Improving Transportation Network Resiliency Using In-Situ Evaluation and Innovative Construction Methods

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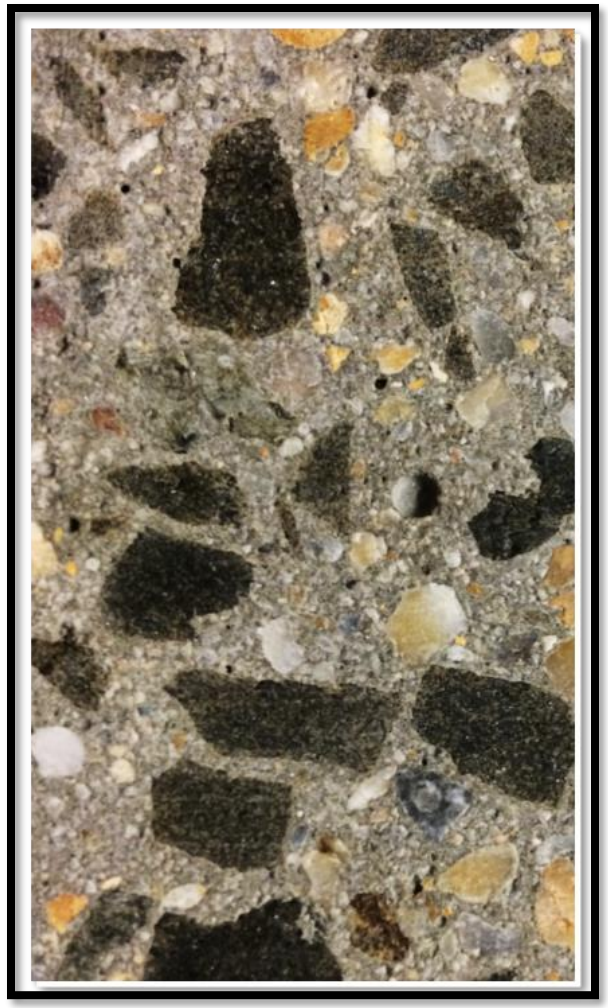
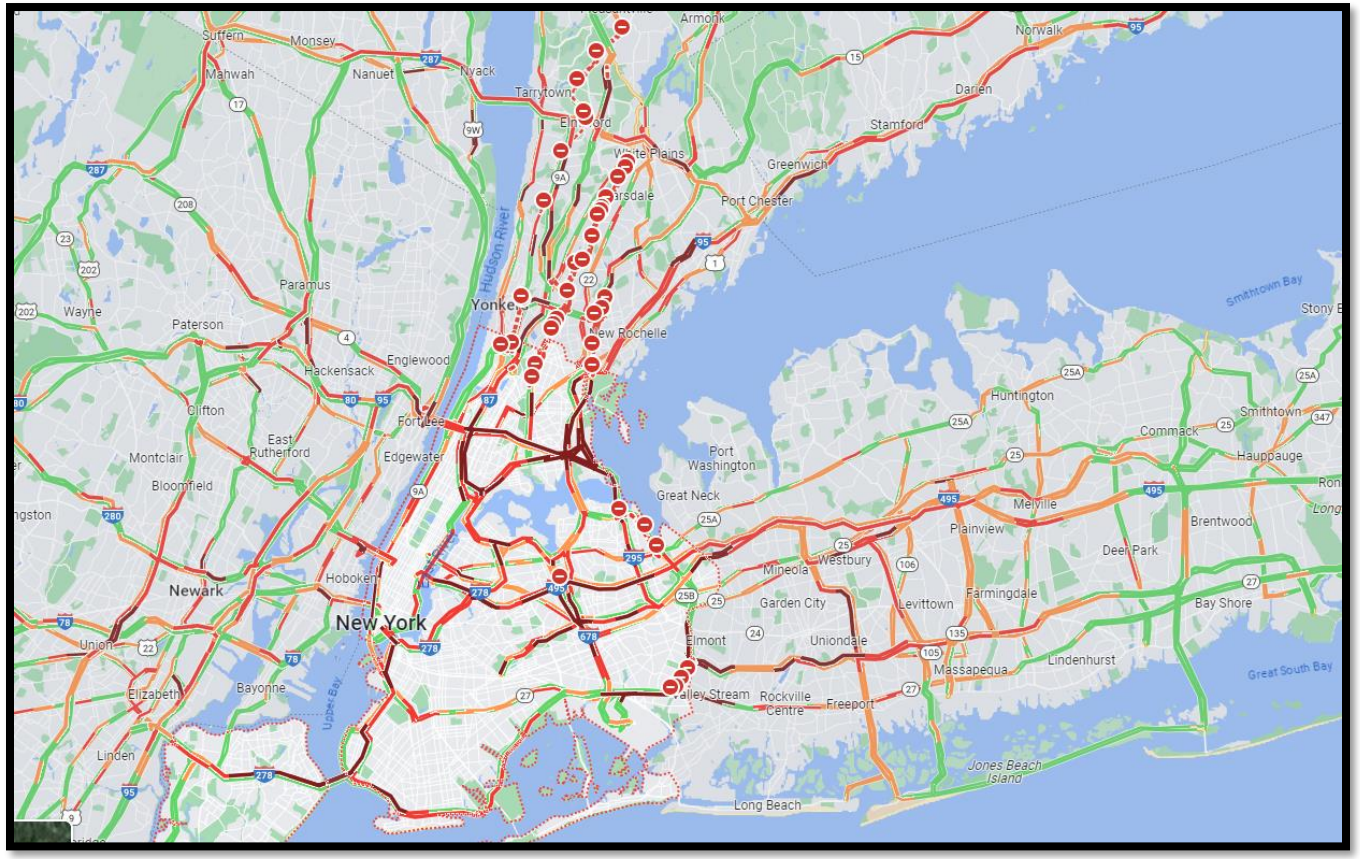
Resiliency at All Levels





Governor Kathy Hochul
@GovKathyHochul

Make no mistake: This is our new normal.

Transportation Network Resiliency: Why Bridges?

