



Future Interstate Study

Sustainability and Resilience Considerations

Debra Nelson, NYSDOT

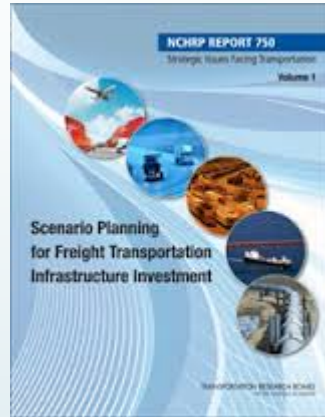
Environment and Resilience Panel, December 19, 2016

Transportation & the environment

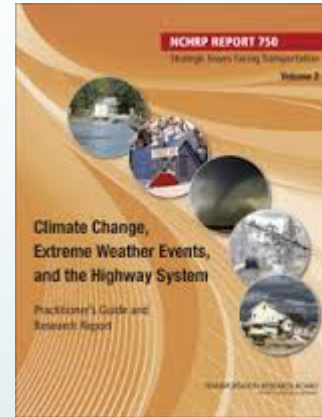


- ▶ 1950s - Interstate Era
- ▶ 1960s - Environmental movement
- ▶ 1970s - NEPA
- ▶ 1980s - Permits
- ▶ 1990s - Mitigation
- ▶ 2000s - Streamlining, Stewardship
- ▶ 2010s - Sustainability, Resiliency
- ▶ 2020s and beyond - ?????

