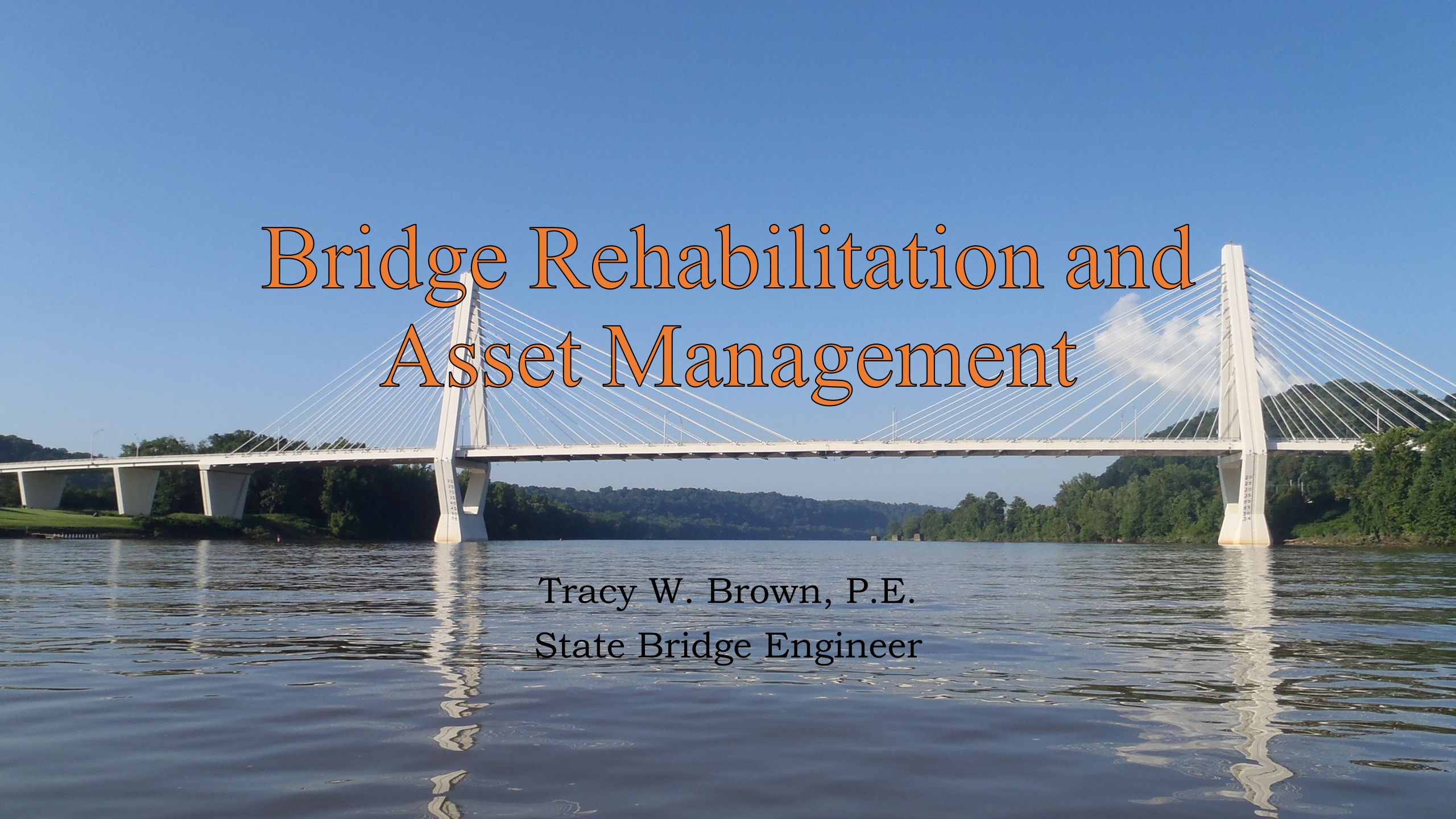


Bridge Rehabilitation and Asset Management

Tracy W. Brown, P.E.
State Bridge Engineer

Moving Ahead for Progress in the 21st Century (MAP-21)

Transitioned the surface transportation program to a performance- and outcome-based program.