Hurricane Irene: Supplies Airlifted to 13 Isolated Vermont Towns

| AFTERMATH |

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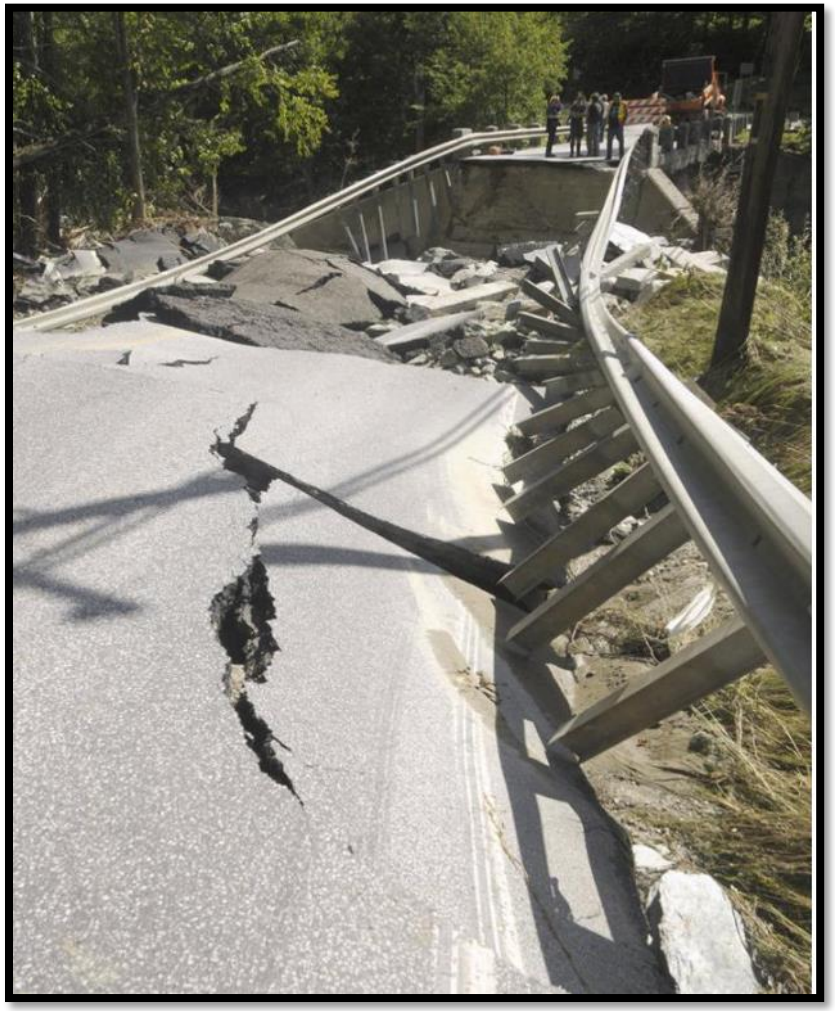
Toby Talbot / AP Photo



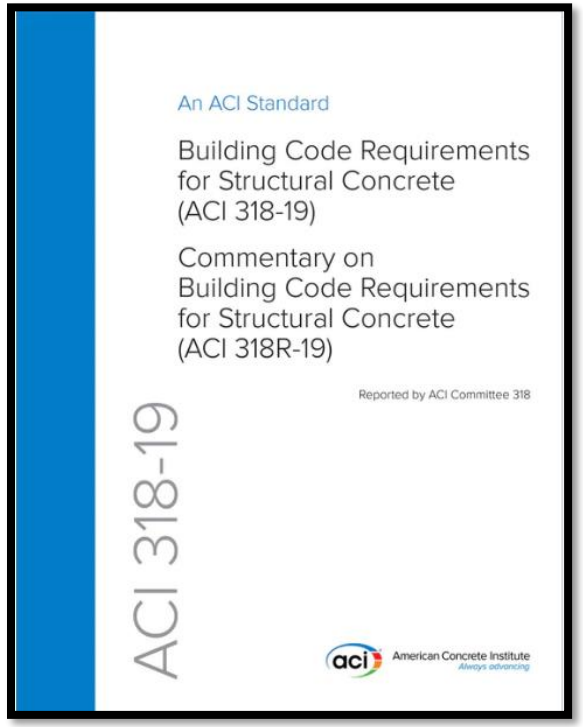
Bridges are:

