Framework for objective risk assessment in bridge management

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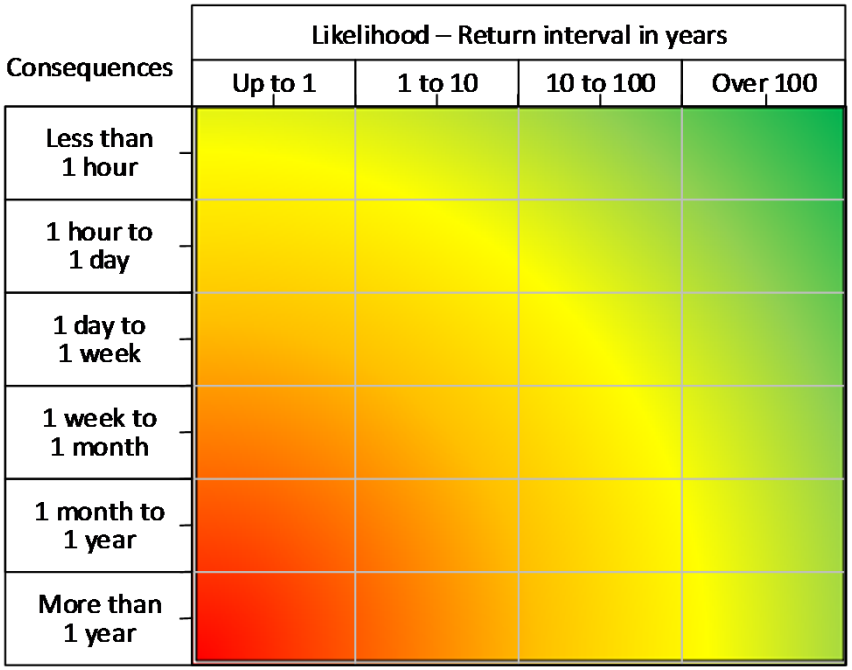
Background

- Persistent gap between risk mitigation needs and funding
- Elected officials have little understanding of risk
- Massive needs across all types of infrastructure
  - Highways and transit
  - Water and sewer systems
  - Airports and seaports
  - Schools and other public buildings

Need for new and better risk tools

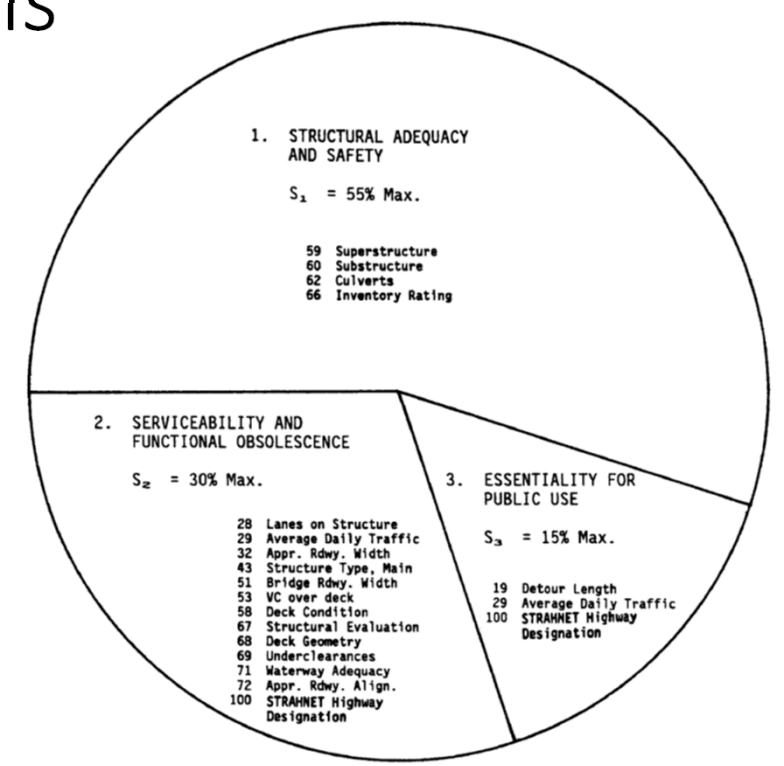
- Measure and track progress, set targets related to risk
- Balance risk against other performance goals
- Balance transportation risk mitigation needs against other programs
- Develop a prioritized multi-year risk mitigation plan
  - At an appropriate level of resources
  - Consistently address the most significant risks first
- Communicate risk more clearly