Section 1203 – National Goals and Performance Management Measures

- Goal is to spend Federal transportation funds more efficiently by:
  - Refocus on National transportation goals
  - Increase accountability and transparency of Federal-aid program
  - Improve project decision making through performance-based planning and programming
- Required the establishment of performance measures and standards in specified Federal-aid highway areas:
  - Interstate Pavement
  - NHS Non-Interstate Pavement
  - NHS Bridges

NBI Condition Ratings

NBI		Description
NA	N	Not Applicable/Component Does Not Exist
GOOD	9	Excellent Condition
	8	Very Good Condition - No Problems Noted
	7	Good Condition - Some Minor Problems
FAIR	6	Satisfactory - Structural Elements Show Minor Deterioration
	5	Fair - All Primary Strucutral Elements Are Sound, But May Have Minor Section Loss, Cracking, Spalling, or Scour
POOR	4	Poor - Advanced Section Loss, Deterioration, Spalling, or Scour
	3	Serious - Loss of Section, Deterioration, Spalling, or Scour Have Seriously Affected Primary Structural Components. Local Failures Are Possible. Fatigue Cracks in Steel or Shear Cracks in Concrete May Be Present
CRITICAL	2	Critical - Advanced Deterioration of Primary Structural Elements. Fatigue Cracks in Steel or Shear Cracs in Concrete May Be Present or Scour May Have Removed Substructure Support. Unless Closely Monitored It May Be Necessary To Close Bridge
	1	Immenent Failure Condition - Major Deterioration or Section Loss in Critical Structural Components or Obvious Vertical or Horizontal Movement Affecting Structural Stability. Bridge is Closed to Traffic But With Corrective Action May Be Put Back In
	0	Failed Condition - Out of Service - Beyond Corrective Action

NBI Condition Ratings

What is assessed with an NBI Condition Rating?

- Wearing Surface
- Deck
- Superstructure
- Substructure
- Channel and Channel Protection
- Culverts

NBI Condition Ratings

What is assessed with an NBI Condition Rating?

- Wearing Surface
- Deck
- Superstructure
- Substructure
- Channel and Channel Protection
- Culverts

NBI Condition Ratings

Item	NBI Rating
Wearing Surface	8
Deck	8
Superstructure	7
Substructure	3
Channel & Channel Protection	8
Culvert	N

NBI		Description
NA	N	Not Applicable/Component Does Not Exist
GOOD	9	Excellent Condition
	8	Very Good Condition - No Problems Noted
	7	Good Condition - Some Minor Problems
FAIR	6	Satisfactory - Structural Elements Show Minor Deterioration
	5	Fair - All Primary Strucutral Elements Are Sound, But May Have Minor Section Loss, Cracking, Spalling, or Scour
POOR	4	Poor - Advanced Section Loss, Deterioration, Spalling, or Scour
	3	Serious - Loss of Section, Deterioration, Spalling, or Scour Have Seriously Affected Primary Structural Components. Local Failures Are Possible. Fatigue Cracks in Steel or Shear Cracks in Concrete May Be Present
CRITICAL	2	Critical - Advanced Deterioration of Primary Structural Elements. Fatigue Cracks in Steel or Shear Cracs in Concrete May Be Present or Scour May Have Removed Substructure Support. Unless Closely Monitored It May Be Necessary To Close Bridge
	1	Immenent Failure Condition - Major Deterioration or Section Loss in Critical Structural Components or Obvious Vertical or Horizontal Movement Affecting Structural Stability. Bridge is Closed to Traffic But With Corrective Action May Be Put Back In
	0	Failed Condition - Out of Service - Beyond Corrective Action

NBI Condition Ratings

Item	NBI Rating
Wearing Surface	8
Deck	**8**
Superstructure	**7**
Substructure	**3**
Channel & Channel Protection	8
Culvert	N

NBI		Description
NA	N	Not Applicable/Component Does Not Exist
GOOD	9	Excellent Condition
	8	Very Good Condition - No Problems Noted
	7	Good Condition - Some Minor Problems
FAIR	6	Satisfactory - Structural Elements Show Minor Deterioration
	5	Fair - All Primary Strucutral Elements Are Sound, But May Have Minor Section Loss, Cracking, Spalling, or Scour
POOR	4	Poor - Advanced Section Loss, Deterioration, Spalling, or Scour
	3	Serious - Loss of Section, Deterioration, Spalling, or Scour Have Seriously Affected Primary Structural Components. Local Failures Are Possible. Fatigue Cracks in Steel or Shear Cracks in Concrete May Be Present
CRITICAL	2	Critical - Advanced Deterioration of Primary Structural Elements. Fatigue Cracks in Steel or Shear Cracs in Concrete May Be Present or Scour May Have Removed Substructure Support. Unless Closely Monitored It May Be Necessary To Close Bridge
	1	Immenent Failure Condition - Major Deterioration or Section Loss in Critical Structural Components or Obvious Vertical or Horizontal Movement Affecting Structural Stability. Bridge is Closed to Traffic But With Corrective Action May Be Put Back In
	0	Failed Condition - Out of Service - Beyond Corrective Action

