



NCHRP Report 750 Series

**Informing
Transportation's
Future**



TRANSPORTATION RESEARCH BOARD
OF THE NATIONAL ACADEMIES



Foresight

NCHRP Report 750 Series

Informing Transportation's Future

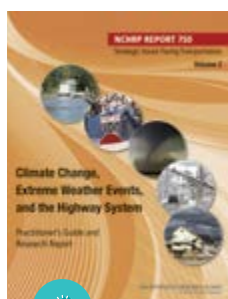
PREFACE

In 2008, the American Association of State Highway and Transportation Officials (AASHTO) Standing Committee on Research (SCOR) established the forward-looking NCHRP Project 20-83 research series. Published as NCHRP Report 750: Strategic Issues Facing Transportation, the series examines global and domestic long-range, strategic issues and their implications for departments of transportation (DOTs). The series includes the following reports:



Volume 1:
FREIGHT

SCENARIO PLANNING FOR FREIGHT TRANSPORTATION INFRASTRUCTURE INVESTMENT



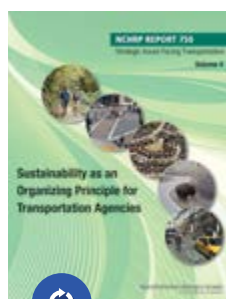
Volume 2:
CLIMATE CHANGE

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



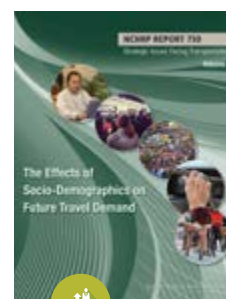
Volume 4:
SUSTAINABILITY

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

Each volume explores fields as varied as freight movement, climate change, technology, sustainability, energy, and socio-demographics and explains how these topics may shape the transportation system of the future. Together, the reports embody the importance of foresight in managing for an uncertain future by giving DOTs a better understanding of the significance and nature of needs or events before they occur.

The Foresight 750 Series reports are a resource for decision makers and practitioners interested in the future of the transportation systems they oversee. This brochure provides a snapshot of the reports and highlights some thought-provoking questions about the future of transportation in the next 50 years.

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NCHRP Report 750 Series

Informing Transportation's Future

A LETTER FROM JOHN HALIKOWSKI, CHAIR, AASHTO STANDING COMMITTEE ON RESEARCH

In today's world, the only certainty is change—and more often than not, acceleration of change! In 2008, the AASHTO Standing Committee on Research (SCOR) had the foresight to set aside the funding to do more than just worry about unforeseen change. Instead, they thought differently and proactively, creating the series of reports I am privileged to describe to you now.

The NCHRP 20-83 research series, published and presented here as the aptly named Foresight 750 Series, includes subjects as diverse and impactful as:

- Freight scenario planning.
- Climate change and extreme weather events.
- Technology for enhancing transportation system performance.
- Sustainability as an organizing principle for transportation agencies.
- Energy and fuels—our uncertain energy future.
- Demographics and their effect on future travel demand.

While every state faces its own set of unique challenges, the topics in this series represent big-picture, strategic thinking: we will have to deal with and manage these issues no matter what else the future holds.

Although we often long for the future and believe it will bring better things, the process of getting there can be messy and filled with questions, such as “What if?” We don’t have a working crystal ball to help solve the greatest transportation challenges of the next 50 years, but NCHRP’s Foresight 750 Series is perhaps the next best thing. Each of the six reports offers new insights and new tools for managing the future. As the director of the Arizona Department of Transportation and chair of the Standing Committee on Research, I join my colleagues in inviting you to take a moment to step away from the often frantic world of delivering transportation programs and projects and take the time to think comprehensively and systemically about transportation.

- **Think about the future scenarios** outlined here and how your actions today set the stage for tomorrow.
- **Consider the signposts** that may foreshadow significant change and ask how your DOT is preparing for these possibilities.
- **Tap into the tools** offered by the Foresight 750 series.

Think of this summary and the Foresight reports as your guide to the future. Dive deeply into a single topic or explore how they overlap and relate to one another. Together, these reports suggest the signposts to watch for that will help practitioners and leaders navigate and interpret different scenarios about the future and make choices about transportation infrastructure that will provide our successors with flexibility to solve future challenges.



John Halikowski
Director
Arizona DOT
and SCOR Chair



ALTERNATIVE FUTURES:

What if Business Is not as Usual?



NCHRP Report 750 Series

Informing Transportation's Future

ALTERNATIVE FUTURES: What if Business Is not as Usual?

As the Foresight Series explains, transportation's future will be determined by the interplay of impossible-to-predict changes in technology, the environment, global and local politics, the economy and society. Business could be as usual, but a range of alternate scenarios that each come with different transportation implications may be equally plausible.

Several of the Foresight Series reports used scenario planning as a tool for managing uncertainty. Scenario planning helps DOTs look into the future, anticipate events and trends, understand risk, gather ideas for proactive organizational response, and help managers break out of their established mental models as they become aware of alternative future possibilities. The Foresight Series introduces several hypothetical scenarios that reflect different perspectives on future trajectories.