Planning for the future



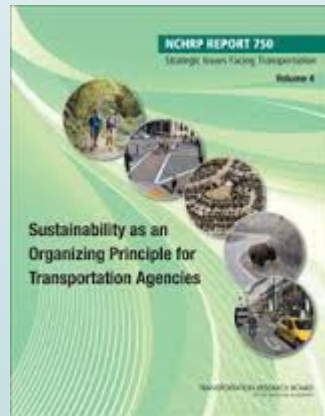
Freight



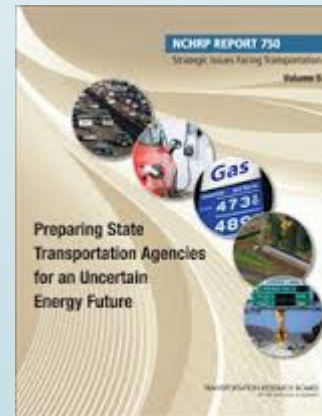
Climate Change



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

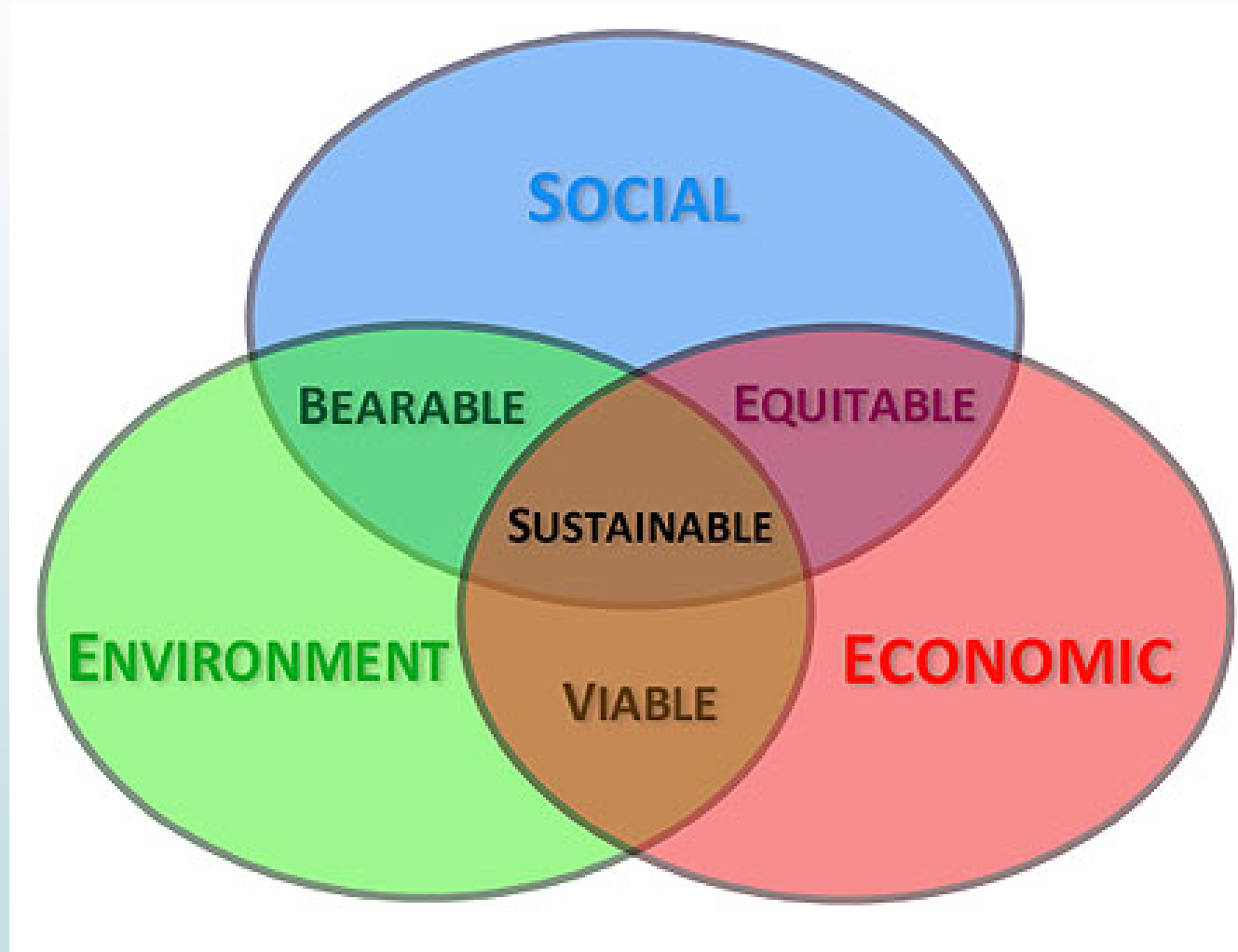


*“In every deliberation, we must consider the impact on the seventh generation . . .”
Great Law of the Iroquois*



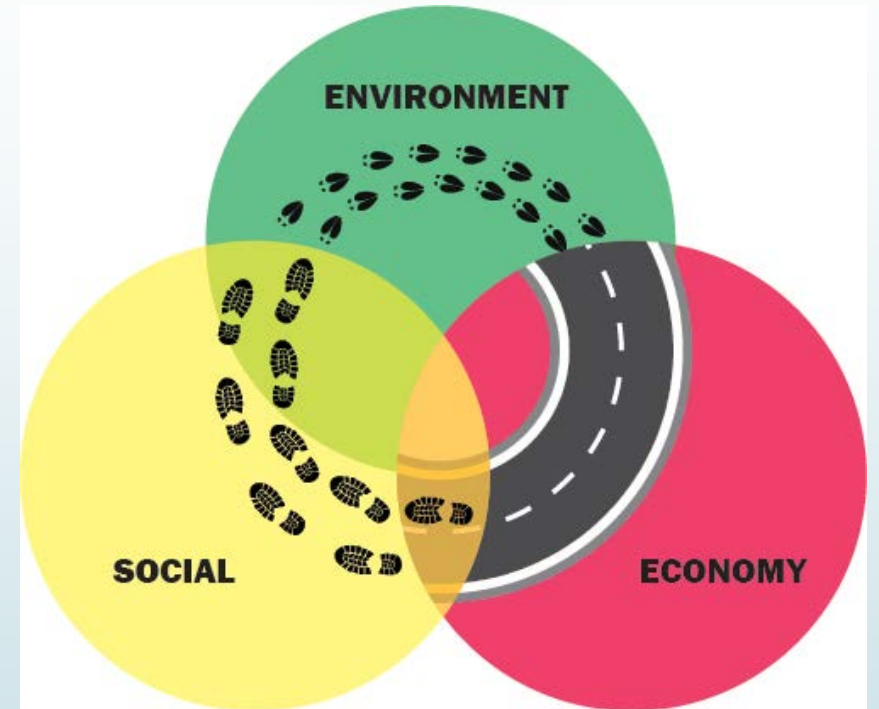
The Congress . . . declares that it is the continuing policy . . . to create and maintain conditions under which man and nature can exist in productive harmony, and fulfill social, economic and other requirements of present and future generations of Americans.” Section 101, National Environmental Policy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