Examples of existing tools

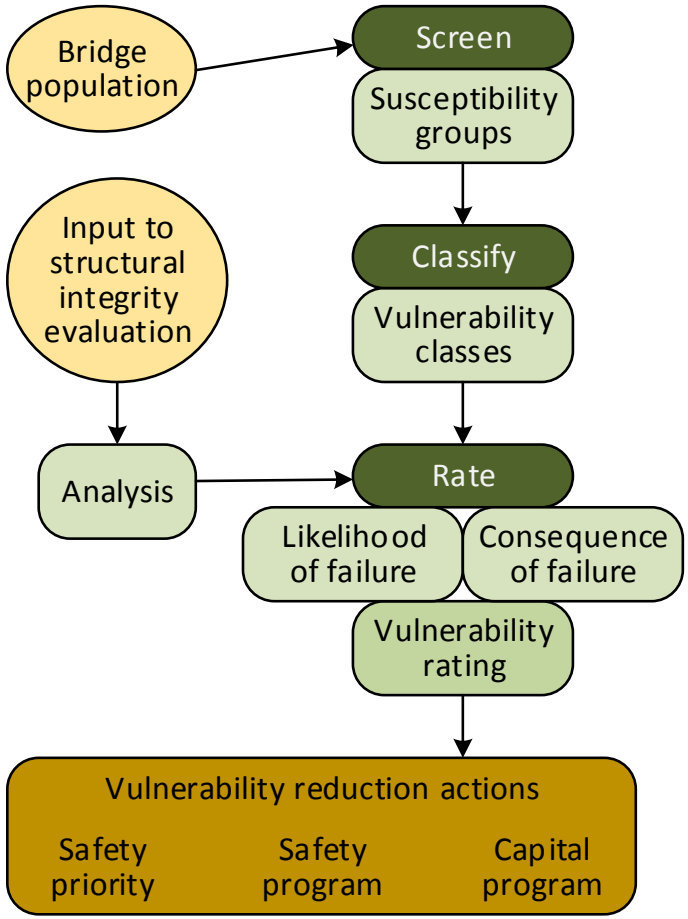
Federal sufficiency rating

- 55% of the rating:
  - Condition
  - Load-carrying capacity
- 35% of the rating:
  - Geometrics
  - Condition and load-carrying capacity
  - Waterway adequacy
- 15% of the rating:
  - Traffic volume and network importance
- Up to 13% reduction for:
  - Special safety and mobility deficiencies