Deck SF In **POOR**

NBI Condition Ratings

Item	NBI Rating
Wearing Surface	3
Deck	8
Superstructure	7
Substructure	7
Channel & Channel Protection	4
Culvert	N

NBI		Description
NA	N	Not Applicable/Component Does Not Exist
GOOD	9	Excellent Condition
	8	Very Good Condition - No Problems Noted
	7	Good Condition - Some Minor Problems
FAIR	6	Satisfactory - Structural Elements Show Minor Deterioration
	5	Fair - All Primary Strucutral Elements Are Sound, But May Have Minor Section Loss, Cracking, Spalling, or Scour
POOR	4	Poor - Advanced Section Loss, Deterioration, Spalling, or Scour
	3	Serious - Loss of Section, Deterioration, Spalling, or Scour Have Seriously Affected Primary Structural Components. Local Failures Are Possible. Fatigue Cracks in Steel or Shear Cracks in Concrete May Be Present
CRITICAL	2	Critical - Advanced Deterioration of Primary Structural Elements. Fatigue Cracks in Steel or Shear Cracs in Concrete May Be Present or Scour May Have Removed Substructure Support. Unless Closely Monitored It May Be Necessary To Close Bridge
	1	Immenent Failure Condition - Major Deterioration or Section Loss in Critical Structural Components or Obvious Vertical or Horizontal Movement Affecting Structural Stability. Bridge is Closed to Traffic But With Corrective Action May Be Put Back In
	0	Failed Condition - Out of Service - Beyond Corrective Action

NBI Condition Ratings

Item	NBI Rating
Wearing Surface	3
Deck	**8**
Superstructure	**7**
Substructure	**7**
Channel & Channel Protection	4
Culvert	N

NBI		Description
NA	N	Not Applicable/Component Does Not Exist
GOOD	9	Excellent Condition
	8	Very Good Condition - No Problems Noted
	7	Good Condition - Some Minor Problems
FAIR	6	Satisfactory - Structural Elements Show Minor Deterioration
	5	Fair - All Primary Strucutral Elements Are Sound, But May Have Minor Section Loss, Cracking, Spalling, or Scour
POOR	4	Poor - Advanced Section Loss, Deterioration, Spalling, or Scour
	3	Serious - Loss of Section, Deterioration, Spalling, or Scour Have Seriously Affected Primary Structural Components. Local Failures Are Possible. Fatigue Cracks in Steel or Shear Cracks in Concrete May Be Present
CRITICAL	2	Critical - Advanced Deterioration of Primary Structural Elements. Fatigue Cracks in Steel or Shear Cracs in Concrete May Be Present or Scour May Have Removed Substructure Support. Unless Closely Monitored It May Be Necessary To Close Bridge
	1	Immenent Failure Condition - Major Deterioration or Section Loss in Critical Structural Components or Obvious Vertical or Horizontal Movement Affecting Structural Stability. Bridge is Closed to Traffic But With Corrective Action May Be Put Back In
	0	Failed Condition - Out of Service - Beyond Corrective Action

Deck SF In **GOOD**

NBI Condition Ratings

Item	NBI Rating
Wearing Surface	N
Deck	N
Superstructure	N
Substructure	N
Channel & Channel Protection	8
Culvert	4

NBI		Description
NA	N	Not Applicable/Component Does Not Exist
GOOD	9	Excellent Condition
	8	Very Good Condition - No Problems Noted
	7	Good Condition - Some Minor Problems
FAIR	6	Satisfactory - Structural Elements Show Minor Deterioration
	5	Fair - All Primary Strucutral Elements Are Sound, But May Have Minor Section Loss, Cracking, Spalling, or Scour
POOR	4	Poor - Advanced Section Loss, Deterioration, Spalling, or Scour
	3	Serious - Loss of Section, Deterioration, Spalling, or Scour Have Seriously Affected Primary Structural Components. Local Failures Are Possible. Fatigue Cracks in Steel or Shear Cracks in Concrete May Be Present
CRITICAL	2	Critical - Advanced Deterioration of Primary Structural Elements. Fatigue Cracks in Steel or Shear Cracs in Concrete May Be Present or Scour May Have Removed Substructure Support. Unless Closely Monitored It May Be Necessary To Close Bridge
	1	Immenent Failure Condition - Major Deterioration or Section Loss in Critical Structural Components or Obvious Vertical or Horizontal Movement Affecting Structural Stability. Bridge is Closed to Traffic But With Corrective Action May Be Put Back In
	0	Failed Condition - Out of Service - Beyond Corrective Action

