

NJTPA LONG RANGE TRANSPORTATION

PLAN 2050

Transportation ▶ People ▶ Opportunity

PLAN 2050 BACKGROUND PAPER

Climate Change and Transportation

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About the NJTPA

The NJTPA is the federally authorized Metropolitan Planning Organization (MPO) for 6.7 million people in the 13-county northern New Jersey region. Each year, the NJTPA oversees more than \$2 billion in transportation improvement projects and provides a forum for interagency cooperation and public input. It also sponsors and conducts studies, assists county planning agencies and monitors compliance with national air quality goals.

A Metropolitan Planning Organization (MPO) is a federally mandated and federally funded transportation planning agency made up of representatives from local government and key transportation agencies. Congress created MPOs to give local elected officials a stronger role in guiding federal transportation investment and to ensure that these decisions are based on a continuing, cooperative and comprehensive (“3C”) planning process.

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Introduction

Climate change presents a growing challenge to the effective functioning of the North Jersey transportation system and its ability to meet the increasing demands for the movement of people and goods on which the economy depends. Rising sea levels, more extreme weather patterns and increasing temperatures caused by climate change result in more frequent and severe flooding of roads and rails, erosion that can undermine infrastructure foundations, and accelerated deterioration of rail and roadway systems, among other impacts. Along with broader disruptions to the economy, environment, quality of life and public health, these threats create an urgent need for the transportation sector to reduce greenhouse gas (GHG) emissions and for transportation infrastructure to be built, retrofitted, or even relocated, in a more resilient way.

The NJTPA has been active in addressing climate change for nearly a decade. This work includes providing support for mitigating air pollution, adapting and preparing transportation infrastructure for climate impacts, and promoting sustainable modes of transportation such as walking, biking and transit. As the region's Metropolitan Planning Organization, the NJTPA is guided by federal planning factors written into law including the need to "Improve the resiliency and reliability of the transportation system." In addition, one of the seven long-term goals adopted by the NJTPA Board is to "protect and improve natural ecosystems, the built environment and quality of life."

This paper focuses on ways North Jersey can meet its environmental goals and become a more resilient region, while protecting current and future investments and maintaining safe operational capabilities

in the face of climate change. Resiliency, as defined by the Federal Highway Administration, is "the ability to anticipate, prepare for, adapt to changing conditions and withstand, respond to, and recover rapidly from disruptions." This paper discusses the changes occurring in New Jersey's climate; projections for the future; implications of recent climate policy on transportation; and recommended mitigation and adaptation strategies, including examples of the NJTPA's work to address the drivers and impacts of climate change.



The information in this paper will be used to inform the development of the NJTPA's *Plan 2050: People, Transportation, Opportunity*—the guiding document for transportation investment policy for North Jersey.

Existing Conditions

At the national level, transportation contributed 28 percent of GHG emissions as of 2018, the largest source followed by electricity generation (27 percent) and industry (22 percent). In New Jersey, transportation's contribution is much higher, accounting for 42 percent of total statewide GHG emissions as of 2018, with on-road diesel and gasoline use accounting for most of those emissions.

The COVID-19 pandemic has at least temporarily altered travel in the region, with travel overall greatly



reduced since the spring of 2020. Telecommuting has replaced many trips and both road congestion and transit ridership have fallen. Walking and biking have increased. Air quality has improved across the region, nation, and the world, with regional reductions in GHG emissions of almost 30 percent. The analysis that follows is based on pre-pandemic travel patterns. Doubtless, the pandemic will have long term impacts

in altering travel, such as greater telecommuting, though the nature and extent of these changes are uncertain.