Examples of existing tools

- New York State DOT multi-level vulnerability assessment



Examples of existing tools

- Minnesota DOT bridge performance index

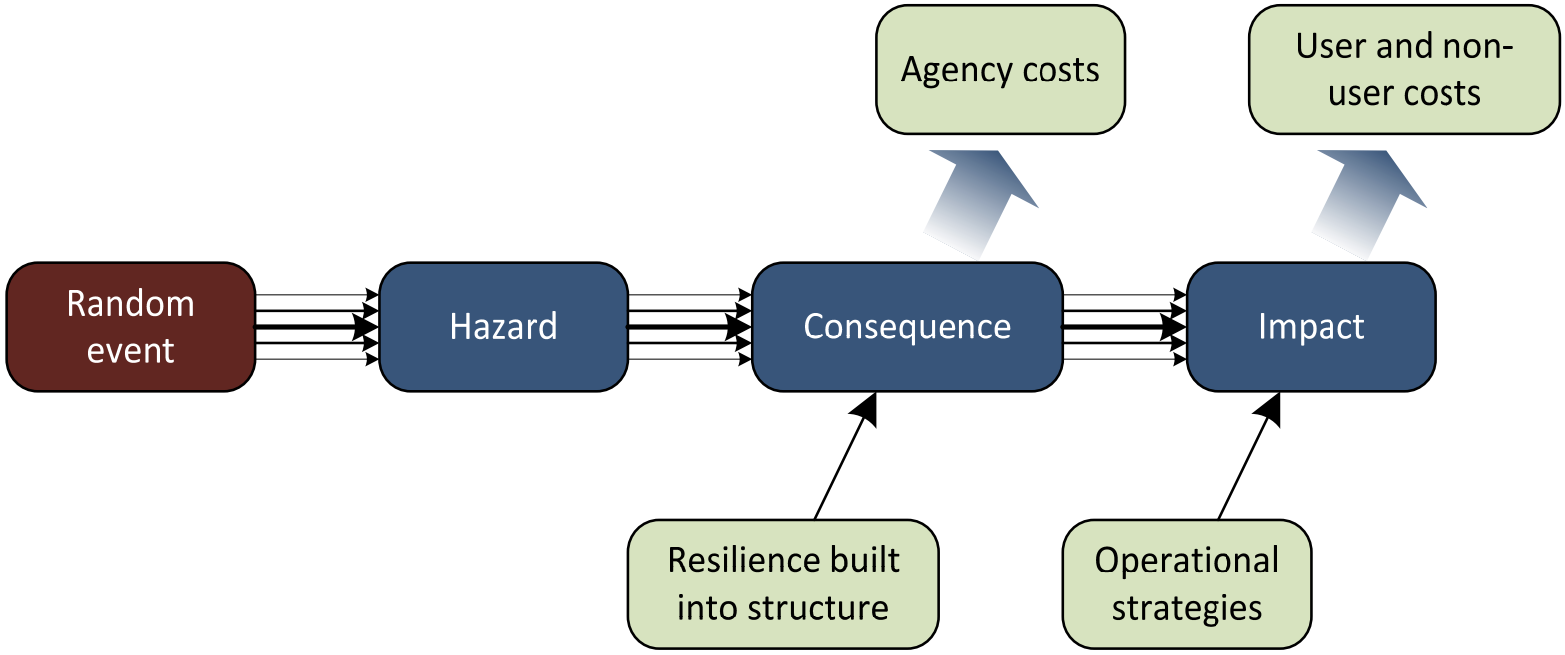
Bridge scour susceptibility					
		Defect reduction			
Code	Description	None	2	3	4
A	Not a waterway	100	100	100	100
E	Culvert	100	100	100	100
M	Stable; scour above footing	90	90	70	40
H	Foundation above water	90	90	70	40
N	Stable; scour in footing/pile	80	80	60	30
I	Screened; low risk	70	70	50	30
L	Evaluated; stable	70	70	50	30
P	Stable due to protection	60	60	40	20
K	Screened; limited risk	60	60	30	20
F	No eval; foundation known	50	50	40	20
C	Closed; no scour	50	50	25	20
J	Screened; susceptible	40	40	30	10
O	Stable; action required	40	40	20	10
G	No eval; foundation unknown	20	20	15	10
R	Critical; monitor	10	10	5	0
B	Closed; scour	0	0	0	0
D	Imminent protection reqd	0	0	0	0
U	Critical; protection required	0	0	0	0

Smart flag reduction:

Use worst condition state of defect 6000, Scour

Examples of existing tools

- Florida DOT Project Level Analysis Tool



Tools we hope to see more: Resilience

- Opposite of vulnerability
- Use it like condition
  - Good-Fair-Poor
  - 0-100 resilience index

Good: The asset is fully sufficient to resist anticipated hazards.