EXAMPLES OF SCENARIOS IN THE FORESIGHT SERIES



MOMENTUM



GLOBAL CHAOS

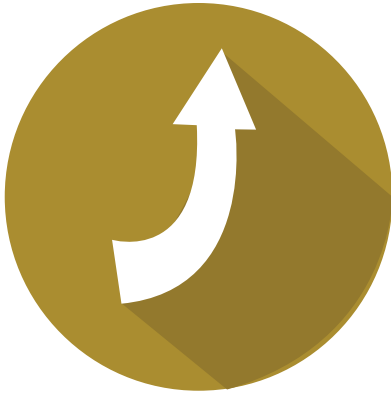


TECH TRIUMPH



GENTLE FOOTPRINT

The following pages explore the scenarios described in the Foresight Series and show a range of possibilities that could be in our future. For more ideas about using scenario planning to map your DOT's future, take a closer look at NCHRP Report 750, Volume 1 (Freight), Volume 4 (Sustainability), or Volume 6 (Socio-Demographics). A helpful list of trends to watch for in the future is presented at the end of this document.



SCENARIO: MOMENTUM

In this scenario, United States socio-demographic shifts reflect changes—across the board—including age and ethnicity. The nation's slow population growth is leading to modest economic growth and shrinking labor force participation, but world trade is open and vigorous.

Technology changes make vehicles safer and more fuel efficient. Fuel taxes stay low relative to other nations. There is a slow growth in vehicle miles traveled, and states directly fund more of their transportation needs.

Population continues to concentrate in urban mega regions, with continued growth of low-density suburbs in these regions; infill continues and demand for transit-oriented development increases.

POSSIBLE TRANSPORTATION IMPLICATIONS

- Travel grows modestly.
- Auto safety and travel reliability remain critical concerns.
- Less federal funding; rising power of states and local agencies in transportation decision making.



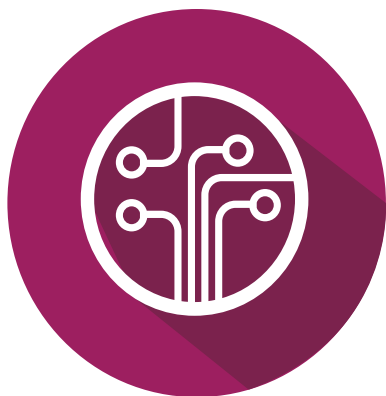
SCENARIO: GLOBAL CHAOS

In this scenario, growing global financial instability and a great recession in the United States lead to negative economic growth. Weather events such as storms, flooding, and droughts have an increasing and visible impact. Lifespans shorten and population falls.

Chronic global conflicts lead to shortages of jobs and oil.

POSSIBLE TRANSPORTATION IMPLICATIONS

- Travel slows due to economic crisis; congestion shrinks; failure to maintain sustainability of transportation revenue sources.
- Fuel prices rise.
- Little infrastructure investment; deteriorating transportation system.



SCENARIO: TECH TRIUMPH

In this scenario, technology fundamentally shifts how we think of transportation. Autonomous cars, wireless communications, and so on, change travel patterns dramatically and drive booming economic growth.

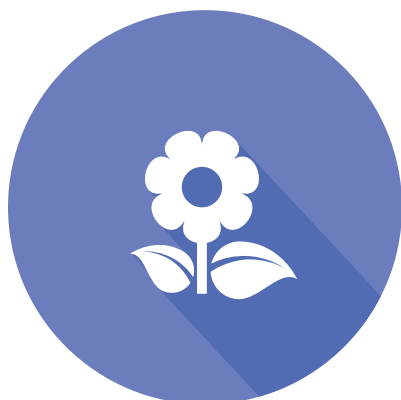
The United States becomes more self-reliant in terms of energy, agriculture, and manufacturing, with innovation hubs producing highly customized goods.

The population grows rapidly due to economic prosperity and longer lifespans.

Economic activity diffuses from population centers; people work and live where they wish and recreate virtually, which spurs lower density development.

POSSIBLE TRANSPORTATION IMPLICATIONS

- Safety is greatly improved.
- Transportation's carbon footprint is smaller.
- Economic growth and self-driving vehicles increase demand for a new transportation infrastructure.



SCENARIO: GENTLE FOOTPRINT

In this scenario, growing public and political consensus spurs low-impact life choices. High carbon taxes lead to reduced energy consumption.

Substantial regulation results in greater social and economic control.

Personal goals and aspirations are limited by efforts to make society greener and more sustainable.

POSSIBLE TRANSPORTATION IMPLICATIONS

- High speed rail, transit, bicycle, and pedestrian networks are expanded instead of increasing highway capacity.
- Land use planning redefines transportation investment.

SIGNPOSTS AND TOOLS TO NAVIGATE AN UNCERTAIN FUTURE





SIGNPOSTS AND TOOLS TO NAVIGATE AN UNCERTAIN FUTURE

Against the backdrop of these four alternative scenarios—or hybrid versions—this document explores some of the critical issues the Foresight research suggests could fundamentally change transportation.

On the following pages, Foresight Series' observations are shared about the potential futures. Vital signposts that might be important indicators of emerging shifts are highlighted. You will be introduced to Foresight reports and tools to help you navigate the changing landscape and make better decisions for your agency and your customers well beyond the typical planning horizon.



Volume 1: FREIGHT
SCENARIO PLANNING FOR FREIGHT
TRANSPORTATION INFRASTRUCTURE INVESTMENT



Volume 2: CLIMATE CHANGE
CLIMATE CHANGE, EXTREME WEATHER EVENTS,
AND THE HIGHWAY SYSTEM:
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Volume 6: DEMOGRAPHICS
THE EFFECTS OF SOCIO-DEMOGRAPHICS ON FUTURE
TRAVEL DEMAND

WILL DOTs WORK DIFFERENTLY IN THE FUTURE?