The NJTPA region's extensive transit network will continue to be the principal option for long distance, low GHG emission travel within the region and beyond. However, the large share of GHG emissions from the transportation sector is driven by the region's dependence on the use of passenger vehicles (almost entirely single occupancy) with internal combustion engines for most trips, and trucks serving the metropolitan region and beyond. According to the New Jersey Department of Environmental Protection (NJDEP), 68 percent of the transportation sector's GHG emissions are generated by the use of passenger cars, passenger trucks or motorcycles. The Census Community Survey and NJTPA household travel survey find that 77 percent of residents commute to work via a car, truck or van, and 83 percent of people use passenger vehicles for other types of travel outside of work. By comparison, only 3.4 percent of people walk or bike to work, 10 percent walk or bike for non-work trips, and 4.6 percent work from home (pre-pandemic), all of which contribute no transportation-related GHG emissions.

GHG emissions have consistently declined over the past 30 years in New Jersey, especially in the past 15 years. GHG from transportation declined 20 percent, from 51 million metric tons (MMT) of carbon dioxide equivalent emissions in 2005 to 40 MMT in 2018. GHG from all sources declined 29 percent from 136 MMT in 2005 to 97 MMT in 2018. This trend is mainly due to a reduction in industrial land uses and a large-scale shift away from coal and petroleum to

natural gas, nuclear energy, and renewables for electricity generation. Further progress will require steps to reduce emissions from the transportation sector,

including electrification of vehicles and the creation of vehicle charging systems drawing on low-carbon electricity generation and distribution.

Climate Projections and Associated Impacts

Climate change presents real and growing threats to the state's future. As temperatures rise, New Jersey will experience a 4 to 11 percent increase in annual precipitation by 2050. Of great significance will be how the state experiences this precipitation. It will come as more frequent, intense and extreme rain events that lead to greater risk of floods.

New Jersey is particularly at risk to flooding and coastal hazards due to sea level rise and storm surge because it is highly developed and much of the population lives in proximity to coastal hazard areas. The aftermath of Superstorm Sandy and Hurricane Irene showed the devastation that can be caused by more frequent severe weather. During these and lesser weather events, transportation infrastructure has been damaged by coastal and riverine storm surge, catastrophic flooding of interior portions of the region, high winds, and debris from fallen trees, all of which can cause widespread and often lengthy disruptions on roads and to transit systems. All these impacts will be more frequent and severe by 2050.

Temperature and sea levels are rising faster in New Jersey than in most of the Northeast and the world because of the state's density and largely urban land uses. Heat waves will impact larger areas, with more frequency and longer duration, resulting in reduced power plant efficiency, increases in energy use and air pollution and negative health effects. Heat waves have also led to train derailments due to rail buckling and extensive pavement damage on roads.

Sea level rise will greatly impact New Jersey's communities and infrastructure in low lying coastal and riverine areas with "sunny day flooding" occurring more frequently along the New Jersey coast. According to a 2019 report by a Rutgers University Science and Technical Advisory panel, by 2050 New



Jersey is expected to experience 0.9 feet to 2.1 feet of sea level rise (SLR) above the levels in 2000; by 2070 it is expected to experience 1.4 feet to 3.1 feet of SLR; and by 2100 it will experience 2 feet to 5.2 feet of SLR. As base sea level rises, storm surge will become a greater risk and is expected to increase in frequency and intensity and flood larger areas of land.

Public Sector Responses

Governments at all levels must play a leadership role in combating climate change. Use of fossil fuels and other practices that contribute to climate change are deeply engrained in the economy and in the daily activities of companies and households. Climate change has been termed the “ultimate negative externality”—an unaccounted-for impact of economic activity on a third party, in this case, affecting the entire world.

Governments can limit or mitigate GHG emissions through a wide range of approaches, some positive such as providing incentives, funding and



education and some negative such as imposing bans or levying taxes and fees on certain activities. In the transportation sector, strategies that mitigate GHG emissions do so either by reducing vehicle miles traveled (such as encouraging more compact and walk-

able land uses to reduce driving) or by switching the energy source, such as vehicle electrification.

Beyond reducing emissions, governments also must help society adapt to climate impacts as they occur. Adaptation strategies in the transportation sector include elevating roadways and transit electrical systems, relocating facilities from flood-prone areas and investing in alternative or redundant routes or systems. Mitigation and adaptation must work in tandem as part of effective climate change responses.

