

Thank you for being here. Today, we're going to discuss emerging trends that impact transportation. We're also going to discuss actions and decisions you can make today – large and small – that could shape transportation for generations.

The greatest achievements in our society have always been the result of good people willing to donate their time to a worthy cause.

I appreciate your willingness to give your time to think about transportation's future and will do my best to make it worth your while. So with that said, let's begin.

WE LIKE IKE



"If progress is to be steady we must have long term guides extending far ahead."

Consider the words of former President Eisenhower, the Father of the Interstate. Progress ceases to exist when people aren't willing to look ahead.

This is a quote from his 1959 State of Union Address – how fitting for this series.



Does it really make a difference?



All our great transportation achievements would not have been possible without people like you willing to look forward and invest in the future.



Think of some of the major world transportation achievements, like the London Underground. Also known as "The Tube", the first segment was finished in 1863, 150 years ago. Today it is comprised of 250 miles of track, 270 stations and carries a billion passengers per year.

This transportation facility resulted from a city recognizing it was growing and it needed a way to better serve its citizens.



Consider the Panama Canal which marks 100 years of operation this year (2014). The American Society of Civil Engineers has named it one of the seven wonders of the modern world.

Who could have imagined, in 1914, these enormous 18,000 TEU (20-foot equivalent) ships which are the length of four football fields would crisscross the ocean? One hundred years ago, the canal was extraordinarily visionary. It was about understanding the need for better defense, transportation and international trade.



The U.S. Interstate System was constructed just over 50 years ago.

Then President Eisenhower recognized that our country needed better roads if it was going to flourish in the 20th century. Who could have predicted the many ways the interstate system would affect the direction of this country?

We know however, our country would be very different today without the foresight to build the interstate system, 50 years ago.

The bottom line is that without foresight, we fail to meet the needs of future generations.

NOTE: Map is the original **Dwight D. Eisenhower National System of Interstate and Defense Highways** as approved and authorized by Congress in 1956. The system as mapped here was completed in 35 years at a cost of \$425 Billion. It has since been expanded several times and represents the second largest highway system in the world (#1 is in China).

IT'S EASY TO GET THE FUTURE WRONG

We have a long history of it, in fact.



There's a difference, though, between looking forward and planning for the future and trying to PREDICT it.

We humans have a long history of trying to predict the future – and a long history of getting it wrong. In fact, some very smart people have gotten it completely wrong at times.

LORD KELVIN 1895

Mathematical Physicist



"Heavier-than-air flying machines are impossible."

Take Lord Kelvin as an example.

Arguably, the greatest mathematician of his day, he thought we would never fly. He said that "flying machines" were impossible. Eight years later the Wright brothers took off at Kitty Hawk, North Carolina.

HARRY WARNER 1925

One of the Warner Brothers



"Who the hell wants to hear actors talk?"

Then there's Harry Warner. In 1925 he doubted anyone would want to hear actors talk.

Two years later, in October 1927, Warner released the first "talkie" "The Jazz Singer" starring Al Jolson. It essentially saved a struggling Warner Brothers studio.

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And, then there was Thomas Watson.

He obviously had this one wrong. Over 300 million computers are sold each year.



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.

The Foresight series provides us with signposts that point us to the future and can help us navigate challenges to the status quo. They help us prepare for the future where we need to be nimble and prepared to adapt to uncertainty.



Many DOTs find themselves planning for the very short term. This approach of point forecast may be driven by uncertain budgets or politics, and it is what many of us are asked to do.

The other common form of planning is risk based. For example, we know when a certain asset will reach its limit of safety, and we program to meet that risk.

But what we're going to talk about is long term planning where we identify multiple futures and work backwards to identify the work that needs to happen today. So, we begin with the end in mind and let that drive our planning.

In other words, a scenario is a set of assumptions about how drivers of change interact.

Scenario planning is about thinking about implications of deficient scenarios.

MULTIPLE FUTURES

Alone or in combination?



MOMENTUM

America gets older and more diverse. Global trade booms. Domestic growth flattens.



GLOBAL CHAOS

Worldwide financial instability leads to negative growth. Extreme weather increases its impact.



TECH TRIUMPH

New tech radically changes transportation. Economy booms and U.S. becomes more self reliant.