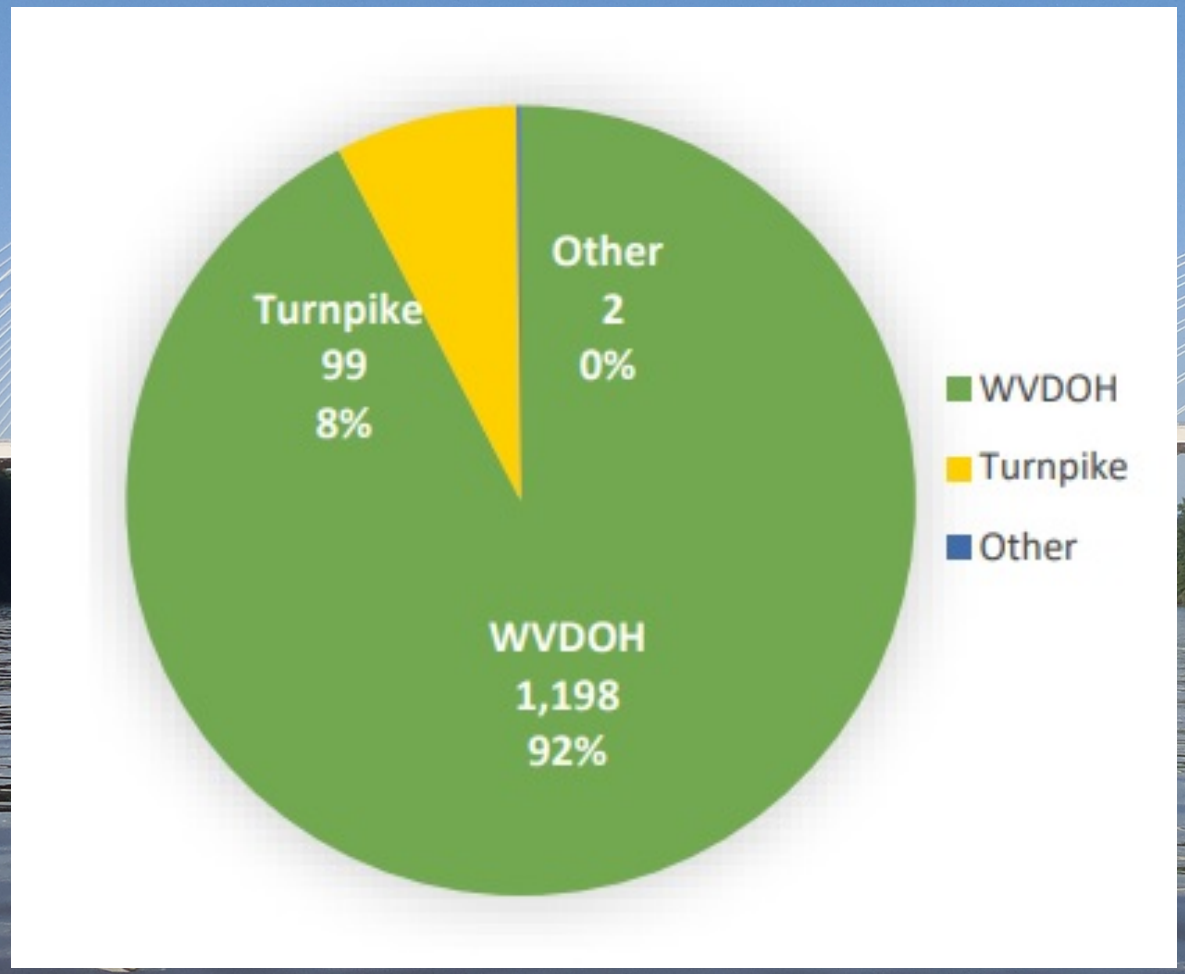
NBI Condition Ratings

Item	NBI Rating
Wearing Surface	N
Deck	N
Superstructure	N
Substructure	N
Channel & Channel Protection	8
Culvert	**4**