This section summarizes public sector responses at various levels of government—federal, state, multi-state, regional and local—and how they affect and are supported by NJTPA’s planning programs and activities.

FEDERAL

The US Environmental Protection Agency (EPA) administers many laws, regulations and programs affecting GHG emissions across the country. In the last four years, key federal climate programs have been challenged, weakened or rolled-back including the Corporate Average Fuel Economy (CAFE) program, which sets emissions standards for vehicles being produced. However, the incoming federal administration has signaled its intention to restore many previous climate change programs and initiatives, although rule-making and other requirements may delay how quickly this is accomplished. As discussed below, many states, including New Jersey, and localities have taken their own actions to implement climate programs in the absence of stronger nationwide mandates or federal guidance focusing on climate change.

However, enforcement of one federal law, the Clean Air Act, has continued to drive reductions in GHG emissions in major metropolitan areas. It requires actions by states to meet standards for various pollutants and these actions simultaneously affect the level of GHG emissions. For instance, the shift of power plants from use of coal to cleaner natural gas reduces emissions of particulates, carbon monoxide, sulfur dioxide and other pollutants targeted by the Clean Air Act and reduces GHG emissions by as much as 60 percent. By centrally powering electric vehicle charging systems, these cleaner plants can help eliminate the “point-source” emissions now generated from 250 million U.S. vehicles powered by internal combustion engines. Greater reductions from many more sources would be achieved if the EPA directly regulated and set standards for GHG emissions under provisions of the Clean Air Act—as court rulings have permitted it to—but EPA regulations to achieve that have been delayed for many years. The new administration is expected to revive efforts to achieve this.

To meet current standards under the Clean Air Act, states must address the large share of emissions generated by the transportation sector. The NJTPA and other MPOs play a role in achieving and monitoring this. Every two years (or sooner as needed), the NJTPA conducts a conformity analysis to demonstrate that investments funded through the Transportation Improvement Program (TIP) have a net positive impact in reducing pollutants in keeping with the standards of the Clean Air Act. The targets and timeframes for reductions and for maintaining compliance with federal standards are set in a statewide plan, called the State Implementation Plan (SIP). In New Jersey, the SIP includes measures to support transit ridership, reduce congestion and promote cleaner vehicles—all of which also help reduce GHG emissions.

The NJTPA is also charged with allocating federal Congestion Mitigation and Air Quality (CMAQ) funds to its region for projects that help the region

meet Clean Air Act standards by reducing emissions and congestion. Through this competitive program, local governments, public agencies and public-private partnerships can obtain funding for readily implementable and innovative projects. CMAQ funds are available for a wide range of transportation projects mitigating climate change, including electric vehicle infrastructure, diesel retrofits for vehicles and equipment, idle reduction technology, traffic signal optimization and Intelligent Transportation Systems,



transit improvements, bicycle and pedestrian facilities and Travel Demand Management (as discussed later), among others.

The NJTPA’s air quality responsibilities under federal law have provided the NJTPA the tools and expertise to help the North Jersey region make progress in addressing climate change. For example, the modeling the NJTPA conducts to demonstrate conformity has also been used to conduct assessments of GHG emissions in the region and support related programs, as discussed elsewhere in this paper. Should federal rules regulating GHG be implemented, the agency’s capabilities in air quality analysis and planning can be directly applied to helping North Jersey achieve those standards.



STATEWIDE NEW JERSEY

In addition to the air quality compliance and programs discussed above, the State of New Jersey has taken steps to reduce climate change impacts in the state, with several significant developments in late 2019 and early 2020. Over time, these initiatives are likely to positively impact the transportation sector in terms of mitigation or adaptation and are a strong foundation for the NJTPA's work. Among the recent developments:

- **June 20, 2020:** The NJDEP issued the state's first scientific report on climate change.
- **January 27, 2020:** An Energy Master Plan was released proposing the goal of achieving 100 percent clean energy by 2050 by addressing New Jersey's energy system, including electricity generation, transportation, and buildings, and their associated GHG emissions and related air pollutants.
- **January 27, 2020:** An Executive Order was issued on Protecting Against Climate Threats, directing the NJDEP to adopt, within two years, regulatory reforms to reduce emissions and adapt to climate change.
- **January 17, 2020:** Legislation signed into law to increase the number of electric vehicles (EVs) on the

road, increase publicly accessible charging infrastructure, electrify fleets and provide an EV rebate program.