GENTLE FOOTPRINT

Public demands lowimpact choices. Regulations reduce consumption, increase government control.

As we discussed, no one can accurate prediction the future or outline a specific scenario. So while you may gravitate to one scenario or another listed above – or have another scenario in your head, we're likely to face a combination of elements from a variety of scenarios. And, thus we face a variety of questions and need signposts to point the way to the scenarios that are emerging.

SOME QUESTIONS WE FACE TODAY

7 cross cutting questions

- 1. Will your organization work differently in the future?
- 2. Will the economy stay global?
- 3. What is resilient infrastructure and how much does it cost?
- 4. What if there is no more <u>driving</u>, but Vehicle Miles Traveled (VMT) <u>still rises?</u>
- 5. Where are the next boom towns?
- 6. Will cars fill up or plug in?
- 7. What's the relationship between more senior Americans and transportation?

These are just a few of the questions we face as we look to the future. And, you can look to the six reports and tools that cut across the Foresight 750 series to help answer these questions and others that your organization may face.

(depending on time available, the speaker may want to walk through each question)

- 1. Will your organization work differently in the future? I think there's no question about that think about how you worked 20 years ago.
- 2. Will the economy stay global? Will there be strong growth worldwide or in certain locations? And what does that mean to our transportation systems?
- 3. What is resilient infrastructure and how much does it cost? That's a valuable question given the frequency and expense of extreme weather events.
- 4. What if there's no more driving, but VMT still rises? Interesting possible question given connected and autonomous vehicle technology.
- 5. Where are the next boom towns? Who would have predicted the booms in North Dakota and other places in the country from fracking? And what will be the next big thing?
- 6. Do cars fill up or plug in? And what does that mean to funding?
- 7. What's the relationship between more senior Americans and transportation? Will we need more transportation travel choices? And do we pay to expand choice?



So, before we take a closer look at the six research reports and associated tools, I'd like to pause on this slide and ask for your thoughts on issues we might want to consider as we plan for the future of transportation in [insert state, or region or the US]?

[Pause for a moment and ask for audience interaction here. If you don't have time for audience discussion, you can omit this slide or ask everyone to think of future issues that are top of mind to them but don't ask participants to voice their thoughts]



There are six reports in in the series, including:

Freight – explore and plan for the future of freight with a scenario planning toolkit to use with stakeholders

Climate - to help you prepare for extreme weather

Technology – to help you select the right technology at the right time Sustainability – with a maturity model to help DOTs organize for a sustainable future

Energy - to identify and assess future scenarios

And, Socio-demographics with a model that considers your state specific data

Each of these reports is comprehensive unto itself, and together represent thousands of pages of research. This presentation may highlight areas or issues which you want to explore in depth yourself or engage in a robust discussion at your transportation agency. However, we're not going to go into depth on each of the research topics today.



Let's start with Freight. This report provides a set of workshop-based scenario planning tools than can be immediately used to create more responsive freight management strategies on an on-going basis.

As we know, transporting freight is a fundamental activity and a key driver of our U.S. economy. It's safe to say – freight is on the rise.



However, what is less clear is **how** freight will move in the future.

We know freight in the U.S. is growing, whether volume, or monetary value and is projected to either double or grow by 50% in the next 30 years.

But look at the slide. As e-commerce increases and more goods are delivered to doorsteps instead of big box stores, what is the impact to highways and local streets? And, what about the expectation for delivery times?

- Source U.S. Census Bureau
- NOTE: All the data charts in this presentation utilize identical year values along the y-axis (every other year from 1998-2012) in order to provide consistency across the data sets and to make the data easier to read. The data in the years left out of the data visualization does not alter the trend lines illustrated in the graphs. In the case of the Freight graph on this slide, the values in each year between 1998-2012 are larger than the year before.

FREIGHT SIGNPOSTS

What to look for in the coming years.



VITAL SIGNPOSTS

Volume:

Will global freight trend up or down?

Technology:

Does a major advance in technology, like digital printers, fundamentally change how goods are delivered?

Protectionism:

Rising trade protectionism could shift global trade.

E-commerce:

With goods being delivered directly to consumers, what is the future of local retail stores?