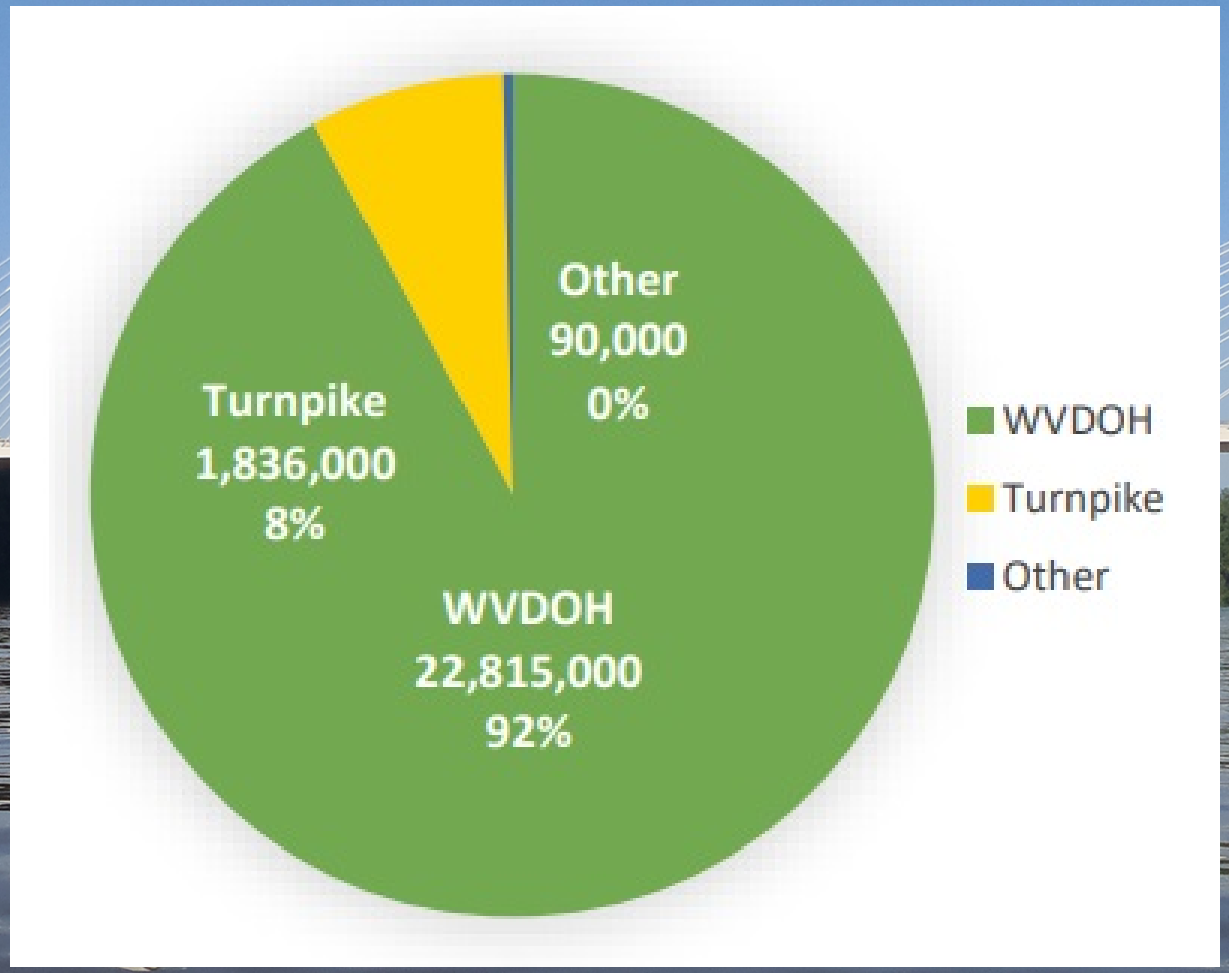
NBI		Description
NA	N	Not Applicable/Component Does Not Exist
GOOD	9	Excellent Condition
	8	Very Good Condition - No Problems Noted
	7	Good Condition - Some Minor Problems
FAIR	6	Satisfactory - Structural Elements Show Minor Deterioration
	5	Fair - All Primary Strucutral Elements Are Sound, But May Have Minor Section Loss, Cracking, Spalling, or Scour
POOR	4	Poor - Advanced Section Loss, Deterioration, Spalling, or Scour
	3	Serious - Loss of Section, Deterioration, Spalling, or Scour Have Seriously Affected Primary Structural Components. Local Failures Are Possible. Fatigue Cracks in Steel or Shear Cracks in Concrete May Be Present
CRITICAL	2	Critical - Advanced Deterioration of Primary Structural Elements. Fatigue Cracks in Steel or Shear Cracs in Concrete May Be Present or Scour May Have Removed Substructure Support. Unless Closely Monitored It May Be Necessary To Close Bridge
	1	Immenent Failure Condition - Major Deterioration or Section Loss in Critical Structural Components or Obvious Vertical or Horizontal Movement Affecting Structural Stability. Bridge is Closed to Traffic But With Corrective Action May Be Put Back In
	0	Failed Condition - Out of Service - Beyond Corrective Action