LEARN MORE:



NCHRP Report 750, Volume 3:
Technology



NCHRP Report 750, Volume 4:
Sustainability



NCHRP Report 750, Volume 5:
Energy and Fuels



VITAL SIGNPOSTS

- 
Population—The size, geographic distribution, and characteristics of the United States' population are likely to be major factors influencing transportation demand, the resources available to state DOTs, and the opportunities and challenges they face.
- 
Economic growth—The broad increase in United States GDP is a major determinant of the resources available to address the largest challenges transportation agencies will face.
- 
Energy—The availability of traditional and new fuels is one of the most important factors in the future viability of the United States economy and the options open to transportation planners.
- 
Transportation technology—Transportation technologies of the future will vary substantially. Changes will occur in technologies that agencies use to deliver their mission, as well as in technologies used by the traveling public.

WILL DOTs WORK DIFFERENTLY IN THE FUTURE?

The simple answer is “yes.” The NCHRP Report 750 reports—particularly Volumes 3 (Technology) and 4 (Sustainability)—make detailed and informed observations about how governance systems, policies, technology adoption, decision making, culture, and enterprise management in DOTs could change, and what agencies can do to stay relevant in a new world.

Sustainability—Increasing awareness of environmental, economic, and social effects of transportation has already led to new demands on transportation agencies to be more responsive in providing transportation services. Undoubtedly, however, fiscal, legal, and institutional structures, decision-making processes, and partnerships must continue to evolve if DOTs are to optimize their contribution to a sustainable society. The sustainability report envisions a maturity model in which DOTs enhance their ability to support sustainability by gradually shifting toward broad decision-making partnerships, risk-sharing between public and private sectors, integrated infrastructure ownership and operation strategies, and sustainability-focused stewardship and regulation.

Technology—New technologies, such as information and communication technology advances that improve traveler information, are changing faster than agencies can react. Many transportation agencies do not have the business processes and organizational structures in place to allow rapid adoption and deployment of new technologies. Furthermore, many barriers outside the control of transportation agencies affect the ability to advance technologies from research to deployment. The Foresight Series presents a process (Systematic Technology Reconnaissance, Evaluation, and Adoption Methodology, or STREAM) to compare technology alternatives on the basis of their likely effects on agency goals, including consideration of barriers to implementation.

WHY CHANGING THE WAY DOTs WORK MATTERS

The point of the Foresight Series is to inform the way DOTs' roles and responsibilities are executed in the future, whether through use of tools like STREAM or by implementing a maturity model approach toward making sustainability an organizing principle. The result will be transportation agencies that are better equipped to handle the future.



WILL THE ECONOMY STAY GLOBAL?

LEARN MORE:



NCHRP Report 750, Volume 1:
Freight



NCHRP Report 750, Volume 6:
Demographics



VITAL SIGNPOSTS

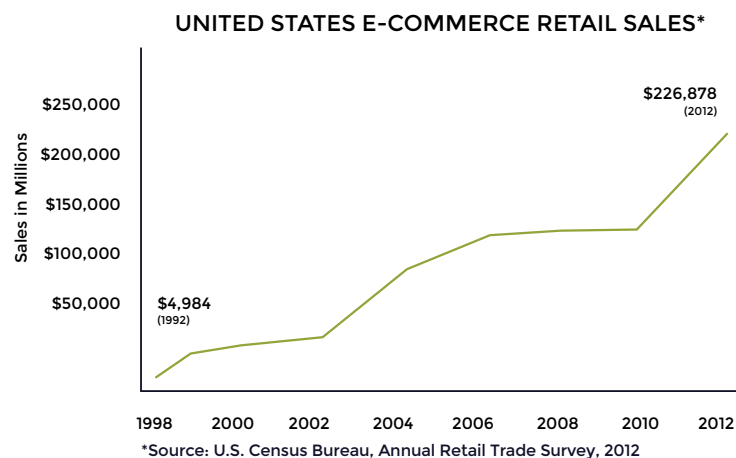
- 
Global freight trends up or down. If the future leans toward a **global chaos or gentle footprint scenario**, global freight may decrease, reducing the return on investment in gateway port freight infrastructure.
- 
Does technology disrupt the status quo? 3D printing, personal fabrication, driverless trucks, and other technology advances could have game-changing impacts on freight infrastructure needs.
- 
Trade protectionism rises or falls. Rising trade protectionism could trigger a decline in container traffic through gateway ports.
- 
What impact does the digital economy have? Growth in the digital economy could affect freight patterns in many ways: For example, digital retail—like Amazon—may contribute to congestion in urban areas as online orders are delivered to a growing population; alternatively, digital design may support diffused manufacturing of goods supported by raw materials delivery.

WILL THE ECONOMY STAY GLOBAL?

One of the biggest questions facing transportation is figuring out the long-term forces that could redefine global freight logistics and how those forces play out in states and cities across the country.

The rise of decentralized manufacturing in the United States is one of those forces. As long as mass production in Eastern countries of goods destined for Western markets makes economic sense, huge ships will continue funneling containers through a handful of massive American gateway ports to be moved to deconsolidation points by truck and rail for final delivery by road.

What happens, however, if the growing digital economy, together with 3D printer technology, cheap domestic energy, and rising labor costs overseas erode the economic advantage of making goods in places like China for use in the United States?



WHY SHIFTING FROM GLOBAL TO DOMESTIC PRODUCTION MATTERS

- Truck freight volumes could change.** Freight logistics infrastructure will change if more of the products we consume are ordered digitally, then “printed” and assembled inside the United States. Most pointedly, the decades-long growth in containerization and the infrastructure that accommodates it could begin to stall, while short-haul domestic truckloads of dispersed, domestically produced goods may grow rapidly.
- What gets imported could change.** A rise in domestic manufacturing could increase global trade in raw materials needed to make goods when and where demanded by the final consumer.