Moving on to the next volume, let's consider how to prepare for extreme weather and associated impacts. This 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.

CLIMATE CHANGE

Number of U.S. weather events (per year) costing over \$1 Billion



Extreme weather events are occurring more frequently in many parts of the country – and they're different in terms of severity and recovery costs. We're now regularly experience multi-billion dollar recovery efforts. What do these events mean to DOTs?

For example, consider when a bridge engineer sets the elevation of the bottom of the bridge over a water body, what year storm do we design to accommodate? What happens when the 100 year storm becomes the 50 year, 20 year, or 10 year storm? Do our standards need to be revisited in order to protect our valuable infrastructure? And are there simpler actions, like cleaning out culverts more frequently that can improve the performance of our transportation system during extreme weather?

- Source U.S. National Oceanic and Atmospheric Administration
- NOTE: All the data charts in this presentation utilize identical year values along the y-axis (every other year from 1998-2012) in order to provide consistency across the data sets and to make the data easier to read. The data in the years left out of the data visualization does not alter the trend lines illustrated in the graphs.
- In the case of the Climate Change graph on this slide, the full data set is as follows:

1998: 9
*1999: <u>5</u>
2000: 2
*2001: 2
2002: 4
*2003: 7
2004: 5
*2005: 5
2006: 6
*2007: 5
2008: 11
*2009: 7
2010: 5
*2011: 16
2012: 11

A full breakdown of the types of events in each year can be found at https://www.ncdc.noaa.gov/billions/time-series

CLIMATE CHANGE SIGNPOSTS

What to look for in the coming years.



VITAL SIGNPOSTS

Population Growth:

If global populations continue to boom, will technology come to the rescue?

Extreme Weather:

Does increased rainfall and drought, alongside increased extreme weather events change how infrastructure is built?

Sea Level Change:

Will rising waters in coastal areas alter where and how Americans live?



There are a variety of signposts related to extreme weather including population growth and sea level changes.



Technology is the next topic. 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 methodology featured in the Foresight Volume 3 report offers a practical and systematic way to select the right technology investments at the right time.



- Take a moment to look at the years to adopt different technologies.
- The rate at which Americans can and are adopting technology has accelerated dramatically. It took us 35 years to adopt a landline telephone but only 13 years to adopt mobile phones. Sixteen years to adopt personal computers but the world wide web was built out in less than half that time.
- So how do transportation agencies decide how and when to invest in new technology? This volume introduces STREAM – an evaluation methodology DOTs can use to select the right technology investments at the right time.
- But this graphic also begs the question: what is next transportation technology will Americans adopt? Will it be autonomous vehicles? Will it be a connected network of vehicles and infrastructure, where vehicles are in constant contact with each other and the roadway features, creating a potentially "crash less" driving environment? Some argue it isn't a matter of if but rather when. And will DOTs be ready?
- Source The Atlantic, July 2012

TECHNOLOGY SIGNPOSTS

What to look for in the coming years.



VITAL SIGNPOSTS

Wireless Sensors:

How might smart infrastructure change the frequency of maintenance cycles if schedules can be better optimized?

Remote Working Capabilities:

Will the need for office space decline as secure file transfer needs increase? At what cost?

Vehicle Technology:

How will worker safety and training be impacted?



New technologies are changing faster than agencies can react, and many barriers to rapid adaptation and deployment exist outside the control of transportation agencies. However, with change comes opportunity. For example: wireless sensors, remote working capabilities and vehicle technology.



There are a host of issues associated with sustainability. At the heart of that discussion is how do we, as transportation agencies, best serve the public at large? How do we meet the needs of our customers today without compromising the needs of future generations?

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



As this slide shows, transportation agencies have various levels of balancing social, environmental and economic goals. And those goals are often tied to whether you have a shorter or longer term view and the resources you have available.

But starting the conversation in your DOT about how to be organized for the future can occur at any of these levels.

* Source- NCHRP 750 Series, Report 4.

SUSTAINABILITY SIGNPOSTS

What to look for in the coming years.



VITAL SIGNPOSTS

Population:

Size, geographic distribution, and change in characteristics.

Economic Growth:

Increase or decrease in U.S. GDP will be a major factor in resources available for transportation.