Culvert In **POOR**

Total WV NHS Bridges = 1,299

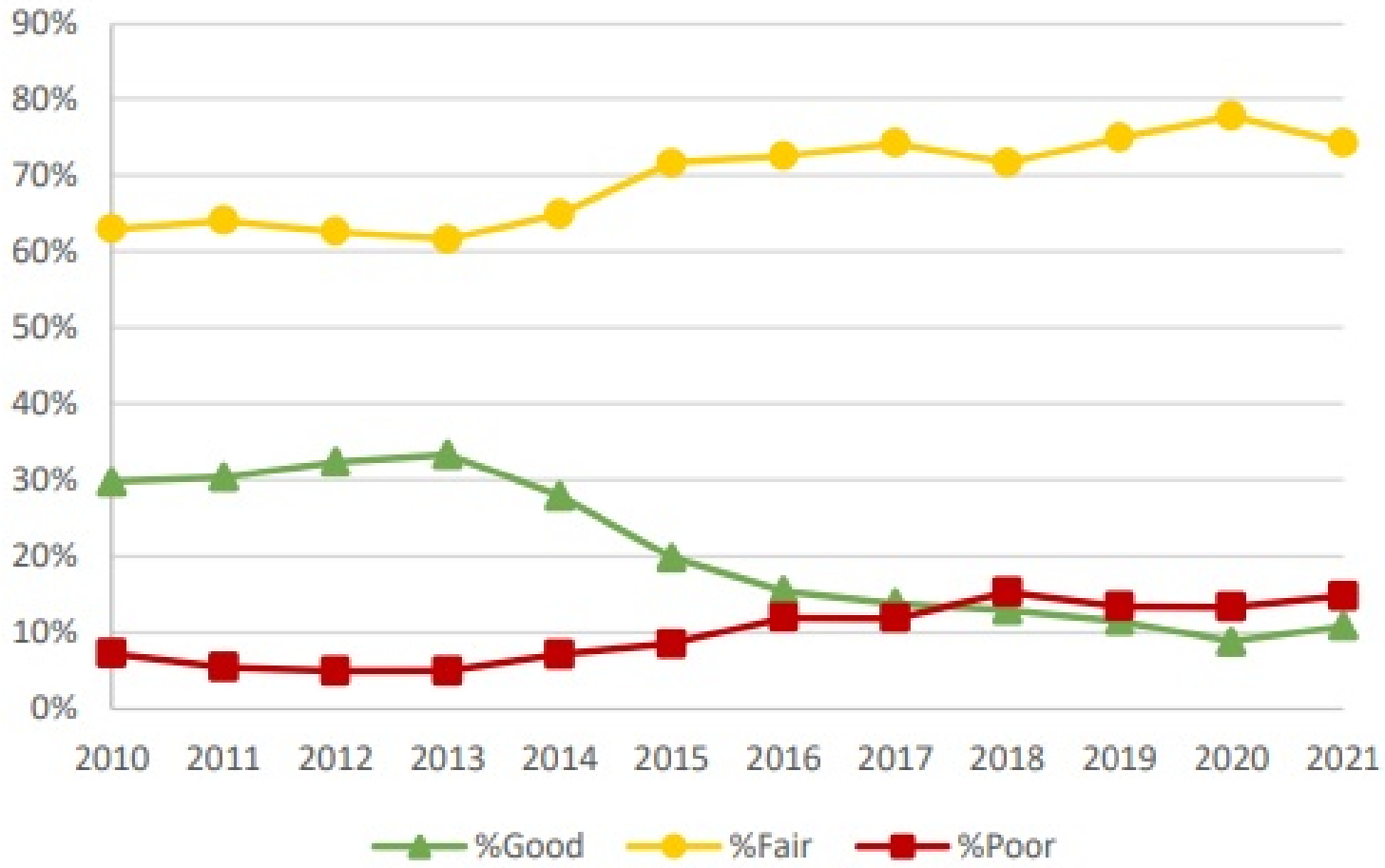


Square Footage of WV NHS Bridges = 24,741,000 ft²

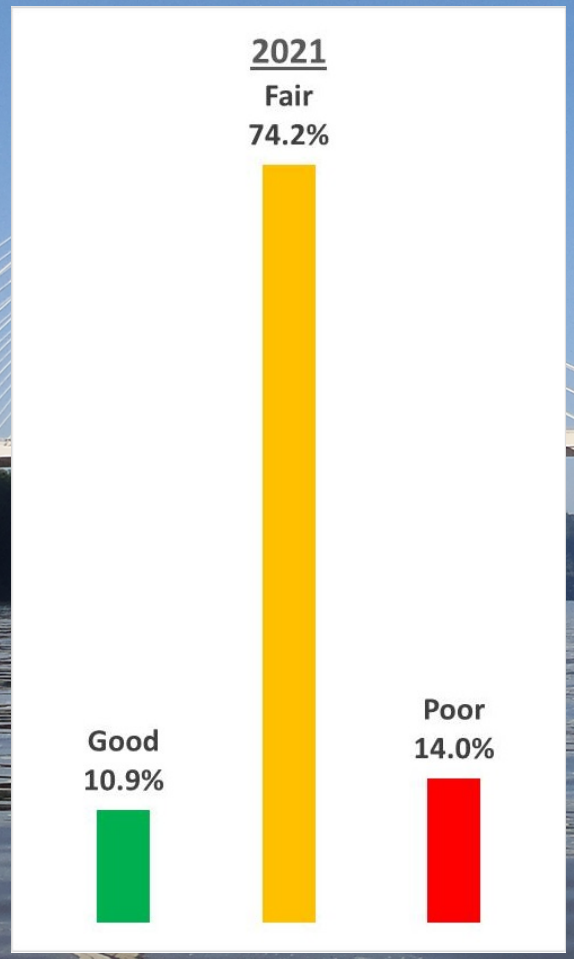


Historic Trend of NBI Bridge Conditions on the NHS