Fair: The asset has elevated likelihood of mild-to-moderate disruption to mobility, safety, economic efficiency, or other performance objectives.

Poor: The asset is ineffective in resisting anticipated hazards, and as a result there is high likelihood of severe disruption.

Tools we hope to see more: Resilience

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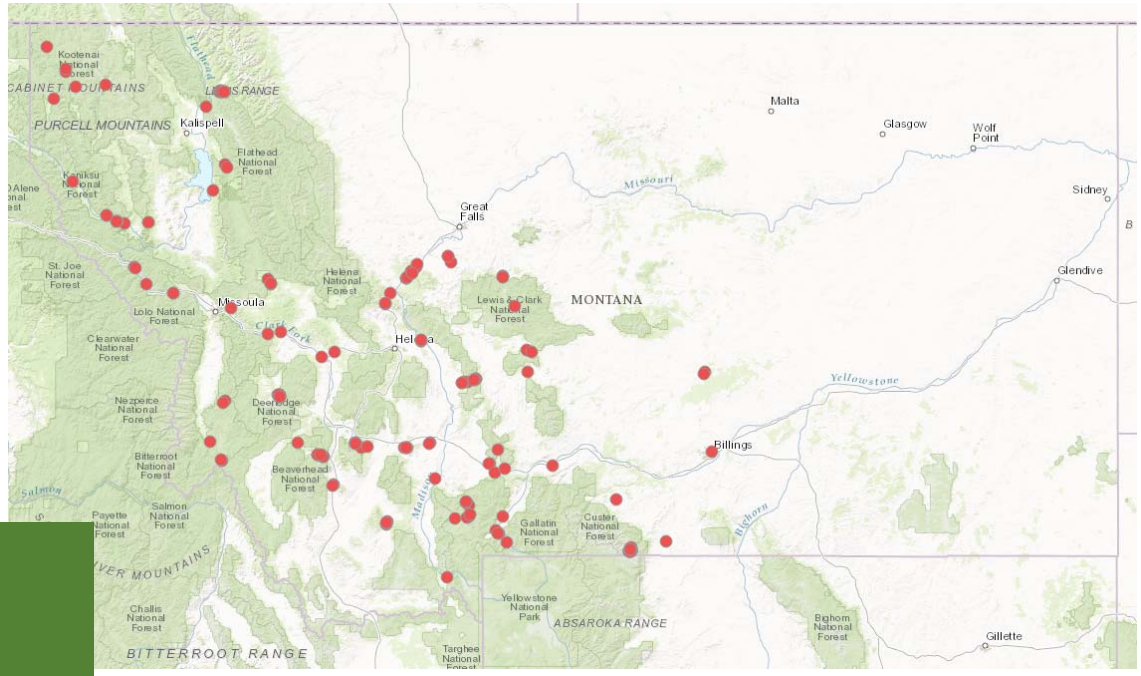

- Good-Fair-Poor can be mapped.