- **October 29, 2019:** An executive order by the Governor established a Climate and Flood Resilience Program in the NJDEP and an Interagency Council on Climate Resilience made up of 16 agencies.
- **July 23, 2019:** Governor Phil Murphy signed a law updating goals and timetables in the Global Warming Response Act of 2007, which called for reducing GHG emissions by 80 percent from 2006 levels by 2050.

The State of New Jersey's legislative, regulatory and policy initiatives for addressing climate change are summed up in the NJDEP *Global Warming Response Act 80x50 Report* issued in October 2020.

The NJTPA will continue to coordinate with and support these and other state initiatives on climate change. The NJTPA Board includes representatives from the NJDOT, NJ TRANSIT and the Governor's Office. In addition, staff regularly attends and participates in climate-related meetings and forums with partners and stakeholders from around the region and state.

MULTI-STATE INITIATIVES

In 2019, New Jersey rejoined the Regional Greenhouse Gas Initiative (RGGI), which established a market-based program to reduce GHG emissions. RGGI caps carbon dioxide (CO₂) emissions from fossil-fueled power plants on a regional level, and then sells allowances to emit CO₂ at quarterly auctions. Regulated entities in the nine Northeast and Mid-Atlantic states that make up RGGI must hold and retire allowances equal to their CO₂ emissions over a three-year control period.

Proceeds from RGGI are to be invested in a way that provides meaningful benefits to communities most affected by pollution and climate change, including energy efficiency, renewable energy and

other consumer-benefit programs. RGGI is expected to provide a considerable funding opportunity for the electrification of the transportation sector.

RGGI may soon be supplemented by transportation-focused market-based measures. New Jersey is monitoring the development of the Transportation Climate Initiative (TCI), a regional collaboration of 12 Northeast and Mid-Atlantic states and the District of Columbia seeking to promote clean vehicles and fuels, sustainable communities, freight efficiency, information and communication technology and explore a cap-and-invest program for transportation fuels. Such a regional program could be operational by 2022.

These programs could potentially have major impacts. According to the Georgetown (DC) Climate Center, “A transportation market-based program or pricing policy, such as an emissions budget program, carbon fee, or mileage-based user fee would increase the range of emission reductions to 32 to 40 percent in 2030, and could generate proceeds to fund the transportation investments.”

The NJTPA is poised to support these efforts by engaging local and regional stakeholders on the importance of TCI and RGGI as part of its role as a forum for discussing regional transportation and climate issues. Furthermore, as NJTPA can help implement policies and programs that complement RGGI and TCI investment strategies. On the technical side, the NJTPA and the other two New Jersey MPOs can support these initiatives by coordinating existing travel demand modeling work to inform decisions about TCI investments.

LOCAL/REGIONAL

The NJTPA Board includes local elected officials representing the region’s 13 counties and two largest cities, Newark and Jersey City—known as subregions. It encompasses 384 municipalities. Many of the governing bodies of these jurisdictions have adopted local

plans and programs addressing climate change. Notable examples are the Climate Action Plans adopted in Hoboken in 2019 and under development in Jersey City. The NJTPA has served as a stakeholder during preparation of both plans.

Such plans include both mitigation and adaptation strategies. Mitigation efforts at the local level include converting vehicle fleets to electric power or alternative fuels, using renewable energy for gov-



ernment services and, importantly, supporting climate-friendly land uses and a local transportation network that facilitates walking, biking and transit use. Adaptation can include relatively inexpensive projects to raise flood-prone sections of roads. Harder to achieve and more expensive are longer-term efforts to rechannel water and raise significant infrastructure such as whole roadways or rail terminals. State programs such as the Blue Acres Floodplain Acquisitions program aim to shift land use away from areas vulnerable to flooding but require substantial additional funding to meet the scale of the needs.