Sustainability Triple Bottom Line



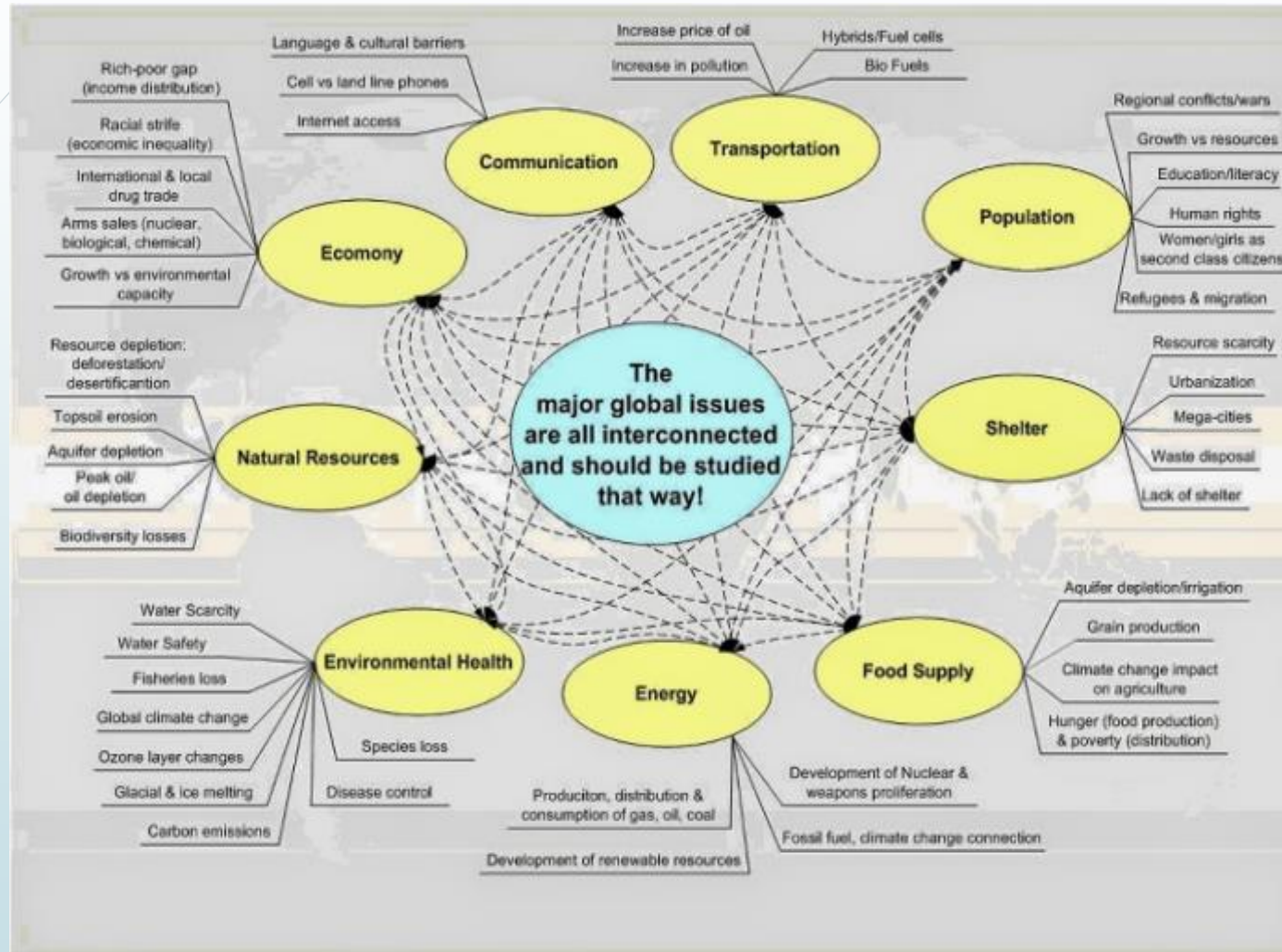
Interconnectivity

- ▶ 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](http://www.globalenergyinstitute.com)