- Bottlenecks
- Most fragile
- Most expensive to retrofit
- Hardest to replace

Resilient Design

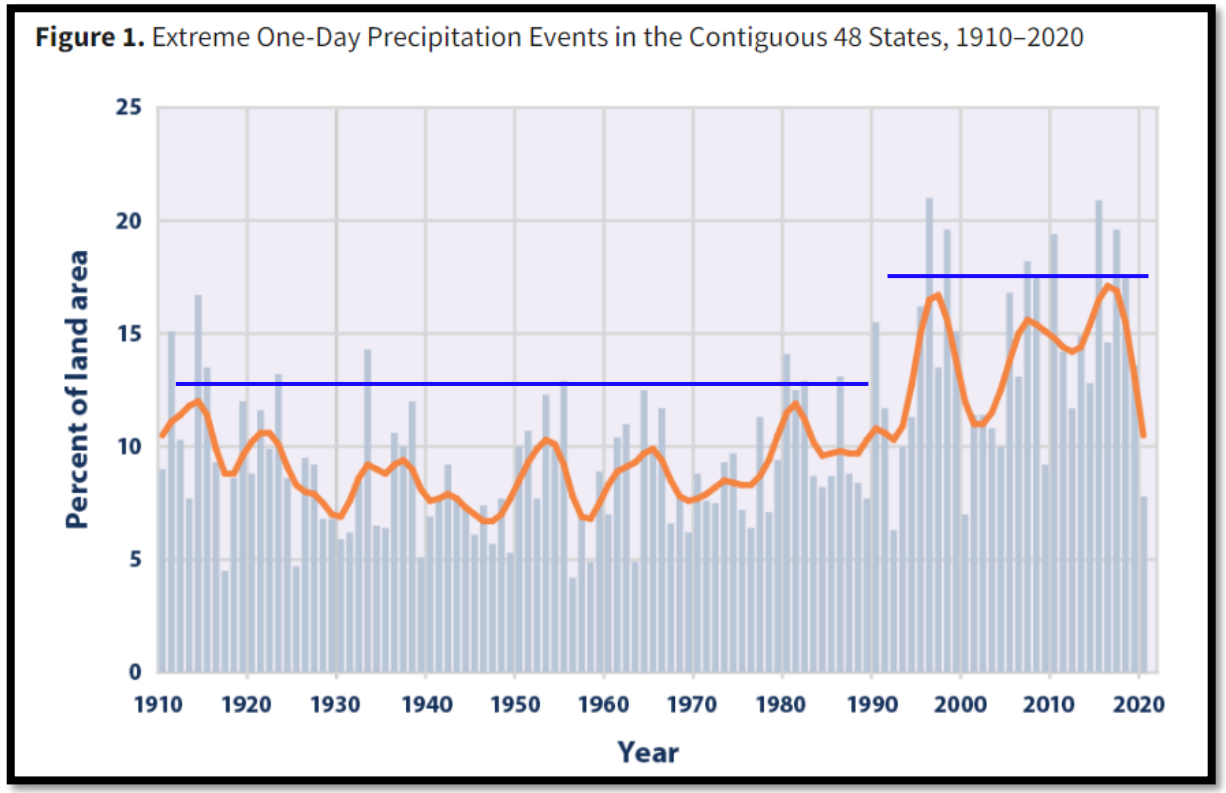
Demand

Materials and Detailing

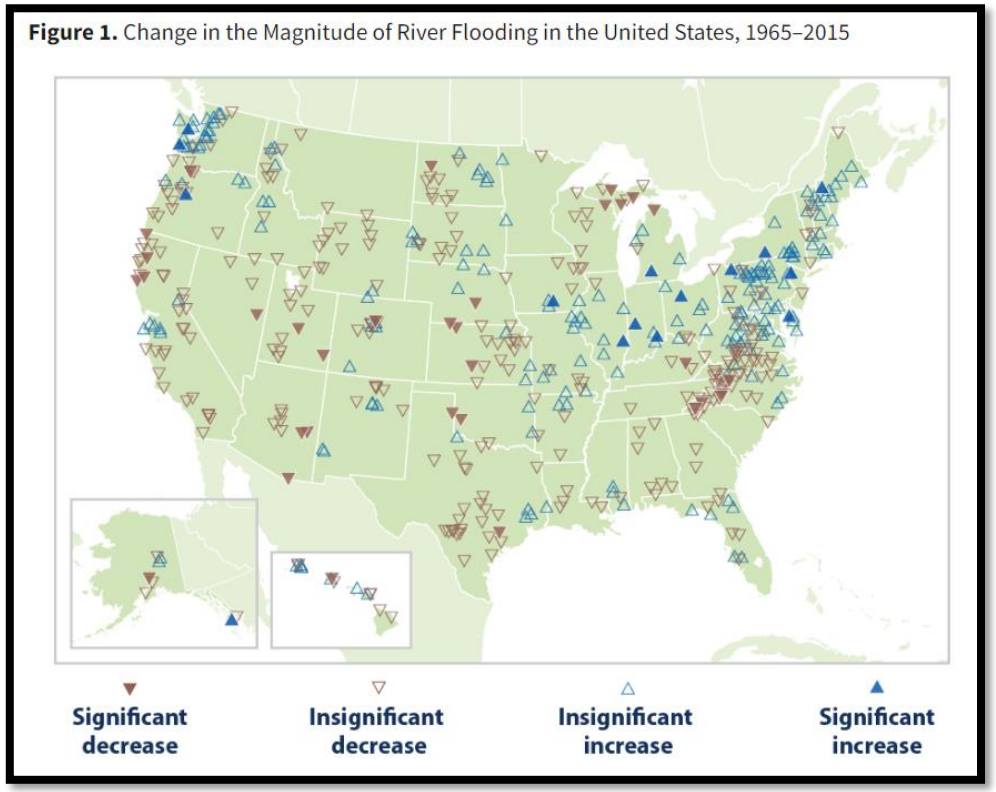


Capacity

Inland Flooding Due to Climate Variability

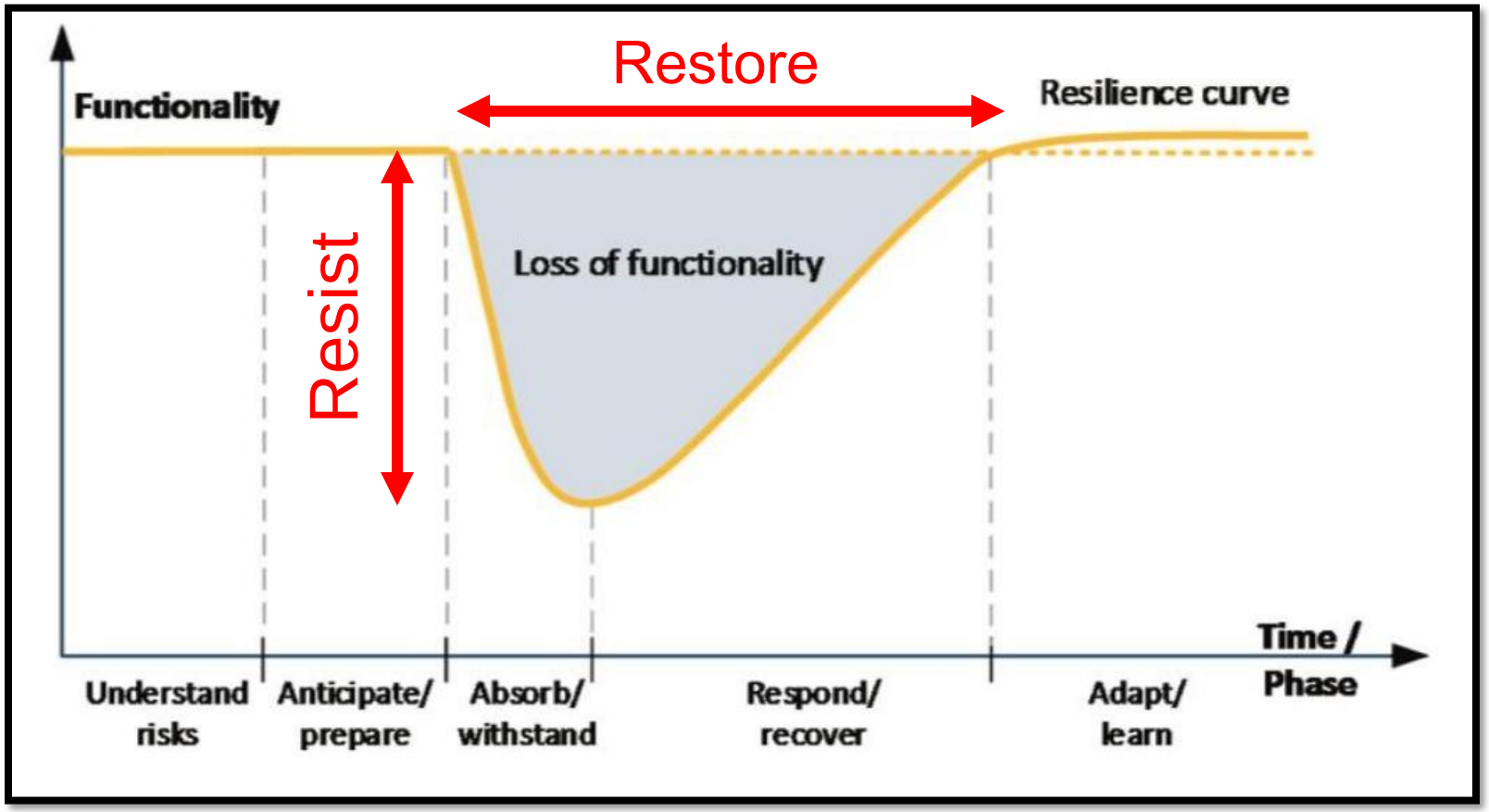


Source: Environmental Protection Agency (EPA)
Note: Dark blue lines added



Source: Environmental Protection Agency (EPA)