Energy:

Changes in how cars fill-up change how DOT's are funded.

Technology:

Innovations may alter how vehicles use transportation infrastructure.



A few signposts as we think about sustainability over the long run:

- 1. Population population trends will clearly have a impact on how what and how DOTs will deliver transportation in the future and we'll talk more about that in a minute
- 2. Economics not only impact the **resources** available for transportation but also the **need** for transportation systems
- 3. And technology we need to think about how our actions influence sustainability and vice versa



As we look to the future, some people are very excited about emerging energy options and trends and others are scared.

Foresight 750, Volume 5 helps state DOTs plan more effectively for an uncertain energy future, such as declining fuel-tax revenue, higher highway construction and maintenance costs, worsening traffic congestion and more demand for alternative travel modes.



- Regardless of whether you're excited or scared about our energy future, we all need to pay attention to the trends.
- Look at the dramatic increase in alternative fueling stations in just the last few years. As agencies responsible for transportation, we have to be thinking about what this means to infrastructure as well as the funding of infrastructure.
- Source U.S. Alternative Fuels Data Center
- NOTE: All the data charts in this presentation utilize identical year values along the y-axis (every other year from 1998-2012) in order to provide consistency across the data sets and to make the data easier to read. The data in the years left out of the data visualization does not alter the trend lines illustrated in the graphs.
- In the case of the Energy and Fuels graph on this slide, the full data set is as follows:

1998: 7269
*1999: 6056
2000: 5205
*2001: 5542
2002: 5741
*2003: 6230

2004: 5740 *2005: 5162 2006: 5091 *2007: 5551 2008: 5756 *2009: 6411 2010: 6912 *2011: 10,071 2012: 20,498

• The full data set can be found at http://www.afdc.energy.gov/data/10332

ENERGY & FUELS SIGNPOSTS

What to look for in the coming years.



VITAL SIGNPOSTS

Technology:

Does new fuel technology lead to fewer carbon emissions and less fuel consumption?

Driverless cars:

How quickly do self-driving cars become the norm? Will they be safer? Will they increase fuel efficiency?

Costs:

Will new fuel technology advances make personal vehicles more or less affordable? More cars? More transit?



There are so many questions and possibilities associated with energy and fuels – and we to keep a close eye on the signposts.

For example, the percentage of the fleet using alternative fuels is a very small , however, the signs point towards a change in that percentage. The question is how significant will that change be, and how long before we start to feel its effects? Likewise, how and when should we try to capture revenues from alternative fuels?



I find this topic fascinating with questions around the issues of who we are, what we are like and how we're changing.

This report and accompanying model allow you to input state-specific data to see how the population in a state may change over time, how sociodemographic changes may affect the ways people travel and the kinds of transportation modes and infrastructure that may be needed.



If you were looking at the data, you would see that we're staying alive longer and having few children.

For example, if you compare the slices above the dotted line, you see that in 2010 about 53% of the US population is 35 years or older. In 1950, only 43 percent of the population was 35 years or older.

2010 Census:	Over 35 = 52.8%
	Under 35 = 47.2%

1950 Census: Over 35 = 43 % Under 35 = 57%

What does it mean to transportation? Much more older drivers, and frankly, fewer younger drivers.

* Data from US Census Bureau: 2010 Census

SOCIO-DEMOGRAPHIC SIGNPOSTS

What to look for in the coming years.



VITAL SIGNPOSTS

Life expectancy:

As people live longer, how does a growing senior population affect transit needs?

VMT:

With DOT budgets based largely on fuel tax, how do changing transportation needs affect VMT/fuel consumption?

Immigration:

Does immigration increase or decrease in the coming years? What will the transportation needs be for America's new additions?



These signposts raise all sorts of interesting scenarios with various impacts on transportation. For example:

Younger people have less appetite for driving and many would give up their driving privileges before their cell phones.

Also, typically immigration populations are more reliant upon and willing to use public transportation, but you see that diminish as generations are in this country longer.



So what should you do in light of all these trends, questions - signposts?

I encourage you to check into the Foresight 750 series where you can find outstanding research materials and practical resources you can use today to prepare for the future.

Go to TRB.org and search for Report 750.





See you in the FUTURE!