Resilience –multi-faceted

Risks

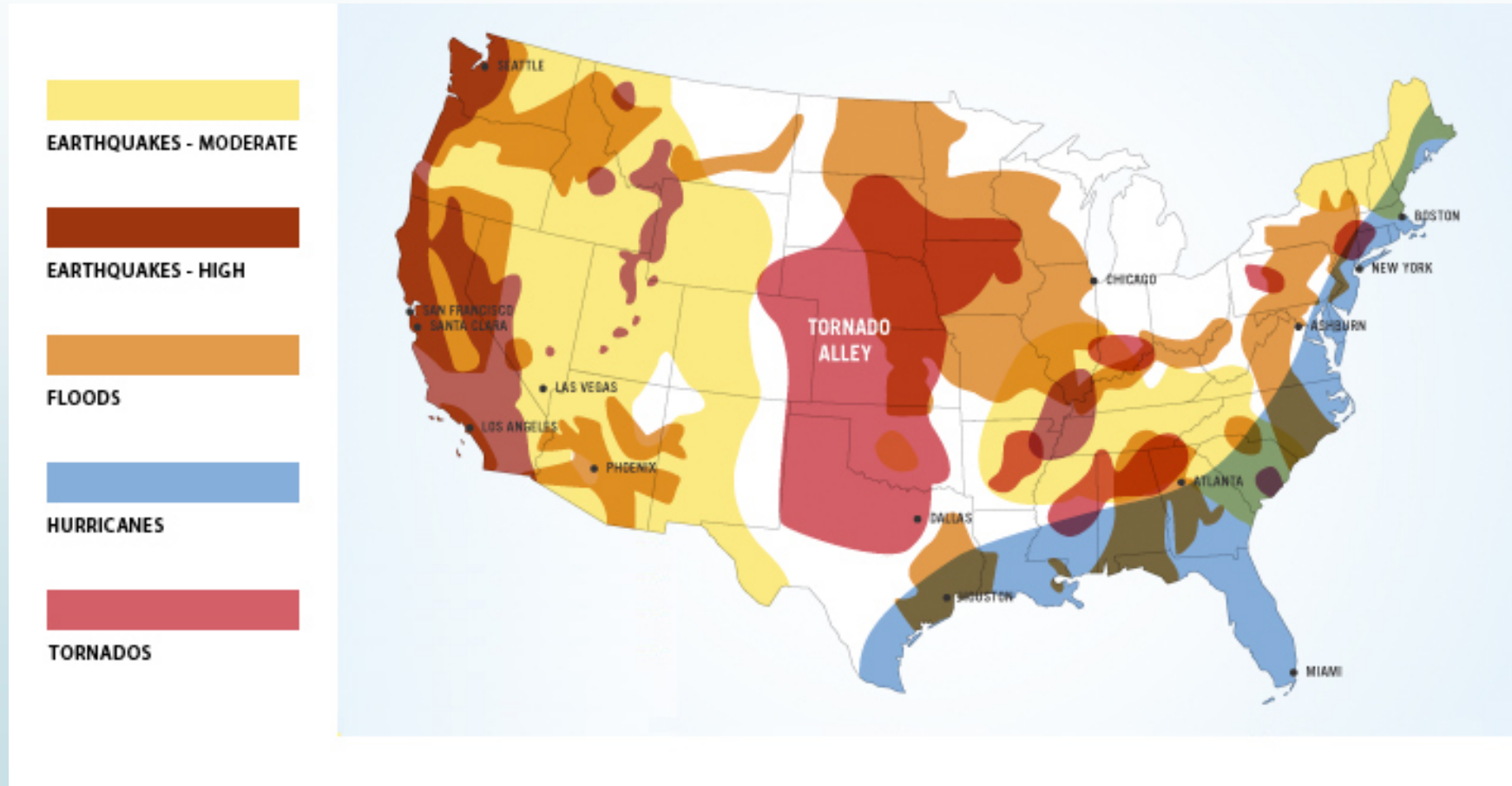
- ▶ Natural disasters:
 - ▶ Blizzards, Tornadoes
 - ▶ Floods, Hurricanes
 - ▶ Wildfires, Heat waves
 - ▶ Earthquake, Other
- ▶ Human-induced disasters:
 - ▶ Acts of terrorisms
 - ▶ Financial crises
 - ▶ Social unrest
 - ▶ Cyber attacks

Transportation System Resilience



Source: NCHRP Project 20-59(54) Fact Sheet

Natural Disaster Risks Map



Source: AlertSystemsGroup.com

65 million put to test



A STRANDED sailboat is battered by the surf Saturday as a couple on the beach failed to outrun the storm.

New York City goes silent as Irene takes center stage

By MITCH WEISS and SARANTHA GROSS
 Associated Press

NEW YORK — A weakening but still dangerous Hurricane Irene shut down New York and threatened other cities more accustomed to snowstorms than tropical storms as it steamed up the East Coast on Sunday, unleashing a foot of rain on North Carolina and Virginia and knocking out power to more than 1.5 million homes and businesses. At least five people were killed.