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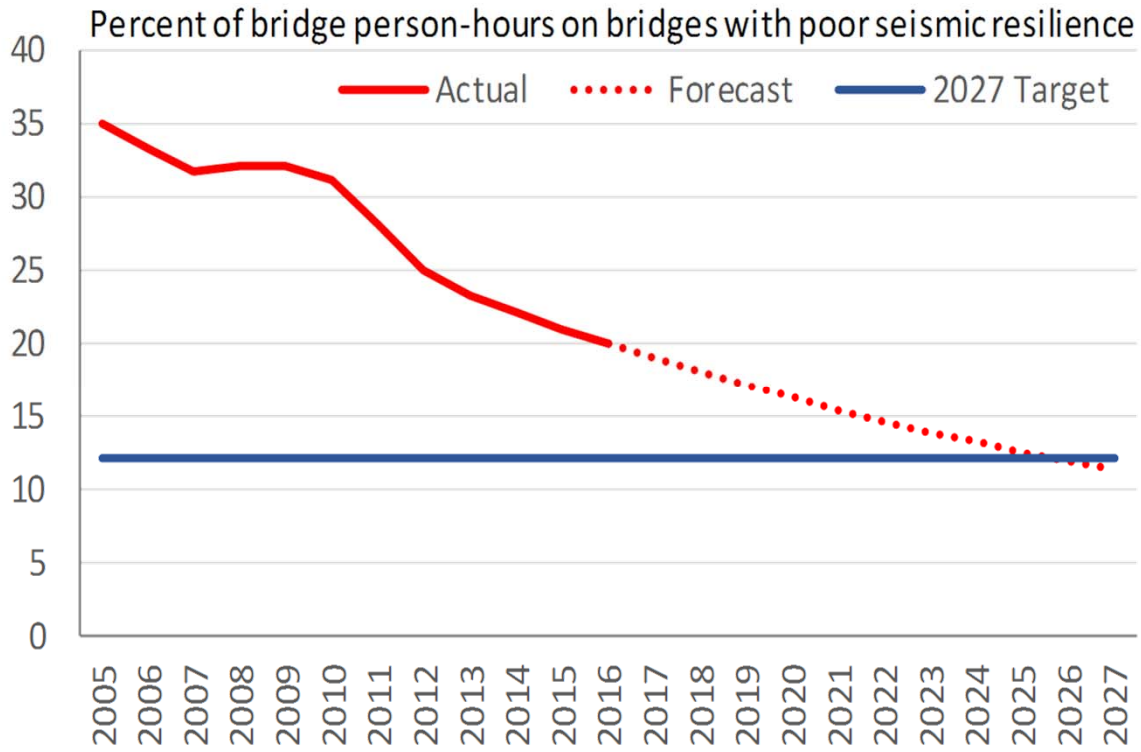
- Also suitable for resilience targets, such as % Good and % Poor