WHAT IS RESILIENT INFRASTRUCTURE AND HOW MUCH DOES IT COST?

LEARN MORE:



NCHRP Report 750, Volume 2:
Climate Change



NCHRP Report 750, Volume 4:
Sustainability



NCHRP Report 750, Volume 5:
Energy and Fuels



VITAL SIGNPOSTS

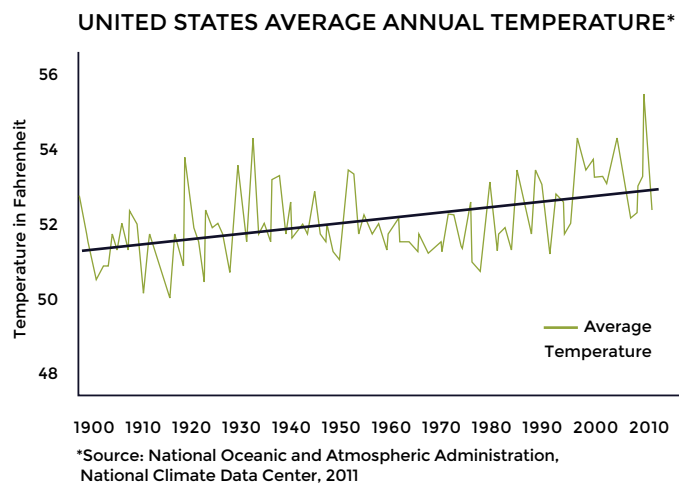
- ✚ If the **Momentum scenario** yields higher populations, can **Tech Triumphs** or new regulations under the **Gentle Footprint scenario** come to the rescue?
- ✚ **Rainfall increases or decreases—or both.** By 2050, some portions of the United States—particularly the West and far South—are expected to see lower precipitation, while the Midwest and Northeast are expected to see increased precipitation.
- ✚ **Sea level change.** Coastal regions of the United States are expected to have sea level increases by 2050.

WHAT IS RESILIENT INFRASTRUCTURE AND HOW MUCH DOES IT COST?

As pointed out in the NCHRP Report 750, Volume 2 (Climate Change), extremes in the physical environment are an enemy to maintaining roads, bridges, and rails. Just think about how freeze-thaw cycles in early spring create the scourge of every driver: pothole season. Equally problematic—though less visible—are impacts like storm surges that scour away at bridge foundations, or intense summer heat waves that buckle rails.


Over centuries of practice, engineers have learned to accommodate an unpredictable environment by relying on historical norms to set reliable, long-lasting benchmarks for their design and construction standards.

Across the United States, some places may get drier while others could be inundated—potentially permanently—by rising oceans. Many locales are facing greater temperature extremes and the risk of weather-related natural disasters, such as mudslides, flooding, or wildfires.



WHY CLIMATE CHANGE MATTERS

- **Resiliency risk could change design standards.** As the insurance industry has discovered, historical averages may no longer be a viable method for predicting future risk. As risks change, well-established engineering standards might no longer be applicable.
- **Construction costs could increase.** With the world's climate already changing in ways that are altering the frequency of extreme weather, the tab to keep infrastructure in good shape could rise with more frequent repairs needed as a harsher physical environment buffets transportation infrastructure. Furthermore, “upsizing” designs for new facilities to cope with increased risk of extreme events will likely lead to a jump in costs.
- **Maintenance practices may need to be changed.** Operations and maintenance forces may need to adapt their work practices—from clearing culverts more often to avoid flooding, to taking on added emergency readiness duties that keep transportation running after a weather event.



WHAT IF THERE'S NO MORE *DRIVING*, BUT VMT STILL RISES?

LEARN MORE:



NCHRP Report 750, Volume 1:
Freight







NCHRP Report 750, Volume 5:
Energy and Fuels



NCHRP Report 750, Volume 6:
Demographics



VITAL SIGNPOSTS

- 
If a Tech Triumph or a Gentle Footprint scenario emerges, new technologies and fuels may lead to fewer carbon emissions and more sustainable vehicles.
- 
How quickly autonomous car technology is adopted. Predictions vary about the timeline for commercially viable autonomous cars, which will in turn influence fleet penetration rates.
- 
Vehicle technology costs. The cost of new technologies will have a significant influence on uptake of new technologies by consumers.
- 
Fatality rates drop sharply. Vehicle-to-vehicle communication technologies or autonomous vehicles could make roads much safer.

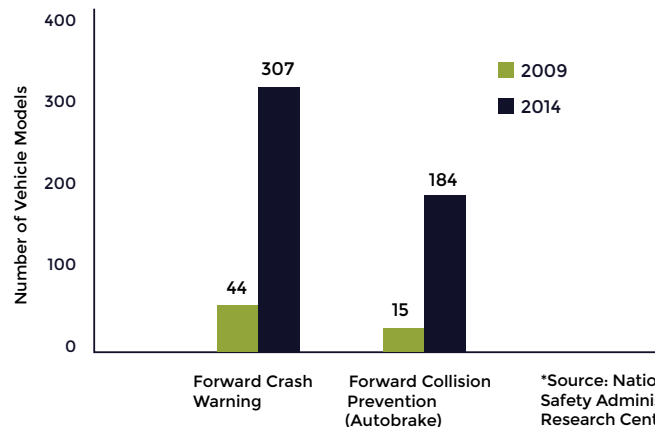
WHAT IF THERE'S NO MORE *DRIVING*, BUT VEHICLE MILES TRAVELED (VMT) STILL RISES?