New York emptied its streets and subways and waited with an

erobic quiet. Waiting for the onslaught, Philadelphia, the Bay area, the Boston area. Packed of 115 mph, the hurricane's winds — and three of the nation's 100 million people.

The hurricane's seven-foot waves warned of danger on the coast and Delaware, of South and in New and Long Island.

Photos by

EAST COAST **NEW YORK CITY** **WINDHAM**



FRED BECHTOLD/ASSOCIATED PRESS

WAVES GENERATED by Irene pumpled the coast Sunday in Westbrook, Conn. There were fears of flooding, but there also was widespread relief that it wasn't worse. **Page A10**



CHELSEA MATIAS/ASSOCIATED PRESS

PEOPLE SLEEP at Penn Station in New York City on Sunday. The city was prepared for the worst as the storm approached, but nightmare scenarios that were presented didn't come to pass. **Page A3**



LANCE WHEELER/SPECIAL TO THE TIMES UNION

A BUS is partially submerged by rushing water in Windham, where Irene dumped more than 10 inches of rain on the village. **More photos, Pages A10, A11.**

Fury after the fury

Dangerous floodwaters assault region in Irene's path

By LAUREN STANFORTH



ROUTE 2 between Cropseyville and Grafton was heavily damaged by flooding from Tropical Storm Irene. Officials said portions of the road were badly damaged.

As rivers back off, recovery



As waters recede, the storm's damage becomes more evident as people deal with the aftermath of Tropical Storm Irene

Times Union staff writers

Devastating flooding from the Capital Region's overflows rivers finally retreated Tuesday as storm-ravaged homeowners and workers pump water from drenched basements begin the slow recovery from Tropical Storm Irene.

Three days after the former hurricane battered the Eastern Seaboard sopping trees, capping power and taking lives, receding floodwaters in the region's saturated cities and towns revealed the ugly toll of the storm's destruction.

The damage was surveyed as officials and victims of the flooding shift to recovery mode.

"I don't want to deal with this," said Cosimo Marras, whose basement in the waterlogged Stockade section of Schenectady was soaked with some 4 feet of water after a raging Mohawk River spilled its banks, "but that may change because right now I'm just saying what's going through my mind."

Over the past few months, Marras had finished an estimated \$20,000 in renovations in his home on Nord Ferry Street, a fix-upper he bought in November.

Irene wiped away the renovations in a matter of hours. The flooding left behind a thick layer of mud-covered hardwood floors in what was once a living room.

Across the soaked neighborhood and region, similar horror stories abounded.

