truck traffic from the port of Savannah holding steady.

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Alternative Futures | **Fierce Headwinds**

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2050 ALTERNATE FUTURE

TECHNOLOGY REIGNS

Once known for its sweet Southern charm, metro Atlanta has changed. Gone are the days of personal customer service as robots now take orders at the Varsity and other fast-food restaurants. That's right, no more "Whaddya-have? Whaddya-have?"

Lenox Mall is being rebuilt as a movie studio because online retailing has killed department stores. Platoons of high-speed, autonomous vehicles pack onto the Perimeter, Downtown Connector and other area highways, dramatically increasing safety and reducing vehicular hours of delay per capita. Instead of seeing UPS' big brown trucks on Peachtree Industrial, the skies are filled with drones that fly overhead with your toilet paper and latest deal from Amazon.

In this new world, technology triumphs. Technological advances vastly improve the quality of life for the metro Atlanta residents who have the means to take advantage of the innovations. Older adults are able to age in place thanks to autonomous vehicles, online shopping, and speedy drone delivery. With the rise of teleworking, the region's Fortune 100 companies can recruit the best talent no matter where they live. The "haves" are seeing vast improvements. Job numbers and the Gross Domestic Product (GDP) are higher than predicted had the region continued with business-as-usual.

While basic universal healthcare now serves all Americans, only the wealthiest citizens can access the newest and best treatments. Longer life spans, better health outcomes and international migration contribute to rapid population increases in the region. Many people delay retirement; it is necessary to work longer to afford private supplemental insurance and new technology. These trends, coupled with reliable robotics, mean fewer jobs for entry level and unskilled workers.

Autonomous vehicles change land uses around the region by freeing up parking decks in dense areas for redevelopment. Small, infill housing options occupy the newly vacant areas. Energy and water efficient aquaponic gardening towers locate near metro Atlanta consumers, providing healthy food access for most. Large employment centers such as Buckhead, Perimeter, and Midtown lose some of their appeal as more people telecommute.

But the pace of change has yielded negative consequences for some of the region's more marginalized communities. Low-income areas south of I-20 are hit particularly hard as good-paying, entry level jobs are difficult to find due to increased automatization. The "digital divide" is stark as many families are unable to afford the latest home internet technology. As technology triumphs, the "have nots" have even less.

The impact of technology on water, land and the environment are mixed. Renewable energy companies are now some of the top employers in the region, and solar panels line the runways at Hartsfield-Jackson Atlanta International Airport. However, rapid advances in technology have led to obsolescence; the disposal of e-waste is a major concern. The legal battles over water from the Chattahoochee have been resolved, and several large desalination plants along the coast limit metro Atlanta's concerns over water supply.

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TECHNOLOGY REIGNS

Autonomous Vehicles

Autonomous vehicles have taken over the freeways, and manual driving among them is difficult. Human operated vehicles are now treated as a pastime and their use is mostly relegated to local streets and country roads.

Aging of the Population

Older adults embrace autonomous vehicles, allowing them to live virtually anywhere they want while continuing to be active and independent. Advances in healthcare increase life expectancies across the board.

Intelligent Infrastructure/ Technology

Teleworking allows professionals to live and work anywhere in the world and dramatically reduces peak travel times in urban areas. Most vehicles are powered by electricity or hydrogen fuel cells and drones have replaced virtually all small-package delivery trucks.

Spatial, Racial and Economic Equity

Distressed communities have been hit hard as reliable robots have replaced unskilled labor. Regional inequality persists as well-paid, entry level jobs are difficult to find.

Transportation Finance Structure

Transportation agencies focus almost exclusively on maintaining existing roadways in order to support the operation of autonomous vehicles. Thanks to technological innovations, motorists are taxed based on the number of miles they drive, which helps to fund infrastructure changes needed to support autonomous vehicle adoption.

Ride-hailing/Carsharing

As ridesharing and carsharing increase, effective partnerships with transit agencies and publicly accessible autonomous vehicle fleets are emerging. These new mobility models are driving down the demand for private vehicle ownership while improving "last mile" connectivity to transit.

Water Supply

Continued advances in technology have reduced the amount of water used in our daily activities and in manufacturing and power generation. Several large desalination plants along the coast have opened. Water supply is not a major concern for the majority of the United States.

Climate Change Regulations

The U.S. is energy independent. With renewable energy sources dominating the market, regulating emissions is no longer a top priority. Consumers move towards shared autonomous fleets, which has resulted in efficient operations and emissions reductions.

Port Traffic

Widening the Panama Canal and the strengthening economy has dramatically increased truck traffic from the Port of Savannah. This results in significant growth in truck volumes throughout the Atlanta Region, but widespread use of autonomous trucks eases the impact of this growth.