Disruptive technologies, such as the Internet, are defined by the sweeping and transformational changes they bring. Transportation may be approaching a period as significant as the switch from buggies to autos, or the arrival of commercial jet planes. Rapid gains in computing speeds and sensor technology now put automated vehicle control within reach of production vehicles.

In today's prototypes, human drivers are replaced to varying degrees by technology that controls speed, braking, turning, navigation, and responsiveness to road conditions, other traffic, and pedestrians. Manufacturers are easing consumers into acceptance of autonomous vehicle technologies via more modest advances like automated parking, lane control features, and automatic braking.

Experts say the tipping point is most likely to arrive only when, or if governments get serious about resolving regulation of driverless cars, giving business a green light to invest.

AVAILABILITY OF COLLISION AVOIDANCE TECHNOLOGY*
2009 vs. 2014 MODEL YEARS



*Source: National Highway Traffic Safety Administration, Transportation Research Center, Insurance Institute for Highway Safety, 2014

WHY SELF-DRIVING CARS MATTER

- Better safety.** Volvo's stated vision is that by 2020 no one will be killed in one of their cars. Safety, of course, could be a big winner in a world of driverless cars, with fatalities and injuries becoming rare. But this will require full fleet turnover to fully maximize benefits.
- More capacity.** Roadway capacity could increase as more vehicles are squeezed onto the same road lanes (platooning), by traveling at higher speeds and in closer proximity. While improvements like better vehicle braking have already helped boost roadway capacity relative to decades ago, they have not curbed congestion.
- More convenience could mean more VMT.** Traditional vehicle ownership and transit business models might also be disrupted as some bus riders and car owners choose to rent cars at a reasonable cost and have them delivered to their location only when they need one. Greater convenience for users, however, could mean lots of extra VMT as autonomous cars travel back and forth between rides.



WHERE ARE THE NEXT BOOM TOWNS?

LEARN MORE:



NCHRP Report 750, Volume 1:
Freight



NCHRP Report 750, Volume 6:
Demographics



VITAL SIGNPOSTS

✦ The **Momentum scenario, Global Chaos, and Gentle Footprint scenarios** all could impact development patterns greatly. More population or less? New sustainable solutions and regulation or mega cities with increased poverty? The future depends on which scenario (or combination) prevails.

✦ **Where population grows.** If growth occurs in cities versus suburbs or rural areas, it will drive different transportation needs.

✦ **Power of local, regional, or state government.** If federal funding for transportation shrinks, it could lead to a devolution of control to states and localities.

✦ **VMT per capita increases or decreases.** More urban growth is likely to push down VMT per capita while increasing demand for transit, but more rural or suburban growth will have the reverse effect.

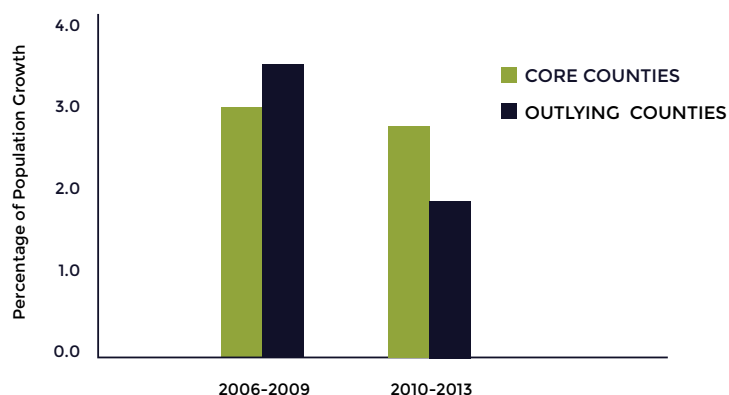
✦ **Car-sharing increases.** Digital economy trends like car-sharing are likely to be more viable if growth occurs in urban areas that are easily served by multi-modal trips.

WHERE ARE THE NEXT BOOM TOWNS?

For decades, Americans have been moving to urban centers at the expense of rural areas. Most urban growth in the United States has favored low-density suburbs that are particularly hard to serve with transit.

Changing societal norms, demographic trends or economic booms (like North Dakota's oil fields) could create new opportunities for growth both in rural pockets of the country and inside large cities in the future. As people live longer, for example, younger generations may postpone families in favor of denser, more urban lifestyles, while older Americans—freed from the need to be near good schools and soccer fields—could move closer in to cities. Meanwhile, technology advances may untether more workers from their commutes, freeing them to choose to live in mid-size cities where people can enjoy the benefits of interacting with others in an urban setting without the drawbacks of an impersonal mega-city.

URBAN vs. SUBURBAN POPULATION GROWTH*
UNITED STATES METROPOLITAN AREAS



*Source: USA Today, March 27, 2014

WHY WHERE THE NEXT BOOMS OCCUR MATTERS

- **Cities often don't have space for expanded highways, and residents want more travel choices.** The suburbs reshaped transportation needs in the twentieth century. A boom in city living could do the same. If more people live in cities, an increasing share of transportation dollars and engineering brainpower may be needed to support urban transportation in dense urban areas where the constraints to capacity expansion can be challenging.
- **Rural infrastructure systems might not keep up.** At the same time, changes like the growth of new oil- and gas-based economies in places ranging from North Dakota to western Pennsylvania are showing how the next boom could also put a strain on roads, water supplies, sewage systems, public safety, and other government services provided by small towns and counties in rural areas.
- **The private sector could play a much larger role in the lucrative markets.** In the face of these changes, state DOTs may struggle to maintain adequate investment in interstate transportation systems, but dense population concentrations could provide a ready market for private sector transportation services.