At the regional level, the NJTPA completed a GHG emissions inventory with data allocating emissions down to the municipal level for vehicle trips. A GHG profile for each county is underway and the

region-wide inventory is expected to be updated in 2021. In June 2019, the NJTPA completed a significant effort to address the vulnerability of transportation infrastructure to climate change with the *Passaic River Basin Climate Resilience Planning Study*.

The New Jersey portion of the Passaic River Basin includes parts of Bergen, Essex, Hudson, Morris, Passaic, Somerset, Sussex, and Union counties. The NJTPA was also a lead agency for a 2017 *FHWA supported study* that provided an assessment of the

tri-state metropolitan regional transportation system's resilience to climate, sea level rise and extreme weather.

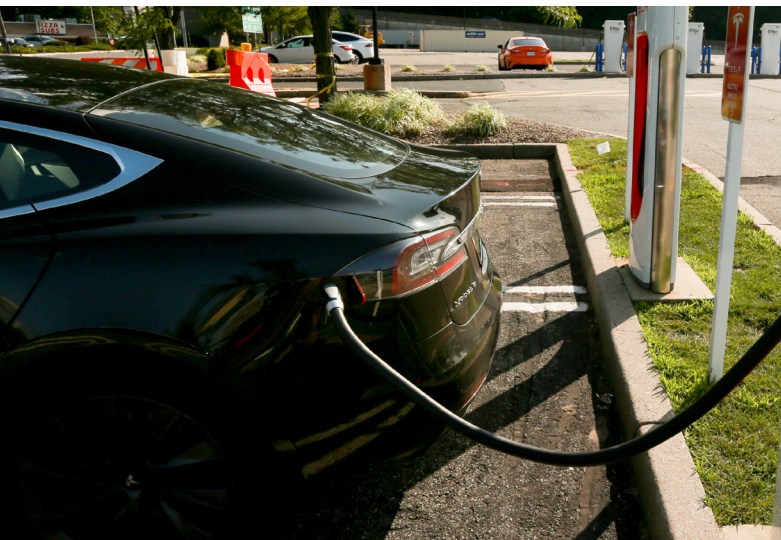
The NJTPA, as a regional body that works with and includes participation by officials at local levels of government, can be effective in coordinating current and future climate change strategies, helping achieve effective concerted action and public support.

Key Strategies for NJTPA and Plan 2050

This section discusses climate change strategies that are most relevant to the planning responsibilities of the NJTPA and how the agency can help address these issues through its plans, programs and coordination functions.

ELECTRIC VEHICLES

The state's 2019 Energy Master Plan calls for maximum electrification of the transportation and building sectors to meet or exceed the 80 percent reduction in CO₂ emissions by 2050 targeted in the state's 2007 Global Warming Response Act. This is only possible with massive reductions in transportation emissions, particularly through electrification of vehicles. The



New Jersey Energy Master Plan calls for all new vehicles sold to be electric by 2035. This will require a vast expansion of the state's electric vehicle charging infrastructure network.

Widespread adoption of electric vehicles would reduce the CO₂ emissions that drive climate change and nitrogen oxide (NO_x) emissions that directly affect public health. According to a 2018 report by ChargeEVC, every electrically powered mile driven in New Jersey emitted 69 percent to 79 percent less CO₂ than an average gasoline-fueled mile. Meanwhile, as noted, CAFE standards have not improved and, in some cases, have been rolled back by the federal government. ChargeEVC notes that air quality improvements, especially a reduction of NO_x, will benefit disadvantaged and environmental justice communities living and working in cities and along high-volume travel corridors. Another benefit is reduced operating costs for vehicle owners. Electricity is a cheaper fuel than gasoline, and EVs generally have lower maintenance costs than gas-powered vehicles.