FIGURE 16: NHS BRIDGE CONDITION OVER TIME (2010-2021)



WV NHS Bridge Condition By Deck Area



Asset Management Targets for NHS Bridges

Set and Report Performance Targets Every Two Years

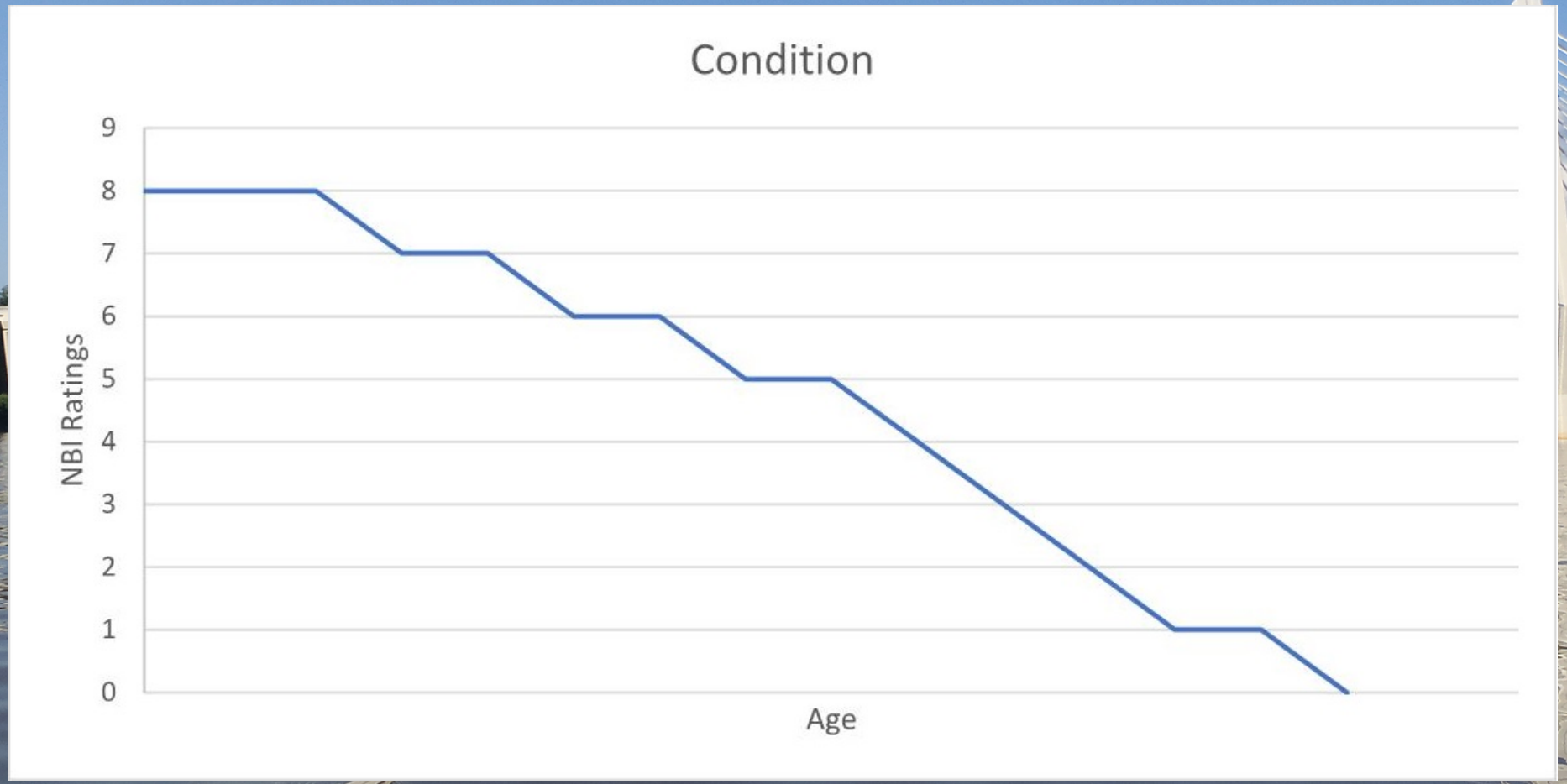
From 2022 Transportation Asset Management Plan (TAMP):