The Case for Rapid Replaceability



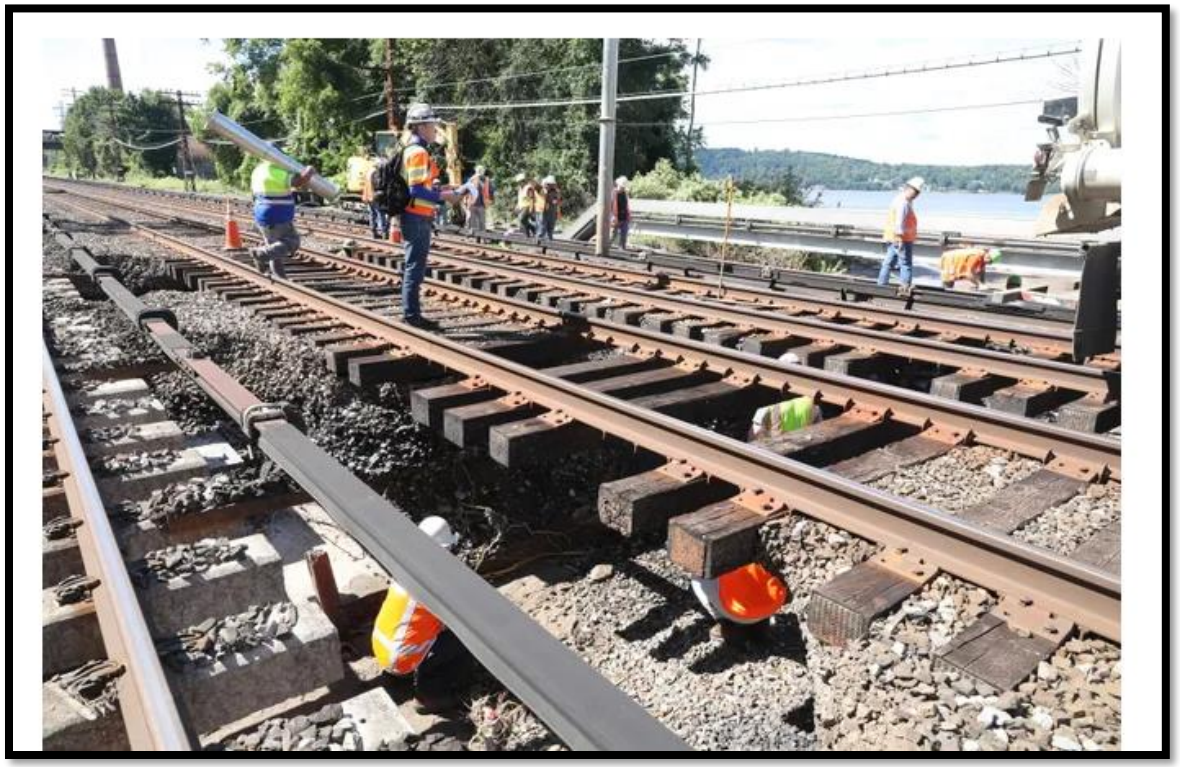
The Case for Rapid Replaceability

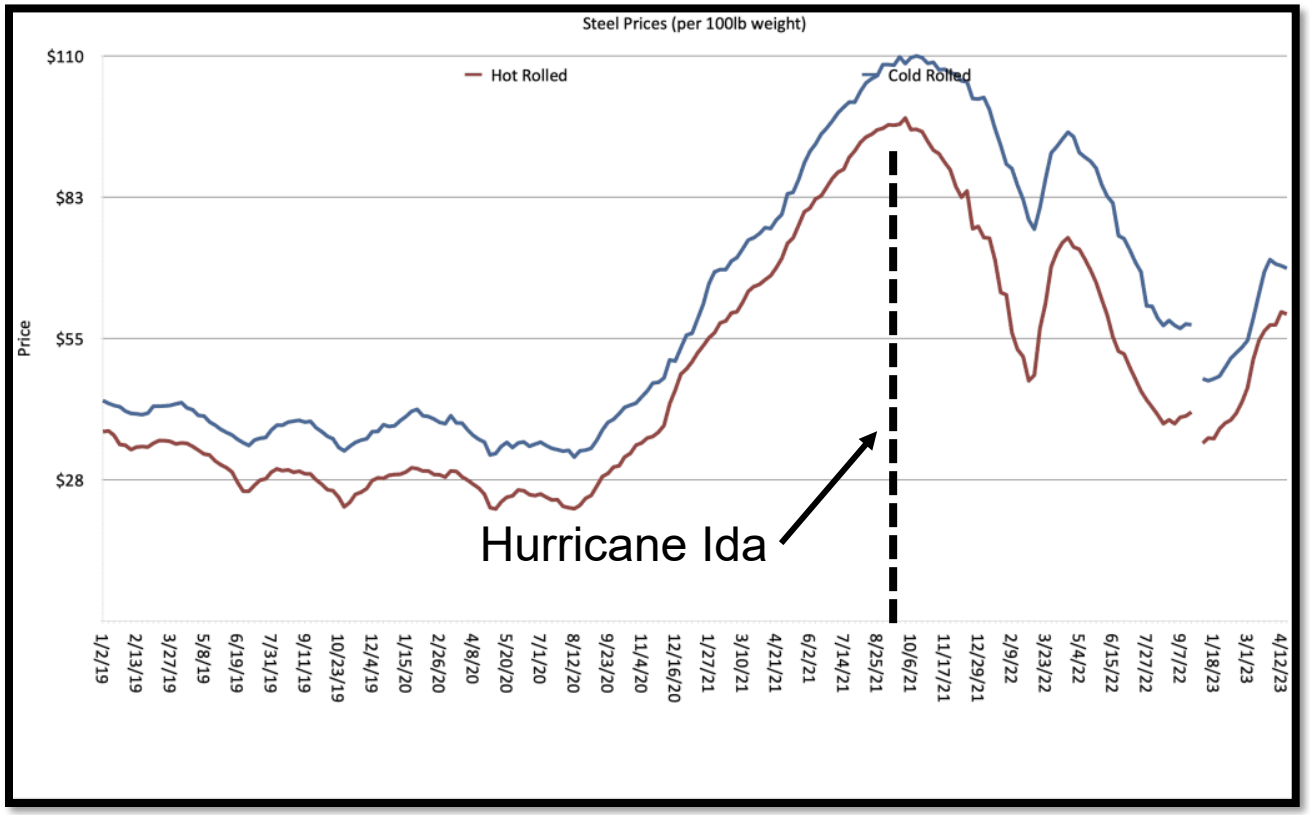
Resiliency in Design of New Bridges

Resiliency in Retrofit of Existing Structures

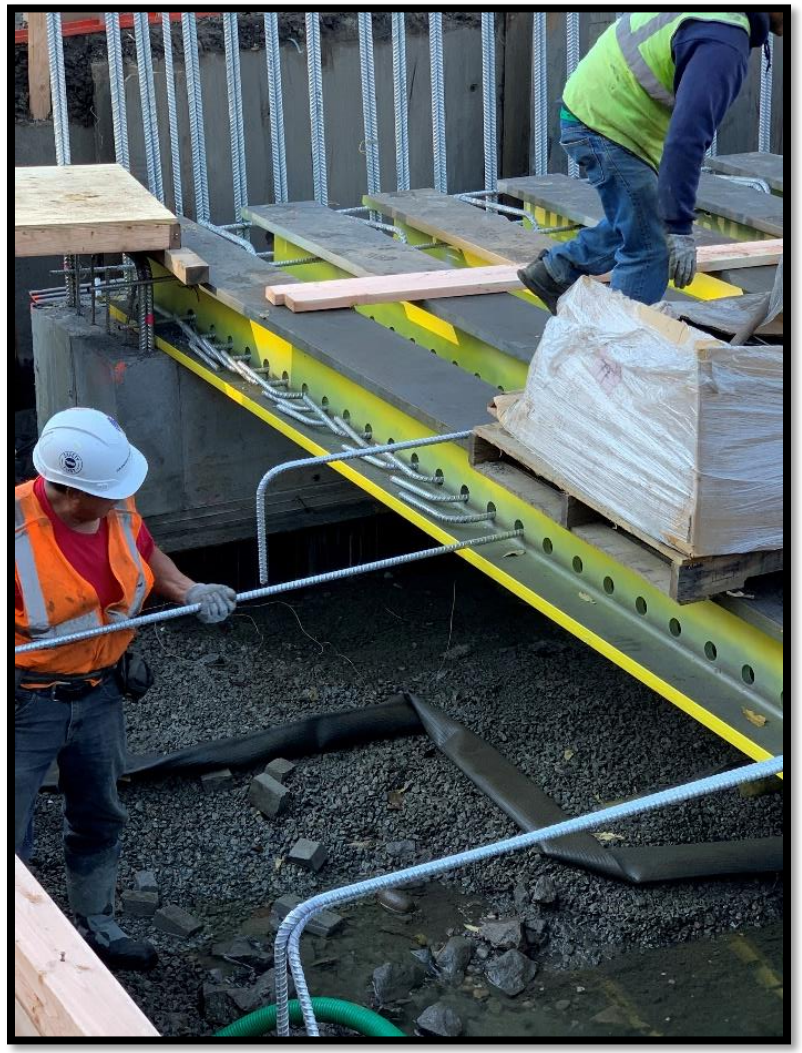
Rapid Replaceability