WILL CARS FILL UP OR PLUG IN?

LEARN MORE:



NCHRP Report 750, Volume 2:
Climate Change



NCHRP Report 750, Volume 3:
Technology



NCHRP Report 750, Volume 5:
Energy and Fuels



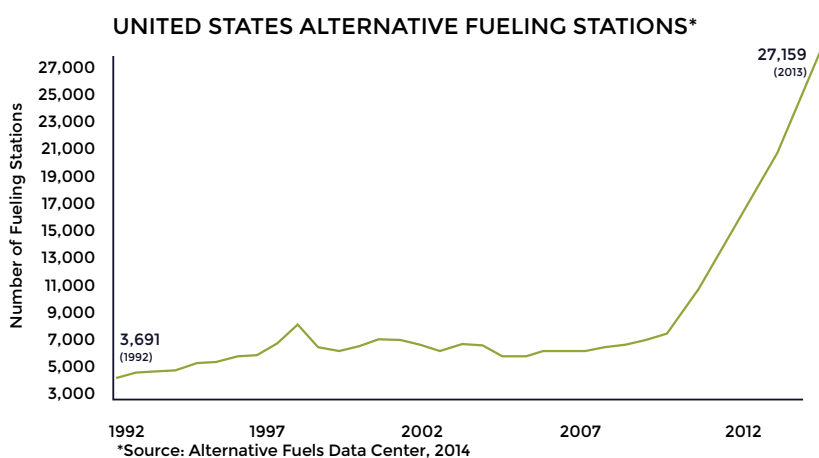
VITAL SIGNPOSTS

- ✚ Perhaps the United States reaches energy independence in the **Tech Triumph scenario**. Robust domestic energy production could lessen the risk of fuel price shocks and encourage more travel.
- ✚ **Low or high fuel price volatility.** Big spikes in energy prices could disrupt economic growth and push down travel growth.
- ✚ **More alternative fuel infrastructure.** For fuels like compressed natural gas or electricity to take off, a viable refueling network must be in place.
- ✚ **Carbon regulations.** Carbon restrictions are likely to drive consumer and manufacturer interest in fuels with a lighter carbon footprint.
- ✚ **Better vehicle fuel efficiency.** Improved fuel efficiency could encourage more travel by reducing the cost of travel, thereby creating pressure to add capacity.
- ✚ **Alternative fuel vehicles remain expensive.** If alternative fuel vehicles command a steep premium as they generally do today, their market penetration rate could be slow, which would help ensure viability of gas taxes as a revenue source.

WILL CARS FILL UP OR PLUG IN?

The NCHRP Report 750, Volume 5 (Energy and Fuels) states no one knows for sure if other fuels can replace gasoline- and diesel-powered engine technology. Most of the major auto manufacturers, however, are already testing and offering cars and trucks that look and feel a lot like regular vehicles, but are powered by natural gas, biodiesel, plug-in electricity, and even hydrogen. Furthermore, promising choices like electricity and natural gas are cheaper than oil at current energy prices. Shell Oil—with 25,000 gas stations in the United States—openly discusses the possibility of an end to liquid fuels.

Experts say the tipping point might occur when oil prices rise *and* governments impose stricter regulations on carbon emissions. Combined, those actions might give businesses serious incentives to invest in new fueling infrastructure and cars.



WHY FUEL CHOICES MATTER

- **Different environmental outcomes are possible.** A switch away from oil could keep commerce and society thriving while potentially helping the environment, if electricity and plentiful natural gas at current prices can power vehicles at a lower cost than oil, while electricity and hydrogen in particular offer a big potential environmental upside.
- **Low prices could increase travel and hit DOT budgets at the same time.** Cheap, plentiful alternative fuels could encourage more travel, triggering more congestion and possibly air pollution. Without a replacement for oil and gas taxes, money to maintain the roads and bridges they pay for will quickly dry up.

WHAT'S THE RELATIONSHIP BETWEEN MORE SENIOR AMERICANS AND TRANSPORTATION?



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NCHRP Report 750, Volume 3:
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NCHRP Report 750, Volume 4:
Sustainability