Education and outreach to residents, local governments and employers is needed to inform them about the basics of EVs, such as their lower operating costs as well as available federal and state programs and incentives. The NJTPA Subregional Transportation Planning and Subregional Studies programs, both of which provide federal funding to support subregional planning, can also be used to explore opportunities for needed electric vehicle infrastructure. The NJTPA has supported pilot projects to help municipalities plan charging infrastructure. This work resulted in *guidelines* for efforts regionwide. The NJTPA is currently supporting the adoption of EVs at the local level by equipping the Transportation Management Associations (TMAs), subregions and other planning partners with technical resources to support local governments and the private sector.

State government (led by the Department of Environmental Protection), local agencies and private companies should continue to work on building-out the charging infrastructure network. In addition, ongoing financial support for NJ TRANSIT to electrify their bus fleet is important, particularly in disadvantaged and environmental justice communities that reside in heavily traveled and congested areas.

The freight sector also must play a role. According to the EPA, 6 percent of registered vehicles in the nation in 2018 were medium- and heavy- duty trucks. These accounted for 23 percent of transportation-sector GHG emissions (about 7 percent of total U.S. emissions). While electrification of smaller delivery trucks and vans by corporate fleets—including at Amazon and UPS—is well underway, electric long-haul trucks are just now reaching the market. Other aspects of freight movement are also being targeted. The NJTPA, among other efforts, used its CMAQ funding in 2019 to support port operators in replacing cargo-handling yard tractors with less-polluting equipment. The NJTPA has also supported efforts to improve goods movement efficiency by limiting the length of truck trips and shifting goods to rail and vessels traveling over “marine highways.” These and other actions—possibly one day including deliveries via drones or automated vehicles—must be encouraged to reduce GHG emissions in the freight sector.

LAND USE / TRANSIT ORIENTED DEVELOPMENT

Land use patterns and transportation networks are inextricably linked. Auto-oriented land development generates travel demand on existing road networks. This in turn generates the need for additional road capacity, which subsequently can open up new areas for development as the process comes full circle. As such, land use patterns have a direct impact on GHG emissions due to transportation.



There are opportunities for regional and state entities in New Jersey to promote sustainable land use patterns and Transit Supportive Development (TSD), despite land use planning and development being predominantly the purview of local governments. This can be accomplished through funding for planning studies, help in crafting zoning ordinances and other measures that support compact land use.

NJDOT and NJ TRANSIT lead the Transit Village Initiative, a program that provides incentives for municipalities to redevelop or revitalize the areas around transit stations using transit-oriented development (TOD) design standards. There are 33 designated Transit Villages in New Jersey, with many located in the NJTPA region.

In addition, the NJTPA’s Planning for Emerging Centers Program provides technical assistance to support municipal efforts to create more sustainable, transit-supportive and walkable communities. The NJTPA can also collaborate with its subregions to use its Subregional Transportation Planning and Subregional Studies programs for planning to support transit use and associated Transit Supportive Development.

ACTIVE TRANSPORTATION

Walking, biking and other forms of human-powered “active transportation” are the least polluting methods of travel. They produce no GHG emissions and thus are an important element in climate initiatives. A separate NJTPA *Plan 2050 background paper* discusses how the NJTPA and the region can promote walking and biking.

That paper notes that the COVID-19 pandemic has added to the importance of walking and biking as a means of exercise, recreation and safe mobility. Increasingly, towns are adopting and implementing “complete streets” policies to better accommodate walking and biking and to meet the needs of all travelers, young and old. In addition to supporting these efforts, the paper calls for expanding shared bicycle-pedestrian trails and improving on-road infra-



structure such as addressing missing sidewalks and disjointed bicycle networks.

To improve active transportation over the long term, the paper recommends the NJTPA give priority to active transportation where possible in its plans and programs; promote education and public par-

ticipation regarding active transportation; improve regional data; and expand available funding.

MASS TRANSIT

The NJTPA region has an extensive network of buses, rails, light rail and ferries. Public transportation reduces GHG emissions per capita as compared to other motorized modes and provides alternatives to auto travel, a prime source of GHG emissions. However, there is a need to phase out diesel-powered vehicles including, buses, vans, trains and ferries.