Commuter Rail Failure



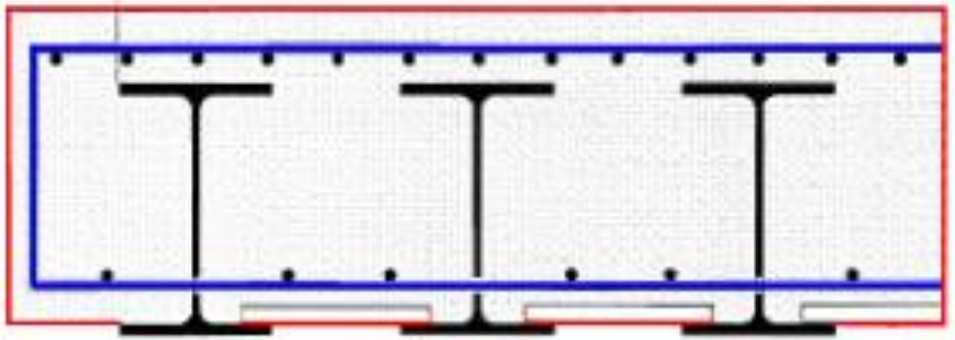


Filler Beam Solution



Project Challenges:

- Steel Shortage
- Limited Site Access
- Adjacent Train Traffic
- Limited Hydraulic Opening



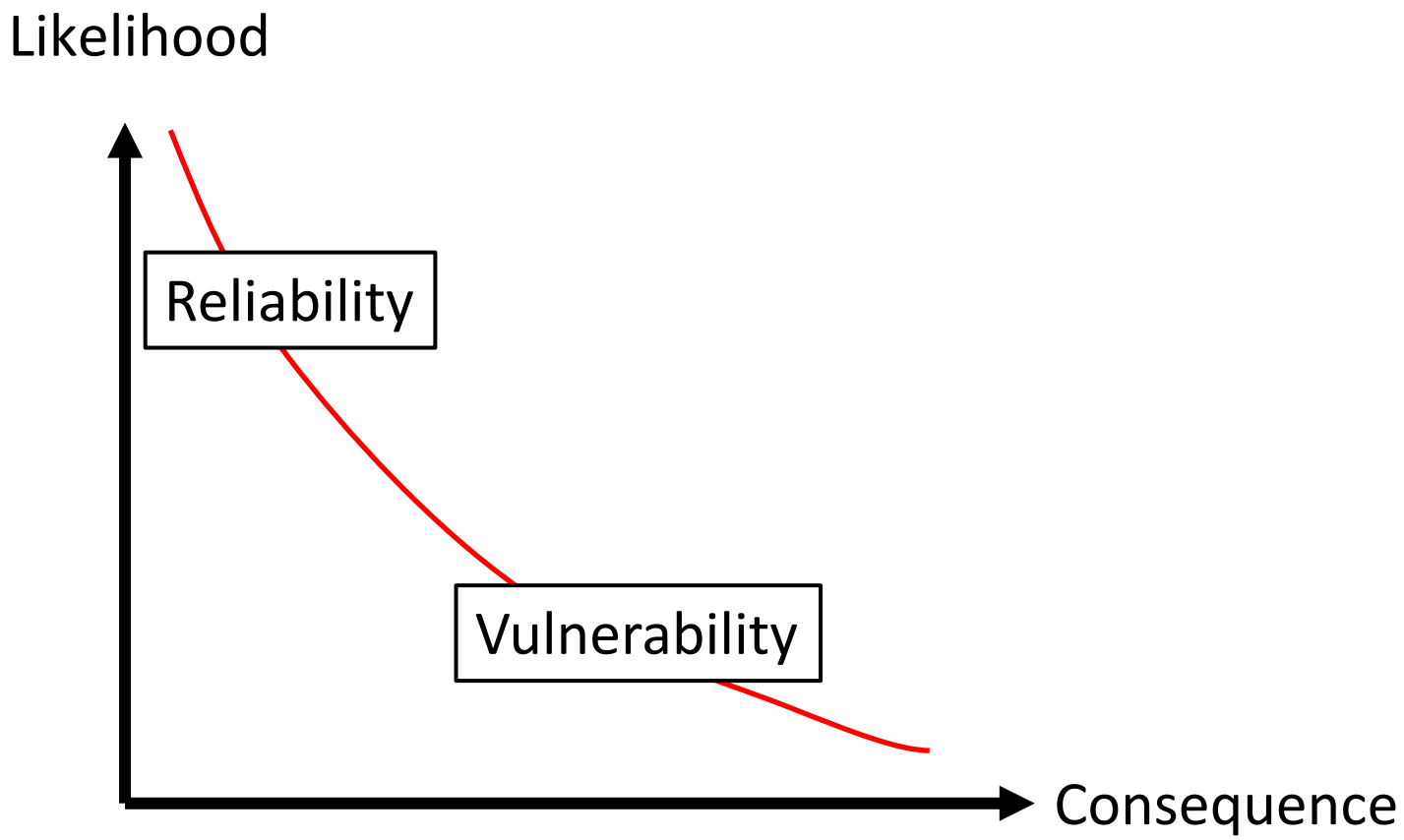
Filler Beam Solution

Design Advantages:

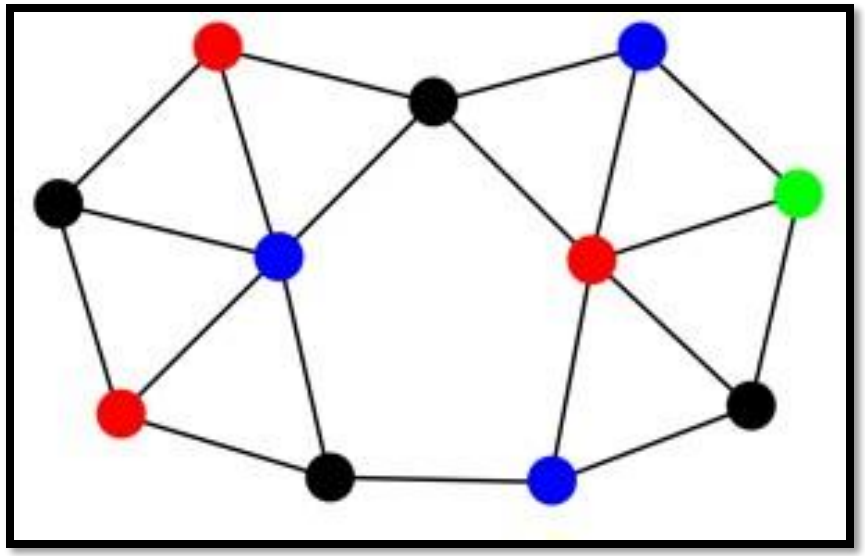
- Flexibility in Steel Size
- Lighter Lifting Weight
- Formwork Support off Beams
- Reduced Section Depth