NCHRP Report 750, Volume 6:
Demographics



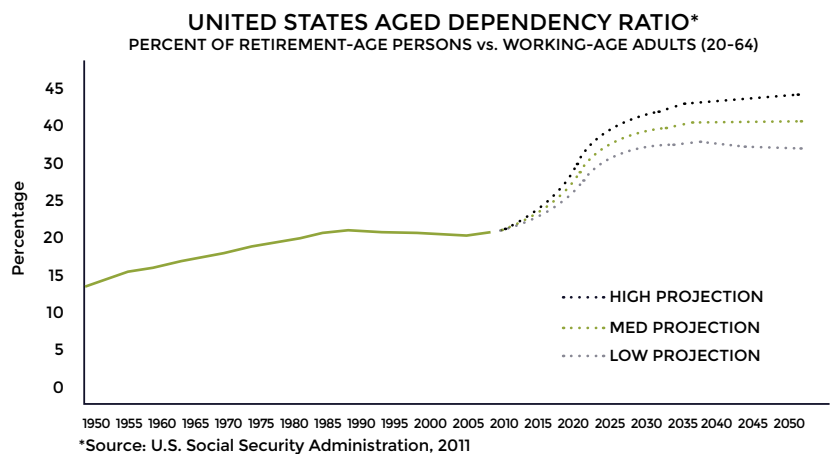
VITAL SIGNPOSTS

- ✚ If the **Momentum scenario** comes to pass, people will continue to live longer, and our population will continue to get older and more diverse.
- ✚ **VMT and VMT per capita could go up or down.** Demographic trends could significantly influence travel growth, which will affect capacity needs in the future.
- ✚ **Dependency ratio increases.** If more of the population is not working, economic growth could slow down, which may reduce travel demand.
- ✚ **Immigration could increase or decrease.** Immigration has fueled population growth in the United States in recent decades. A slowdown in immigration could influence population and travel demand.
- ✚ **Longer or shorter life expectancy.** If life expectancy increases, the United States' population may face new transportation needs that support mobility of seniors.

WHAT'S THE RELATIONSHIP BETWEEN MORE SENIOR AMERICANS AND TRANSPORTATION?

A bigger share of Americans will be older in the future, according to NCHRP Report 750, Volume 6 (Demographics). The trends that power this change are already in motion: fewer young immigrants, falling birth rates, and a longer life expectancy.

The dependency ratio is a term demographers use to describe the share of workers relative to seniors. As a nation, we are about to shift from a half century where the number of workers was increasing relative to dependent populations, to the exact opposite.



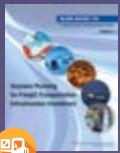
WHY AN AGING POPULATION MATTERS

- **Economic challenges might be ahead.** America has never experienced the kind of rising dependency ratio we now expect. Can a relatively smaller workforce support a growing population of seniors without triggering slower economic growth?
- **Travel growth could slow.** Since older people don't work as much and they don't have young families, they may drive less. If the average amount driven by Americans starts to shrink, states could struggle to collect enough money from gas taxes to pay for roads and bridges.
- **New transportation solutions could emerge.** While older Americans may drive less, they could seek better transit service to preserve their mobility.

SIX REPORTS AND TOOLS: FORESIGHT 750 SERIES AT-A-GLANCE



The Foresight Series reports were prepared by some of the most preeminent thinkers on transportation in the United States. Each report features expert insights, trend analysis, frameworks for organizing, and technical tools. As the following summary table shows, the Foresight reports are useful for both short- and long-term thinking horizons, and together they apply to agency roles in planning, programming, design, operations, policy development, partnering, and funding. Volumes 1-6 can be found by searching for NCHRP Report 750 Series at www.trb.org.



VOLUME
01

SCENARIO PLANNING FOR FREIGHT TRANSPORTATION INFRASTRUCTURE INVESTMENT



VOLUME
02

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



VOLUME
03

EXPEDITING FUTURE TECHNOLOGIES FOR ENHANCING TRANSPORTATION SYSTEM PERFORMANCE



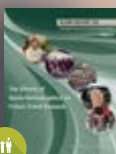
VOLUME
04

SUSTAINABILITY AS AN ORGANIZING PRINCIPLE FOR TRANSPORTATION AGENCIES



VOLUME
05

PREPARING STATE TRANSPORTATION AGENCIES FOR AN UNCERTAIN ENERGY FUTURE



VOLUME
06

THE EFFECTS OF SOCIO-DEMOGRAPHICS ON FUTURE TRAVEL DEMAND



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VOLUME 01



FREIGHT

Explore and plan for the future of freight with a scenario planning toolkit

This report provides decision makers with a critical and comprehensive analysis of the factors, trends, and uncertainties that may affect the United States' freight transportation system over the next 30 to 50 years. The report explains how to use this information in a set of workshop-based scenario planning tools and procedures that can be adopted and immediately used to create a more flexible, adaptive, and responsive transportation management strategy on an ongoing basis.

●	●	●	●	●	●	●	○
Immediate	Near-Term	Long-Term	Planning	Programming	Design	Operations	Funding
Horizon			Application				

VOLUME 02



CLIMATE CHANGE

How to prepare for extreme weather events

Foresight 750 Series, Volume 2's report and web browser-based software offer specific, region-based information on incorporating climate change adaptation into planning and design of bridges, culverts, stormwater infrastructure, slopes, walls, and pavements.

●	●	●	●	●	○	○	○
Immediate	Near-Term	Long-Term	Planning	Programming	Design	Operations	Funding
Horizon			Application				





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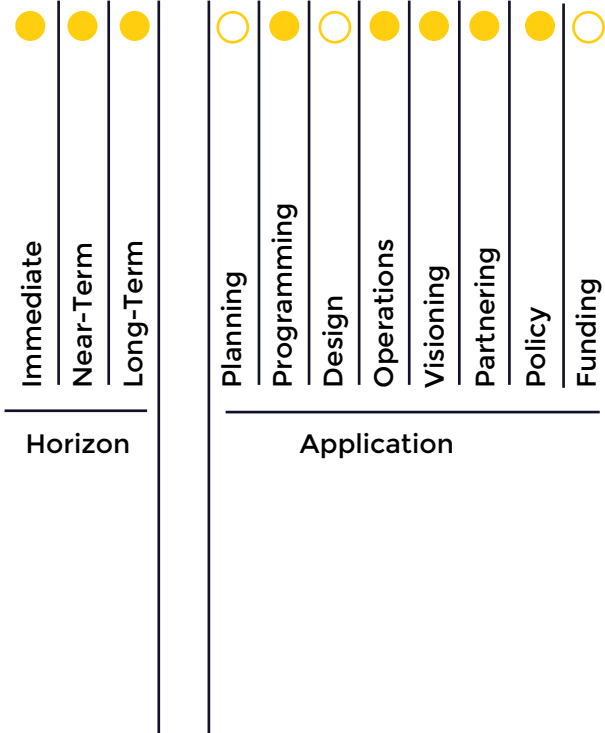
VOLUME
03



TECHNOLOGY

Select the right technology investments at the right time

New technologies have the potential to transform how transportation agencies perform. Yet, making the right choices about if, when, or where to deploy new technology can be overwhelming. The Systematic Technology Reconnaissance, Evaluation, and Adoption Methodology (STREAM) featured in the Foresight Volume 3 report offers a practical and systematic technology assessment process that allows evaluation of technologies, based on important system and agency outcomes.



