Future Interstate Study
Sustainability and Resilience Considerations

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Transportation & the environment

- 1950s - Interstate Era
- 1960s - Environmental movement
- 1970s - NEPA
- 1980s - Permits
- 1990s - Mitigation
- 2000s - Streamlining, Stewardship
- 2010s – Sustainability, Resiliency
- 2020s and beyond - ?????
Planning for the future

Freight  Climate Change  Technology

Sustainability  Energy  Socio-demographics
Terms/concepts

- **Systems thinking**
  - A management discipline that concerns an understanding of a **system** by examining the **linkages** and **interactions** between the components that comprise the entirety of that defined system.

- **Resilience**
  - The ability to **prepare** and **plan for, absorb, recover from**, or more successfully **adapt** to adverse events.

- **Adaptation**
  - Actions by individuals or systems to **avoid, withstand, or take advantage** of current and projected **changes and impacts**. Adaptation decreases a system’s vulnerability, or increases its resilience to impacts.

- **Transformation**
  - A fundamental **alteration** of the nature of a system once the current ecological, social, or economic **conditions become untenable** or are **undesirable**.

- **Sustainability**
  - Meeting the **needs** of the **present without compromising** the ability of **future generations** to meet their own needs.
Sustainability principles

“A society grows great when old men plant trees in whose shade they will not sit.” – Ancient Greek Proverb

“In every deliberation, we must consider the impact on the seventh generation . . .”
Great Law of the Iroquois

The Congress . . . declares that it is the continuing policy . . . to create and maintain conditions under which man and nature can exist in productive harmony, and fulfill social, economic and other requirements of present and future generations of Americans.” Section 101, National Environmental Policy Act, 1969
Sustainability Triple Bottom Line

- Social
- Economic
- Environment
  - Bearable
  - Sustainable
  - Viable
  - Equitable
Interconnectivity

- Interconnected systems
  - Physical infrastructure (e.g., transportation, information)
  - Natural systems (e.g., land, water, air)
  - Social (e.g., community network, human behavior)
- Interrelated needs
  - Environmental quality
  - Social equity/community viability
  - Economic development
- How can our decisions support the interdependent needs?

Transportation Actions/Decisions That Support a Sustainable Society
Transportation is an essential link

Source: Global Energy Network Institute
Resilience - multi-faceted

**Risks**

- **Natural disasters:**
  - Blizzards, Tornadoes
  - Floods, Hurricanes
  - Wildfires, Heat waves
  - Earthquake, Other

- **Human-induced disasters:**
  - Acts of terrorisms
  - Financial crises
  - Social unrest
  - Cyber attacks

**Transportation System Resilience**

Source: NCHRP Project 20-59(54) Fact Sheet
65 million put to test

New York City goes silent as Irene takes center stage

Fury after the fury
Dangerous floodwaters assault region in Irene’s path

As rivers back off, recovery

As waters recede, the region’s damage becomes more evident as people deal with the aftermath of Tropical Storm Irene.

Times Union
ALBANY, NEW YORK • SUNDAY, AUGUST 28, 2011
August 29, 2011
Risk = Vulnerability + Criticality

http://nyanc-alt.org/gis/champlain/
Culverts and the Triple Bottom Line

**Ecological:**
- Fish populations with access to cold, upstream waters
- Improved habitat
- Decreased erosion of banks
- Avoided water quality impacts

**Economic:**
- Avoided flood damage
- Avoided travel delay/freight disruption
- Avoided loss of business/tourism income from road closures
- ROI improves over time

**Social:**
- Improved safety and mobility on transportation systems, including access to emergency services
- Avoided health impacts
Move from Reactive to Proactive

“Although disasters will continue to occur, actions that move the nation from a reactive to a proactive approach will reduce many of the societal and economic burdens and impacts that disasters cause.

Building the nation’s resilience is a long-term process, one that will be socially and politically challenging, but the reward for our efforts will be a safer, healthier, more secure, and more prosperous nation.” ~ The National Academies, 2012
Develop collaborative partnerships
How will we move better?

More and more, the transportation sector is relying on data to drive decisions, and on technology to reimagine how we move people and goods.

**Connected Vehicles**

Vehicles that communicate are the latest innovation in a long line of successful safety advances.

The motor vehicle fatality rate has dropped by **80%** over the past 50 years.

Connected vehicles and new crash avoidance technology could potentially address **81%** of crashes involving unimpaired drivers.

**Robotics**

Advances in robotics are changing transportation operations and will impact the future transportation workforce.

Robots will perform vital transportation functions, such as critical infrastructure inspection.

**NextGen**

GPS and new technologies are leading to a safer, more efficient U.S. airspace.

By 2020, one-second updates will pinpoint the aircraft location and speed of 30,000 commercial flights daily.

**Real-time Travelers**

Mobile access to everything from traffic data to transit schedules informs our travel choices.

90% of American adults own a mobile phone.

20% use their phones for up-to-the-minute traffic or transit information.

Smartphones are regularly used for turn-by-turn navigation.

**Big data** is all around us. Global data generated is projected to grow by **40%** annually.

Data enables innovative transportation options, such as car-sharing, ride-sharing, and pop-up bus services, and more rapid delivery of goods.

Source: TheBluePaper.pdf
Infrastructure resilience

- Context and connectedness
- Smart technology
  - Connected and autonomous vehicles
  - Nanotech in construction materials
  - Sensors for real-time conditions
  - Vehicle-infrastructure integration - real-time communication
- Green infrastructure and sustainable materials
- Multi-modal and intermodal opportunities
- Strategic preservation, expansion, retreat
- Sea-level rise/extreme weather considerations
- All hazards security

Route 9A, Manhattan, NYC
Environmental resilience

- Reduce carbon footprint
  - Energy/fuel efficiency, alternative fuels, reduced GHG emissions, reduced VMT
- Land use/growth planning
- Context sensitive solutions
- Integrate infrastructure and conservation planning
- Design with nature
  - Aquatic and hydraulic connectivity
  - Natural stream design
  - Habitat connectivity

Source: https://www.wildlife.ca.gov/Conservation/Planning/Connectivity
Community resilience

A safe and resilient community
1. ...is knowledgeable and healthy.
2. ...is organized.
3. ...is connected.
4. ...has infrastructure and services.
5. ...has economic opportunities.
6. ...can manage its natural assets.

Source: http://www.ifrc.org

NY Rising Community Reconstruction Plans
https://stormrecovery.ny.gov/nyrcr/final-plans
Organizational resilience

- Resilience affects every major business function within a transportation agency including planning, project delivery, operations, and business management.
- With future changes, we should expand disciplines within state DOTs to evolve from our currently engineering-dominated organizations to a multi-disciplinary and diverse organization.
  - Planners, systems thinkers
  - Information technologists, modelers
  - Environmental scientists
  - Economists
  - Social scientists
  - Public health specialists
  - Emergency managers
“The future belongs to those who believe in the beauty of their dreams.”

~Eleanor Roosevelt

http://www.toyota-global.com/innovation/intelligent_transport_systems/mobility/