Likelihood and Consequence

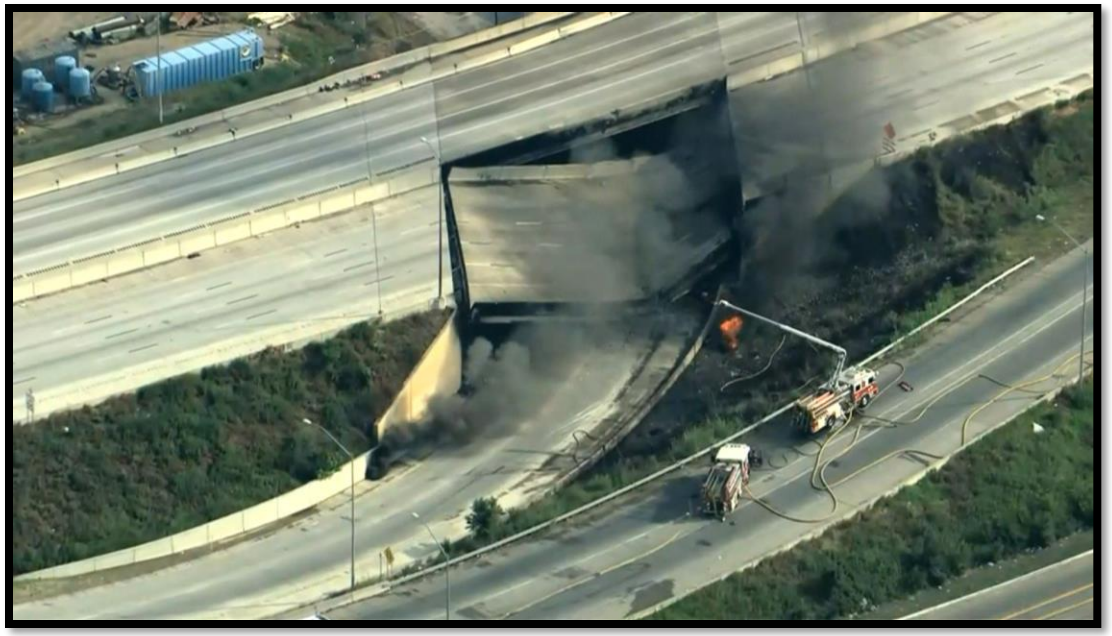
Risk = Likelihood x Consequence

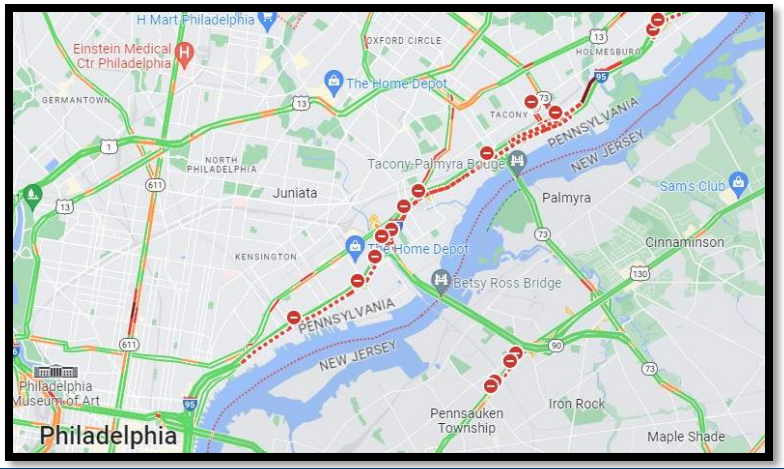


Bridges and Network Behavior



Bridge Failures and Network Resiliency

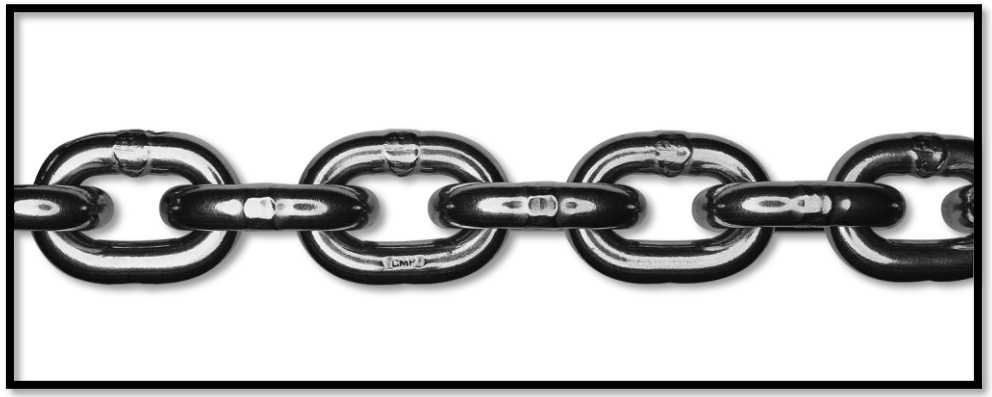


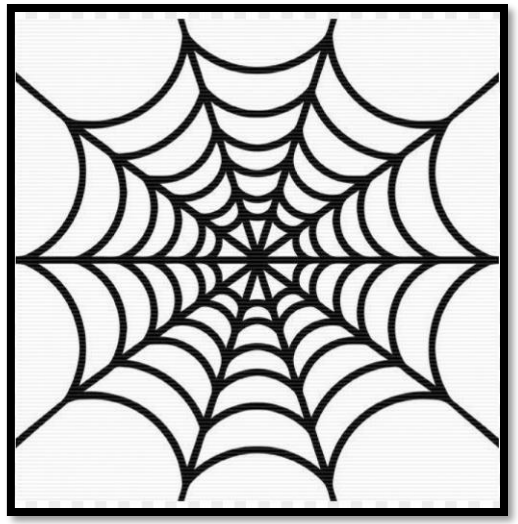


I-95 Overpass in Philadelphia

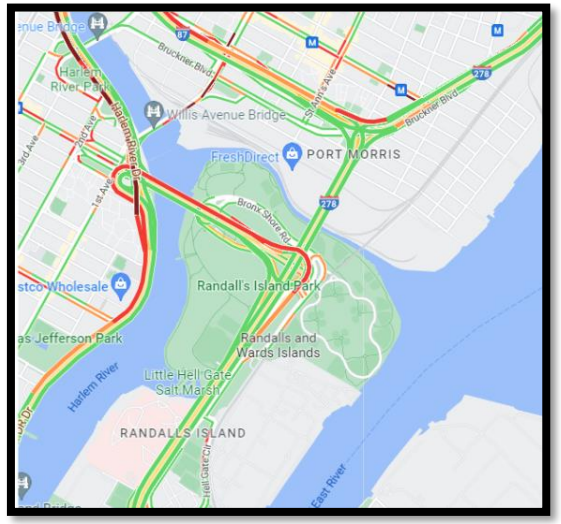
I-40 Bridge in Memphis

Asset Criticality Within a Network

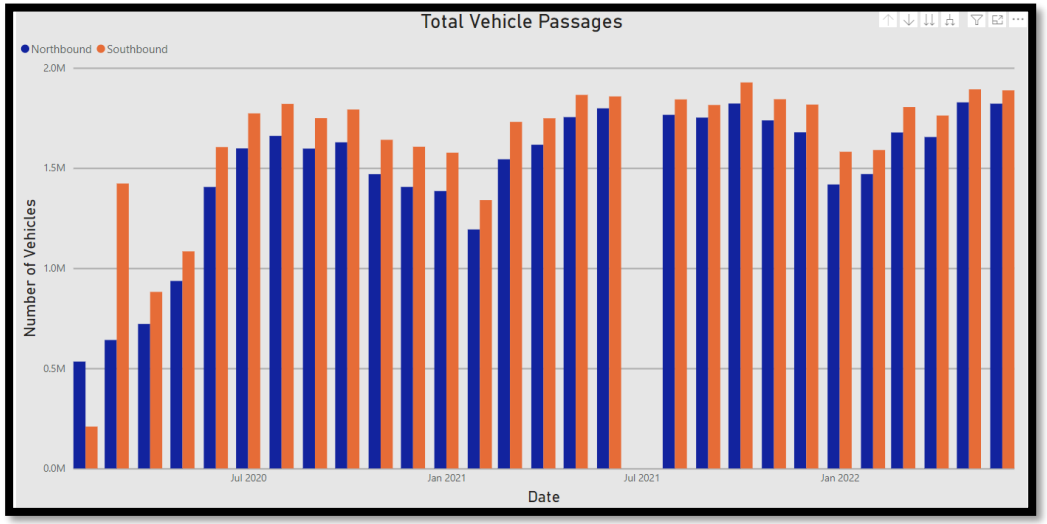




Bridges and Networks: What has Changed?