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GREEN GROWTH

Sustainability is on the forefront of public consciousness. With an emphasis on green growth, Metro Atlanta's new economic, social, and transportation priorities reflect strong environmental ethics.

It's a kindler, gentler metro Atlanta region where the prevailing desire is to leave the planet in better shape than when we found it. Metro Atlanta, once the poster child for resource-intensive development patterns, is now a model for protecting its natural resources.

Whether motivated by concerns over pollution and climate change, a personal ambition to lead a simpler lifestyle, or opportunities to make money in new markets, people are united in the common goal of environmental stewardship. The desire to put forth a "gentler footprint" profoundly effects the way people live their lives around the world and in metro Atlanta.

Heathy lifestyles and diets result in longer lifespans. Meanwhile, a desire to limit the impact of development has sharply increased multi-generational households. New home construction features smaller and more energy efficient designs.

Transit-oriented, mixed-used developments soar in popularity as residents strive to reduce reliance on gas-guzzling cars. New commuter transit stations around the Atlanta region are designed from the ground up as mini-town centers, offering a mix of housing, offices, schools, shops and retail – no car needed. Adaptive reuse of older commercial structures is considered best practice.

The Atlanta region's embrace of density has led to a major shift in transportation funding. Instead of a focus on road expansion, priority is given to projects that maintain the existing road network and expand transit options.

The number of people who take transit, bike, or walk to work is sizable. For those farther afield, teleworking is a popular practical option as companies have invested in technology to enable large numbers of employees to work at home. Meanwhile, people who do not live near transit are able to access car-sharing services and fleets of electric-powered, autonomous vehicles. Collectively, the region's conservation has decreased greenhouse gas emissions by 51% compared to a future where historical trends continue to be the norm.

Our commitment to simplicity and ethos of conservation has minimal economic consequences. As expected in a greener world with lower levels of consumerism, the economy doesn't grow quite as robustly as it would if today's momentum predicted the future. But the difference is slight – in an EcoTopian world, GDP is about 0.4 percent lower.

As we've better protected the region we call home, great strides have been made in a range of conservation efforts; technological innovation and behavior change are dually driving sustainability. The region is using less water despite population growth as high-efficiency fixtures, smaller yards and low-water landscaping techniques abound. Technical innovations by utilities dramatically reduce the pollution running into our streams and rivers. Children are able to swim in all parts of the Chattahoochee River; Lake Lanier has plenty of water for the region's drinking and recreation needs. And no one in Florida is complaining about having enough water for their oysters.

GREEN GROWTH

Autonomous Vehicles

Autonomous vehicles are readily available for longer trips, but most people still rely on transit, bicycling and walking for trips around town.

Aging of the Population

Universal healthcare and technological advances increase life expectancy. More older adults are choosing to live with their extended families, slowing the growth of new households.

Intelligent Infrastructure/ Technology

As most of the region's residents are concentrated in transit-oriented developments and mini-town centers, work commutes rely on biking, walking or transit. However, for those farther afield, teleworking is a popular practical option. Fleets of electric-powered, autonomous vehicles enable connectivity for those with special mobility needs.

Spatial, Racial and Economic Equity

Solar panels and green roofs have become a major growth industry in the Atlanta region, providing good wages for low-skill workers. Affordable workforce housing is available in all but the most exclusive parts of the region. Pockets of systemic poverty remain, but they are geographically dispersed and attributable primarily to the lack of access to transportation services.

Transportation Finance Structure

Roadway expansion is no longer a top priority, thanks to dense communities and high travel costs. Governmental funding is directed to maintaining transit services and expanding walking and bicycling networks. Roadway maintenance is funded by user fees.

Ride-hailing/Carsharing

Demand for ridesharing and carsharing is low as people concentrate near the region's robust public transportation system. For those living farther afield, ridesharing and carsharing programs exist; however, denser neighborhoods mean most residents do not rely on vehicle fleets.

Water Supply

The region continues to have an adequate water supply, thanks to greater awareness of the issue and widespread participation in conservation programs. Despite losing the legal challenges over water supply, the region's growth has not been significantly impacted.

Climate Change Regulations

Climate change regulations change the way electricity is made and consumed. It is increasingly expensive to operate carbon-intensive industries, which forces innovation. There is wide-spread awareness of climate change, and more people are adopting environmentally sensitive travel habits and making more sustainable purchasing decisions.

Port Traffic

Favoring a low carbon living environment, consumers have embraced locally produced products and reduced overall consumption. Lower levels of imported goods havr resulted in a reduction in port and truck traffic.