SHIP DICKSTER/TIMES UNION



Traffic Conditions

Map Legend

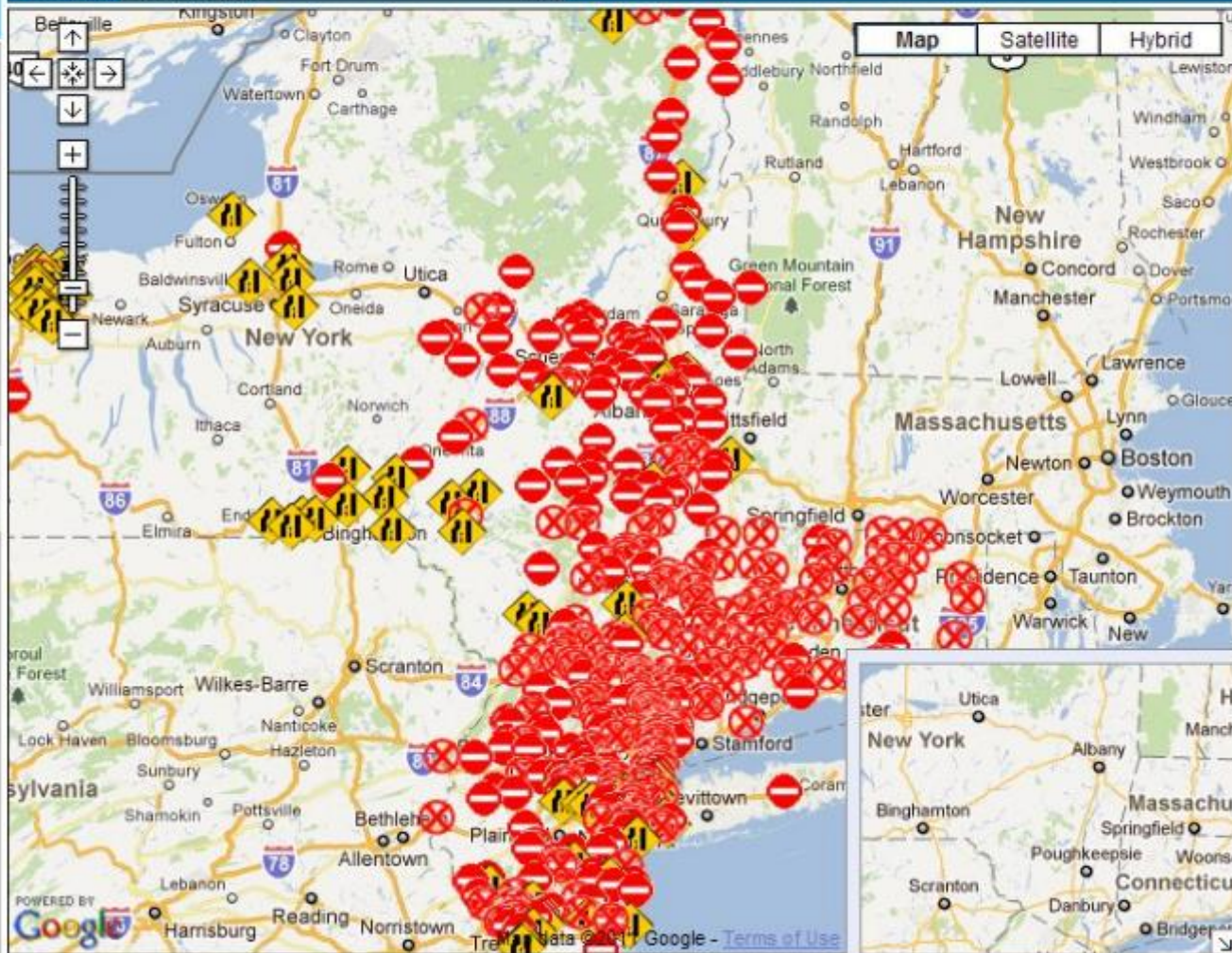
- Incidents / Closures
- Weather/Alerts
- Special Events
- Bridges and Tunnels
- Construction
- Cameras
- Show Speeds
- >= 50mph
- 30-49mph
- < 30mph
- No Info