The NJTPA has made expanding and improving transit services and access to transit a top priority of its long range plans. This reflects transit’s environmental benefits, its ability to provide equitable mobility—particularly for low income, minority and other underserved communities—and its potential for supporting sustainable economic development. The NJTPA works with NJ TRANSIT, a member of the NJTPA Board, to fund and support key transit improvements. Among the long-term projects needed is the completion of new Hudson River rail tunnels and the larger Gateway project, which will enable expansion of rail services throughout the region, thus lowering GHG emissions from auto commuting.

Facilitating local transit access is also an important climate strategy. In addition to the NJTPA’s support for transit planning by subregions, the NJTPA administers the work of eight TMAs statewide. These non-profit organizations play an important role in working with employers and communities in encouraging use of transit and ridesharing, as part of Travel Demand Management, as discussed below.

TRAVEL DEMAND MANAGEMENT

Transportation Demand Management, or TDM, is a set of strategies that encourage the shift from single-occupant vehicle (SOV) trips to transit or shared vehicles, walking or biking, or to trips out of peak periods. TDM reduces local pollutants and congestion

and makes the transportation system more efficient, among other benefits. The NJTPA is currently developing a TDM plan for the region which will contain a broad set of policies and programmatic recommendations.

Numerous TDM strategies reduce GHG emissions, according to the Federal Highway Administration, with the most effective of those reducing multiple pollutants. This includes strategies that support transit such as park-and-ride lots, improved travel information, or pricing that encourages transit use; ridesharing or van pools that provide shared rides when traditional transit isn't appropriate; parking management; bicycle and pedestrian facilities; and pricing schemes such as VMT-based fees, high occupancy toll (HOT) lanes, or congestion pricing that help shift travel to less polluting modes or patterns and generate funding for complementary programs.

Implementing such TDM programs requires coordination among many parties including employers, institutions, municipalities, transportation authorities, transit providers and the public. As noted, TMAs are experienced in fostering this coordination and in creating public-private partnerships to make TDM successful.

INFRASTRUCTURE ADAPTATION

Most transportation infrastructure is built to last for decades. But threats and damage caused by climate change may require changes in its planning, design, materials, construction, operation, and maintenance.

The new weather extremes from climate change will require novel science, engineering, and materials. The materials science community has been and will continue to improve our concrete, asphalt, metal, and other basic transportation infrastructure components to yield longer life and/or cheaper life-cycle costs, and to reduce GHG emissions in creating construction materials. Existing and future assets can be strategically hardened against newly intense threats.

Climate scientists will provide models with higher resolution and more accurate forecasts. These models can be integrated with infrastructure mapping and other GIS products to provide better predictions, situational awareness, and current status. Better sensing technologies will allow for greater knowledge of infrastructure status before, during, and after disasters. In the near term, drones can provide visible, infrared, and LIDAR imagery for instant damage



assessment. Longer term, smart infrastructure will assess itself and directly broadcast the information. For example, technology can provide more precise assessment of the location and nature of utility failures, such as electric system outages.

The NJTPA, working with its partner agencies and subregions, supports efforts to take advantage of these approaches to infrastructure adaptation and preparedness. This includes vulnerability assessment of critical assets, corridors and systems to understand their exposure and sensitivity to climate effects and identifying opportunities for adaptation. Results of such vulnerability assessments help guide where and how infrastructure investments are made to increase the transportation system's resiliency.

The NJTPA factors climate adaptation into the criteria it uses to rank projects that are candidates for funding, awarding points to projects that “promote adaptation and resiliency to extreme weather events and the impacts of climate change.” Further vulnerability assessments will help the NJTPA refine the criteria and other plans and programs to address infrastructure adaptation and resiliency. The assessments can also be used in asset management programs, hazard mitigation plans, and other programs and processes.