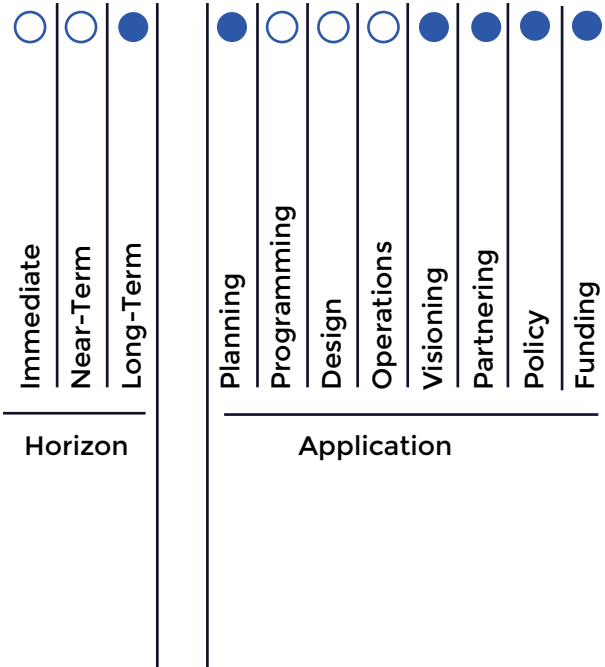
VOLUME
04



SUSTAINABILITY

How to organize DOTs for a sustainable future

Foresight 750 Series, Volume 4's analytical framework and implementation approaches are designed to assist state DOTs and other transportation agencies evaluate their current and future capacity to support a sustainable society.



SIX REPORTS AND TOOLS: FORESIGHT 750 SERIES AT-A-GLANCE

VOLUME 05



ENERGY AND FUELS

Identify and assess strategies for a variety of future energy scenarios

Transportation fuel technologies are rapidly evolving. In the future, high efficiency gas-fueled vehicles or cars powered with natural gas, biofuels, electricity, or hydrogen are all possible. Foresight 750, Volume 5 helps state DOTs plan more effectively for an uncertain energy future that may include challenges such as declining fuel-tax revenue, higher highway construction and maintenance costs, worsening traffic congestion, more crashes and fatalities, greater difficulty meeting air quality standards, more pressure to mitigate greenhouse gases, and more demand for alternative travel modes.

Immediate	<input type="radio"/>
Near-Term	<input checked="" type="radio"/>
Long-Term	<input checked="" type="radio"/>

Horizon

Planning	●
Programming	●
Design	●
Operations	●
Visioning	●
Partnering	○
Policy	●
Funding	●

Application

VOLUME 06



DEMOGRAPHICS

Model and envision the transportation impacts of shifting demographics

This report and accompanying model help transportation decision makers understand how the population in their state may change over time, how socio-demographic changes may affect the ways people travel, and the kinds of transportation modes and infrastructure that may be needed.

Immediate	○
Near-Term	●
Long-Term	●

Horizon

Planning	●
Programming	○
Design	○
Operations	○
Visioning	●
Partnering	○
Policy	●
Funding	●

Application



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TRENDS TO WATCH

Each of the reports in the Foresight Series discusses a range of trends and data patterns that could influence the future of transportation. This list will evolve in response to new and emerging circumstances.

Economics

- Measures of economic growth (personal income, unemployment, GDP, and so on)
- Wage levels/income inequality
- Growth rate in global trade
- Growth rate in online retailing
- International regulation of trade; growth rate of protectionism
- Growth rate in emerging markets
- Commodity prices and price volatility levels
- Growth rate of domestic manufacturing
- Per mile cost of driving
- Truck volume trends

Environment and Land Use

- Growth rate of water scarcity
- Greenhouse gas emissions/air quality
- International regulation of climate change
- International regulation of sustainability
- Growth rate for “green” demand
- Growth of mega cities
- Growth of mid-size cities
- Housing starts

Technology

- Printed fabrication technology
- Use of wireless sensors on products, vehicles, and infrastructure
- Remote working capability
- Virtual social networks
- Vehicle safety
- Adoption of driverless-car technology

TRENDS TO WATCH



Transportation

- Transit trips
- Congestion
- Bike/pedestrian trips
- Carpooling/car-sharing
- VMT growth
- Work trips
- Auto ownership
- Vehicle age/cost

Energy

- United States' dependence on foreign energy sources
- Energy prices and energy price volatility
- Growth in alternative fuel vehicle technology, fueling infrastructure
- Fuel tax revenue

Demographics

- Aging of United States' population/age structure/dependency ratio
- Population growth rate
- Population diversity
- Labor force size/participation rate
- Immigration rate
- Fertility rate
- Longevity
- Household population
- Population health

Other

- Growth rate in global security concerns

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Fore sight

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