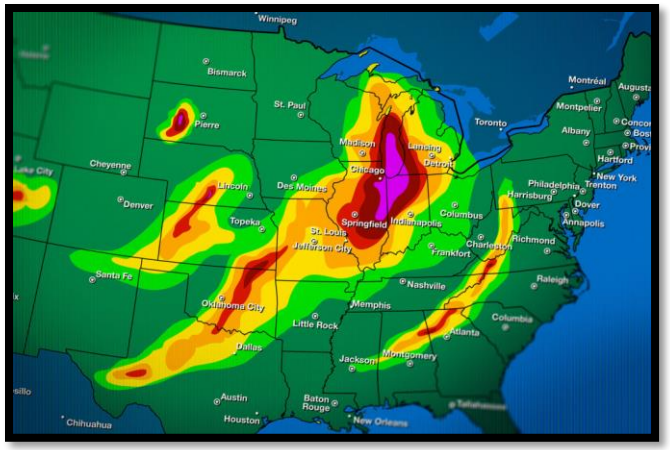


Quantifying congestion



Understanding live load

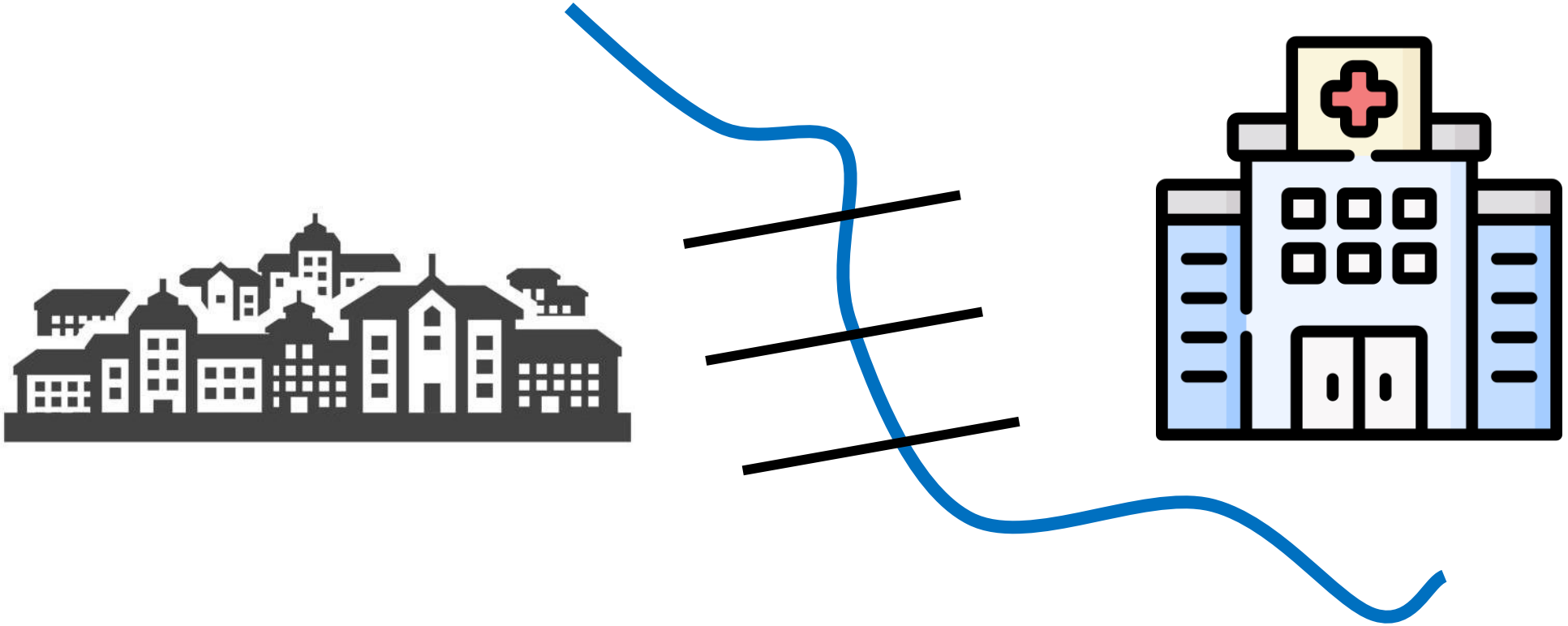
Wireless monitoring



Real time and historic weather

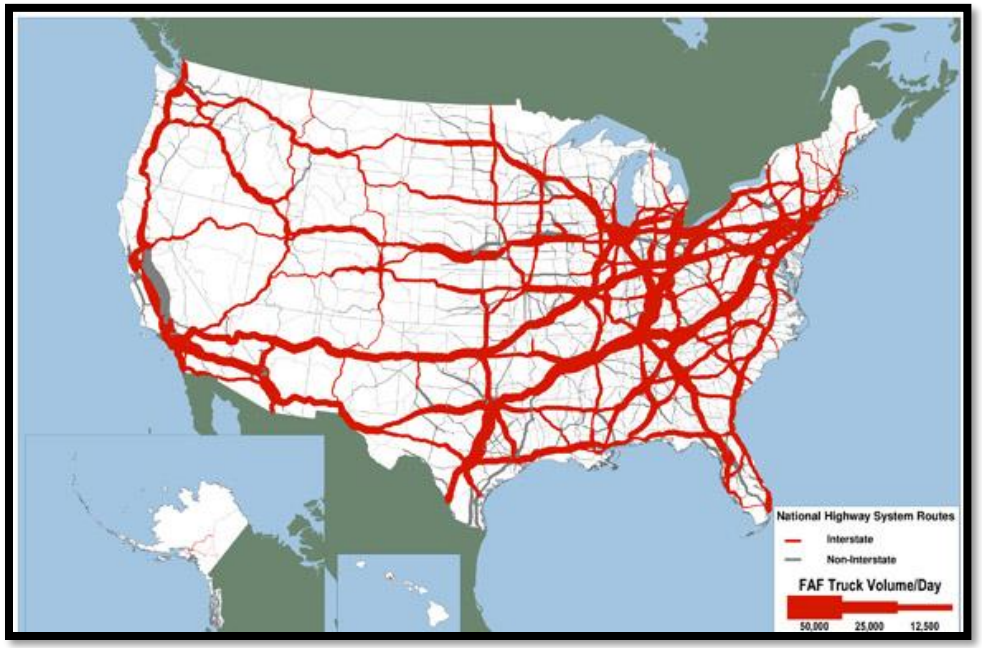
Bridge Resiliency and Freight Trends

Redundancy vs Resilient

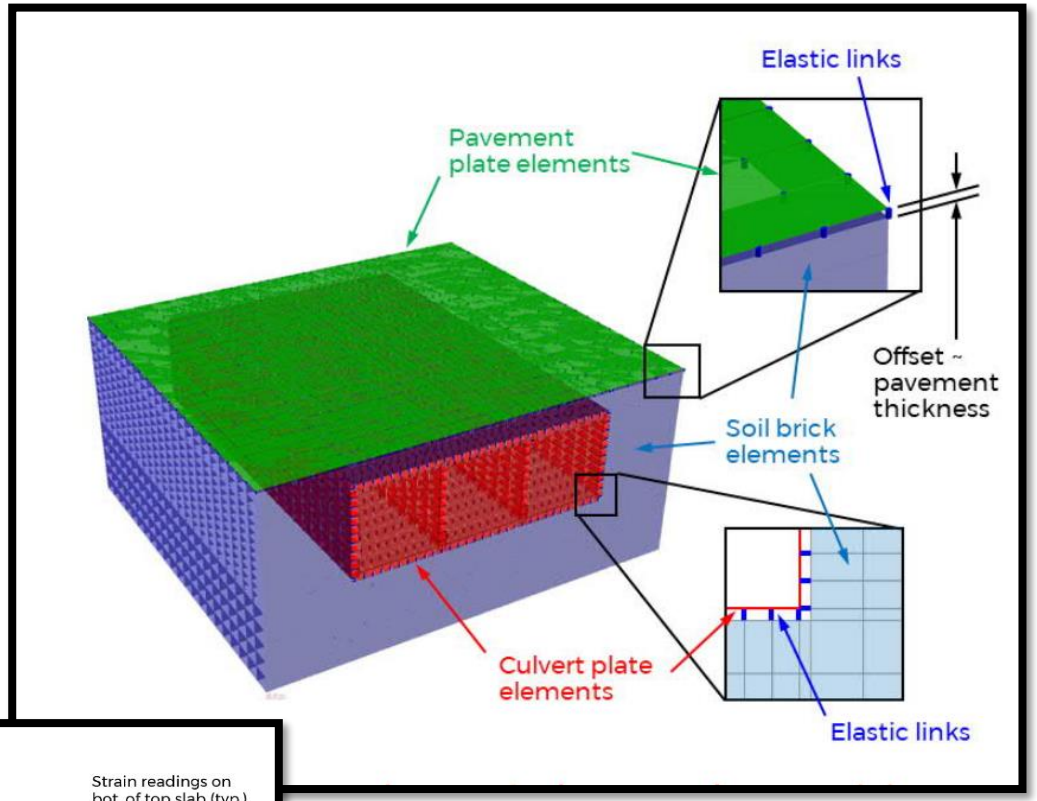


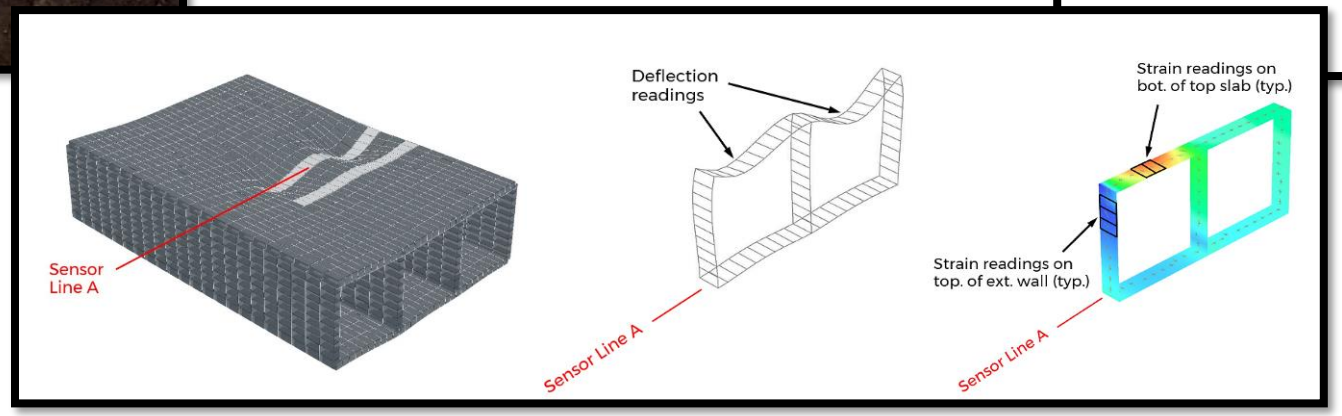
The Importance of Collaboration

Element**	Total Quantity	Unit	CS-1	CS-2	CS-3	CS-4	CS-5
PR225 - Steel Pile	12	each					12
PR233 - Prestressed Concrete Pier Cap	92	ft	80	12			0
PR316 - Other Bearing	5	each	5				0
PR800 - Erosion or Scour	82	ft					82
PR831 - Steel Beam End	5	each	5				0
PR852 - Pier Pedestal	5	each	5				0



Culvert Load Testing Case Study





aci CONCRETE CONVENTION

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