Tools we hope to see more: Resilience

- Opposite of vulnerability
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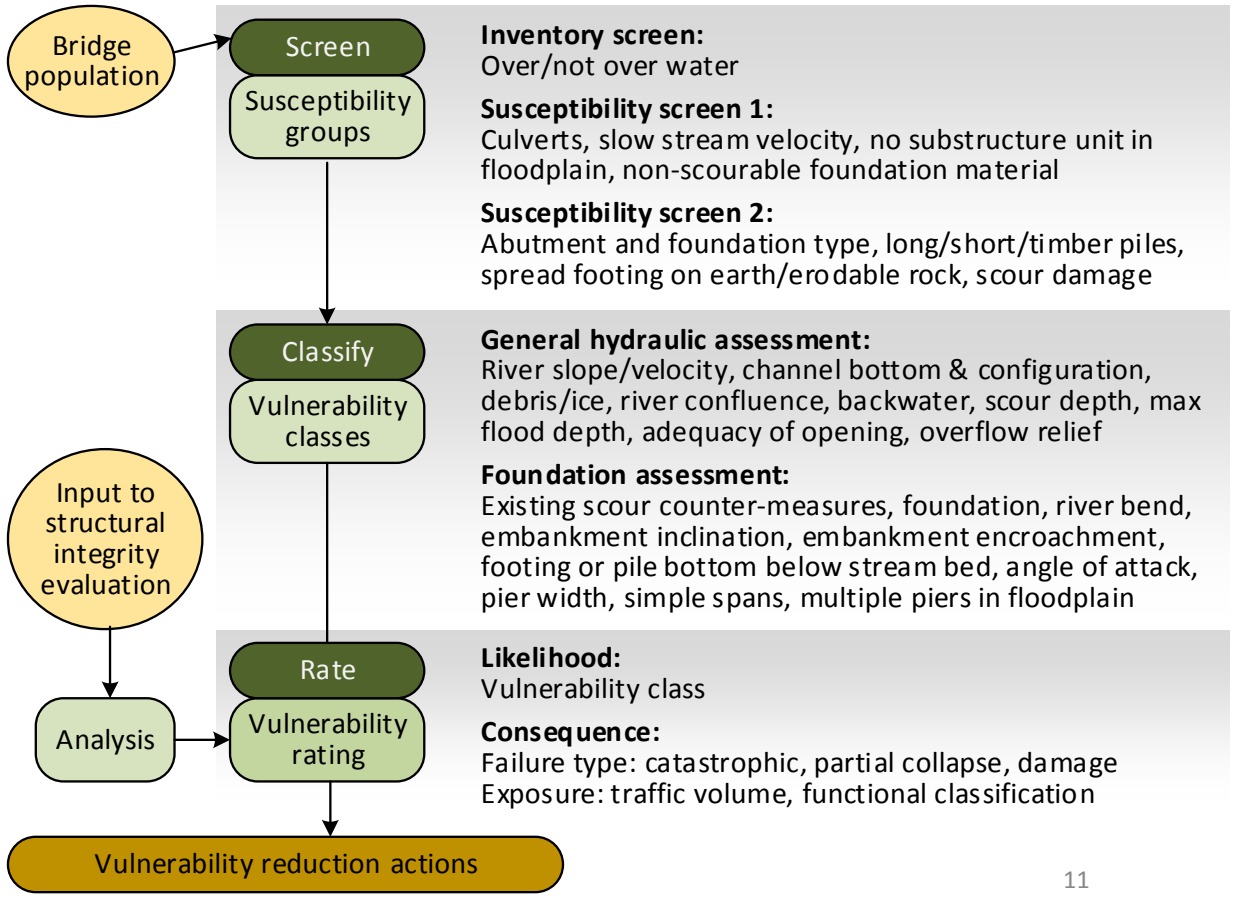
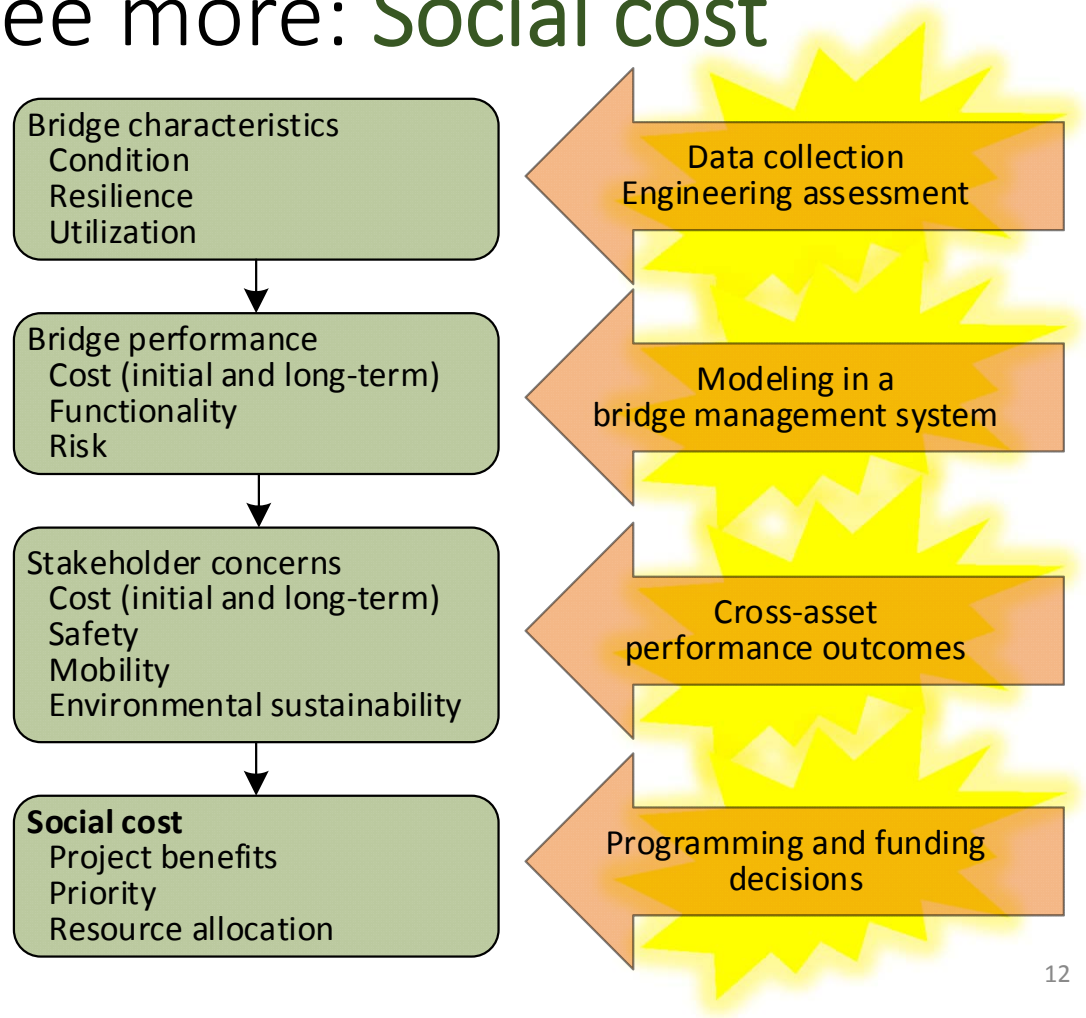
- Use engineering criteria to assess Good-Fair-Poor