Save My Map View

View My Saved Map

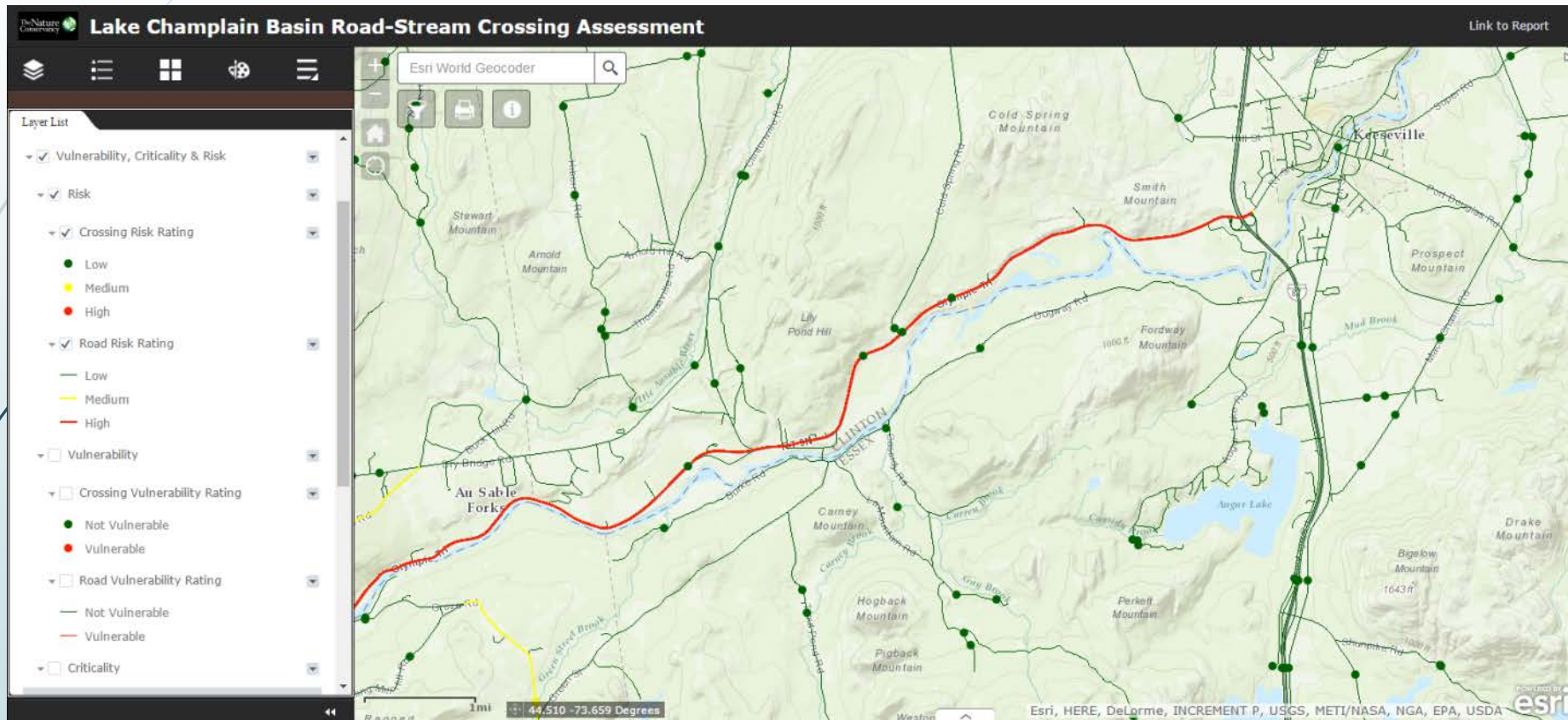
Clear My Map View

Zoom to: Select a Region



Map | Satellite | Hybrid

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



**RIGHT SIZE
CULVERTS**
can provide
multiple
benefits

SOCIAL:

- Improved safety and mobility on transportation systems, including access to emergency services
- Avoided health impacts



ECONOMIC:

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

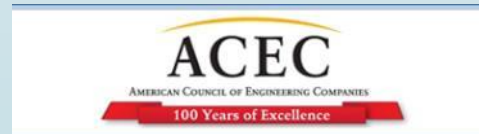
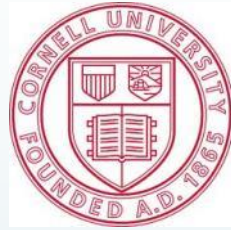
Move from Reactive to Proactive

“ 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.

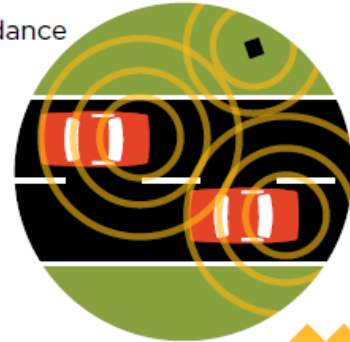
Connected Vehicles

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

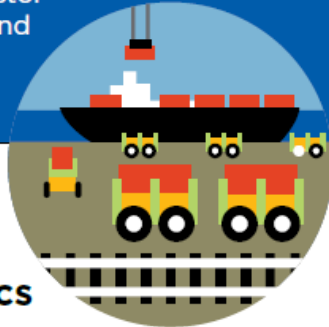
81% of crashes involving unimpaired drivers.



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**.



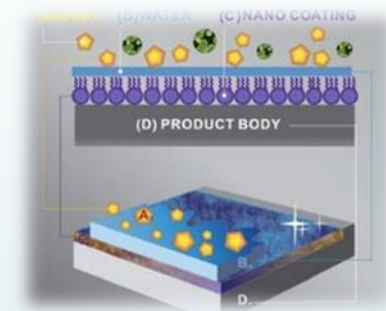
Big data is all around us. Global data generated is projected to grow by **40%** annually.