The NJTPA supports and coordinates its plans and programs with the adaptation efforts of its partner agencies. This includes using NJTPA’s capital programming process to secure needed federal funding. This occurred after Hurricanes Sandy and Irene, with the NJTPA supporting partner agencies funding needs to address the storms’ impacts. In addition to such capital investments, the NJTPA supports the efforts of partner agencies and subregions to review and revise operations to reflect both current and projected climate impacts. Funding for plans, programs and projects to carry out this adaptation planning

work will save agencies money over the long run by avoiding costs associated with replacement, repair and emergency service response. Examples of key infrastructure resiliency initiatives of partner agencies include the following:

- In the aftermath of Hurricane Sandy, the Port Authority of New York and New Jersey established Climate Resilience Design Guidelines, updated in 2018, that provide guidance for climate change projections and managing the risks to Port Authority assets.
- NJ TRANSIT is addressing infrastructure resiliency for critical signal and communication systems on four commuter rail lines and the Hudson-Bergen Light Rail Line, all of which have been identified as vulnerable to extreme weather.
- The New Jersey Department of Transportation is currently developing tools to identify vulnerabilities and criticality in its transportation system and developing ways to factor this into the agency’s project delivery process.

Conclusion

There is broad consensus that climate change caused by GHGs is a global problem that warrants urgent action by the public and private sectors with public involvement. Transportation contributes a large share to the problem, but also offers many opportunities for mitigating GHG emissions and adapting to climate impacts. As discussed in this paper, the NJTPA, through its federal mandates for conducting regional planning and administering key air quality programs, can assist and bolster the

climate strategies underway in the region and in the state. The development of the NJTPA's long range transportation plan, Plan 2050, reflects this role and the agency's commitment to working with its partner agencies and the counties, cities and municipalities in the region to combat climate change and achieve sustainable transportation and a more sustainable environment.

Appendix A: Statewide Milestones and Resources

- *NJDEP Global Warming Response Act 80x50 Report*, issued in October 2020, communicates the ability and limitations of existing policies and programs in reaching state climate goals and provides options that will assist policymakers in crafting new initiatives to bridge the emissions reductions gap.
- *New Jersey Scientific Report on Climate Change*, issued in June 2020, is NJDEP’s first scientific report. The report summarizes the current state of knowledge regarding the effects of climate change on New Jersey’s environment to inform state and local decision-makers as they seek to understand and respond to the impacts of climate change.
- *Executive Order 89*, issued by Governor Murphy on October 29, 2019, established a Statewide Climate Change Resilience Strategy, established a Climate and Flood Resilience Program within the New Jersey Department of Environmental Protection, and created an Interagency Council of 16 state agencies on Climate Resilience.
- *New Jersey’s Rising Seas and Changing Coastal Storms: Report of the 2019 Science and Technical Advisory Panel*, commissioned by NJDEP and prepared by Rutgers University.
- *S4162* signed by Governor Murphy in mid-January 2020 establishing the “NJ Climate Change Resource Center” at Rutgers and appropriating \$500,000 to support the Center’s work.
- Governor Murphy’s release of the *Final Energy Master Plan* on January 27, 2020, which proposes the goal of achieving 100 percent clean energy by 2050 by addressing New Jersey’s energy system, including electricity generation, transportation, and buildings, and their associated greenhouse gas emissions and related air pollutants. Transportation strategies include encouraging electric vehicle adoption, electrifying transportation systems, and leveraging technology to reduce emissions and miles traveled; addressing transportation through the development of EV-ready building codes; and prioritizing clean transportation options in underserved communities.
- January 27, 2020 release of Governor’s *Executive Order 100 or Protecting Against Climate Threats (PACT)*. This directs the Department of Environmental Protection (DEP) to adopt, within two years, regulatory reforms to reduce emissions and adapt to climate change, including a greenhouse gas monitoring and reporting program, establishing criteria to reduce carbon dioxide emissions and short-lived climate pollutants and reform environmental land use regulations which will allow for building resilient communities, for example by avoiding flood-prone areas and encouraging green infrastructure.
- January 27, 2020 release of *NJDEP’s Administrative Order No. 2020-01*, which details the PACT reforms and set deadlines for the DEP to adopt these progressive climate rules within the next two years.