Tools we hope to see more: Social cost

- Use with life cycle cost
- Benefits of improved resilience
- Considers safety, mobility, and sustainability

- NCHRP 20-07 (378) describes a methodology



Tools we hope to see more: Social cost

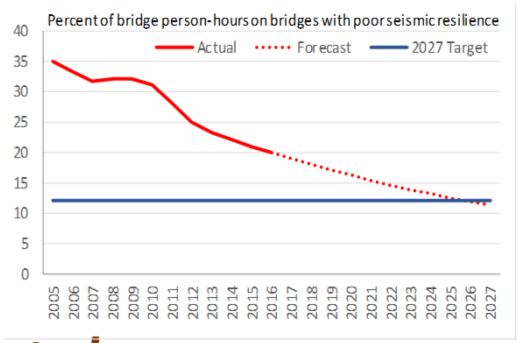
- Setting priorities and allocating resources across dissimilar asset classes that are typically managed independently
- Prioritization that consistently and objectively considers the cost of risk mitigation and the magnitude of exposure to risks
- Combining risk avoidance with life cycle cost savings in an overall assessment of project benefits
- Quantifying the benefits of projects that combine multiple asset classes
- Evaluating projects that postpone hazardous conditions
- Suggesting a reasonable starting point for balancing safety, mobility, environmental, and economic concerns

Methodology conclusions

- ***Resilience is the ability to resist natural and man-made hazards***

  Resilience and vulnerability are opposite ends of a scale

  - It can be characterized as Good-Fair-Poor
  - It can be shown on a map
  - It can be graphed using trend, forecast, and target
  - It can be assessed using objective data



- ***Social cost can quantify project benefits across asset classes***
  - Even non-highway assets such as sewers and school buildings
  - Standardized methods and metrics already exist
  - Easy to integrate with life cycle cost
  - Basis for objective resource allocation

Implementation conclusions

- Develop a shared vision among decision-makers
  - Objectivity, verifiability, transparency
  - Understanding what information is possible to obtain
- Authorizing environment
  - Elected officials accept measurable objectives
  - Persistent communications
- Organizational capacity
  - Staffing to deliver risk mitigation projects
  - Systems and training in place
- **Thank you!**