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



Infrastructure resilience

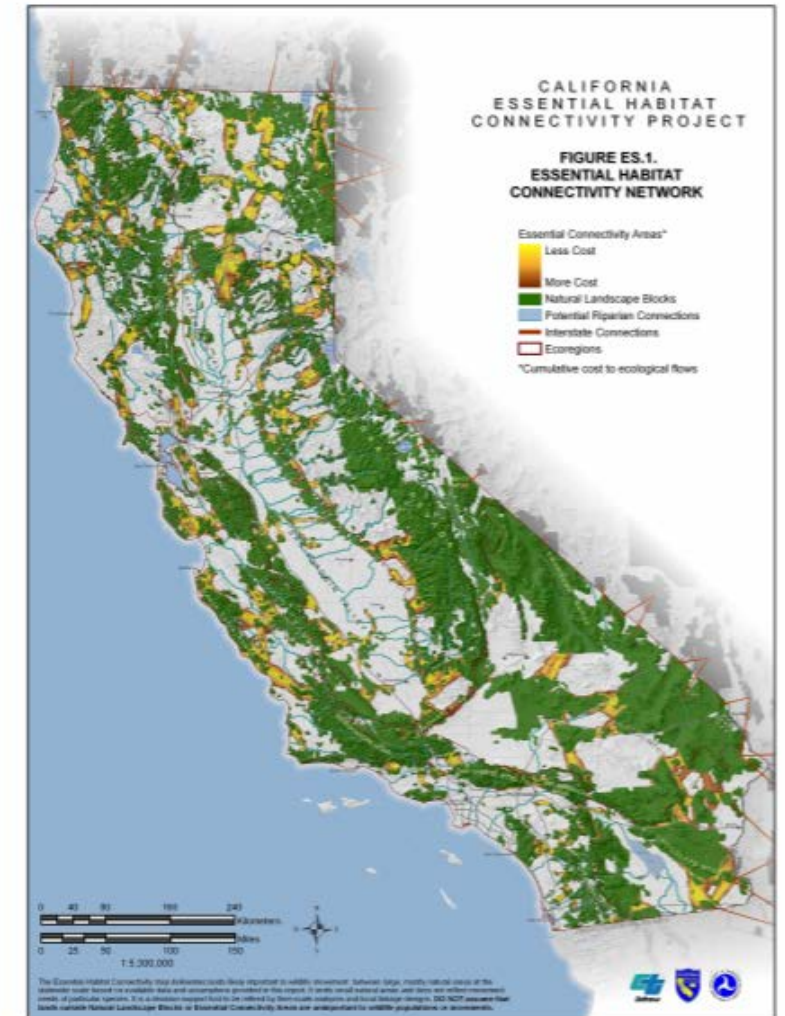
- ▶ Context and connectedness
- ▶ Smart technology
 - ▶ Connected and autonomous vehicles
 - ▶ Nanotech in construction materials
 - ▶ Sensors for real-time conditions
 - ▶ Vehicle-infrastructure integration – real time communication
- ▶ Green infrastructure and sustainable materials
- ▶ Multi-modal 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

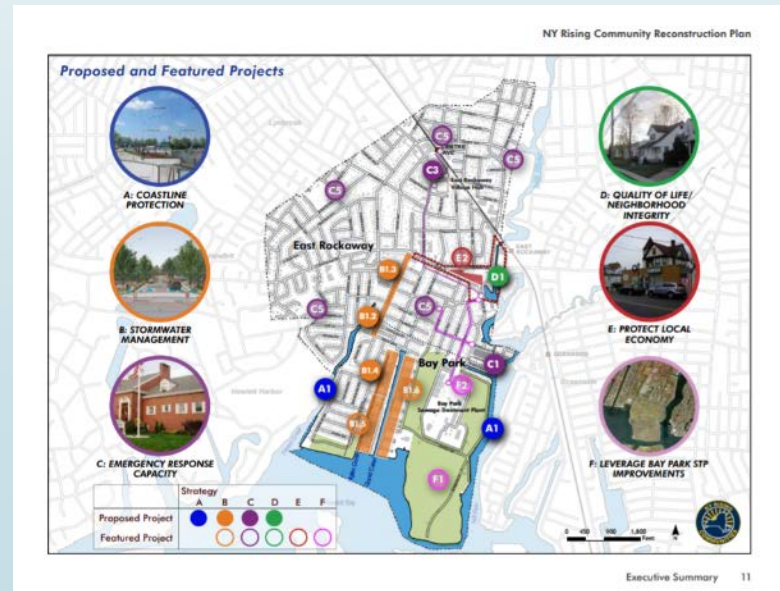
A safe and resilient community

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>



Plan for a Beach 108th Street Ferry Terminal, which can improve coastal protection and catalyze economic development in the area.



NY Rising Community Reconstruction Plans
<https://stormrecovery.ny.gov/nycrcr/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