- Deck Surface Area (SF) in **GOOD** Condition: >= 11% (2023)
  >= 12% (2025)
- Deck Surface Area in **POOR** Condition: >= 13% (2023)
  >= 13% (2025)

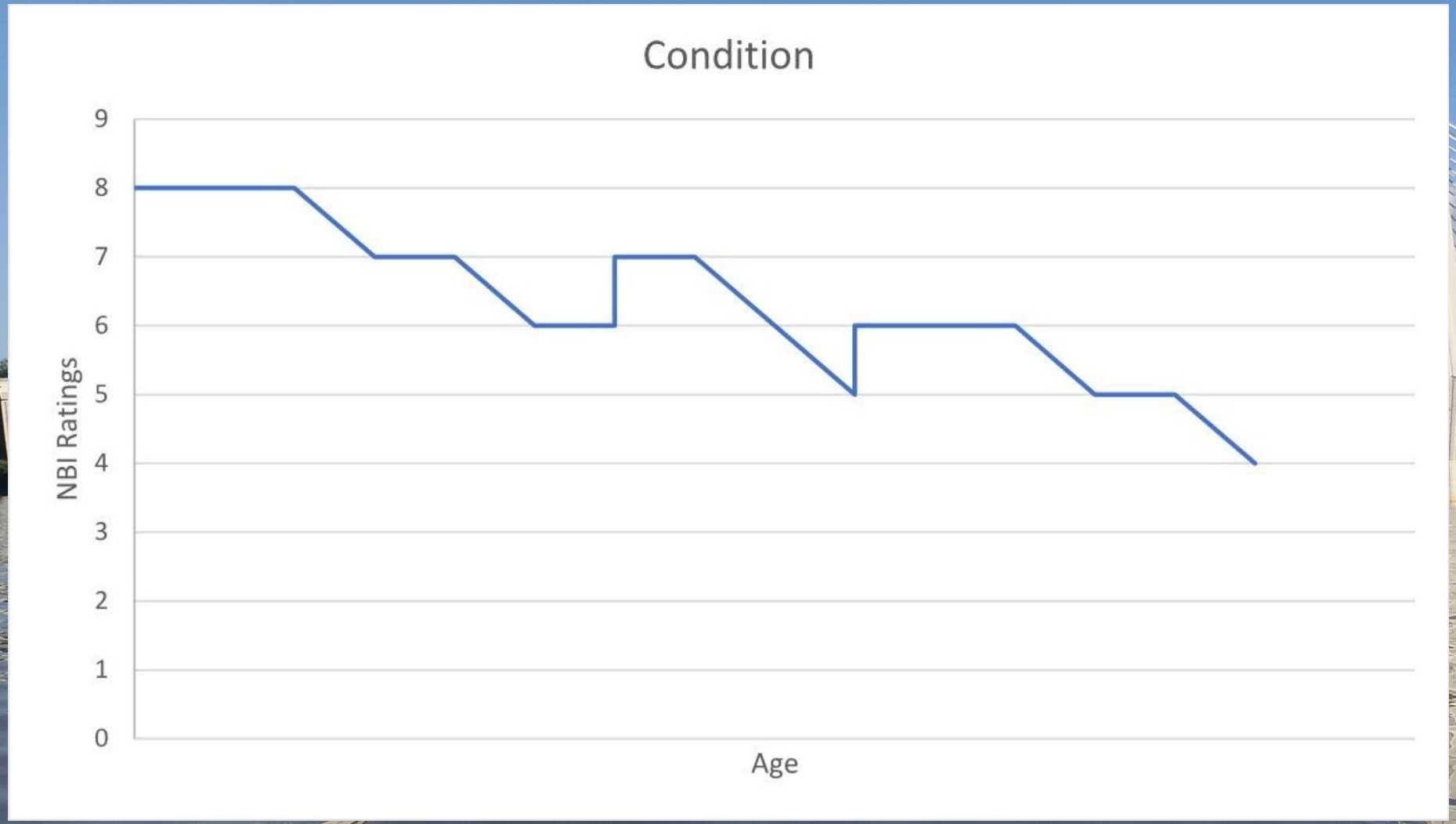
Actual 2022 Assessment: **GOOD** Condition = 10.1%
POOR Condition = 14.0%

Official 2023 Data Will Not Be Available Until April

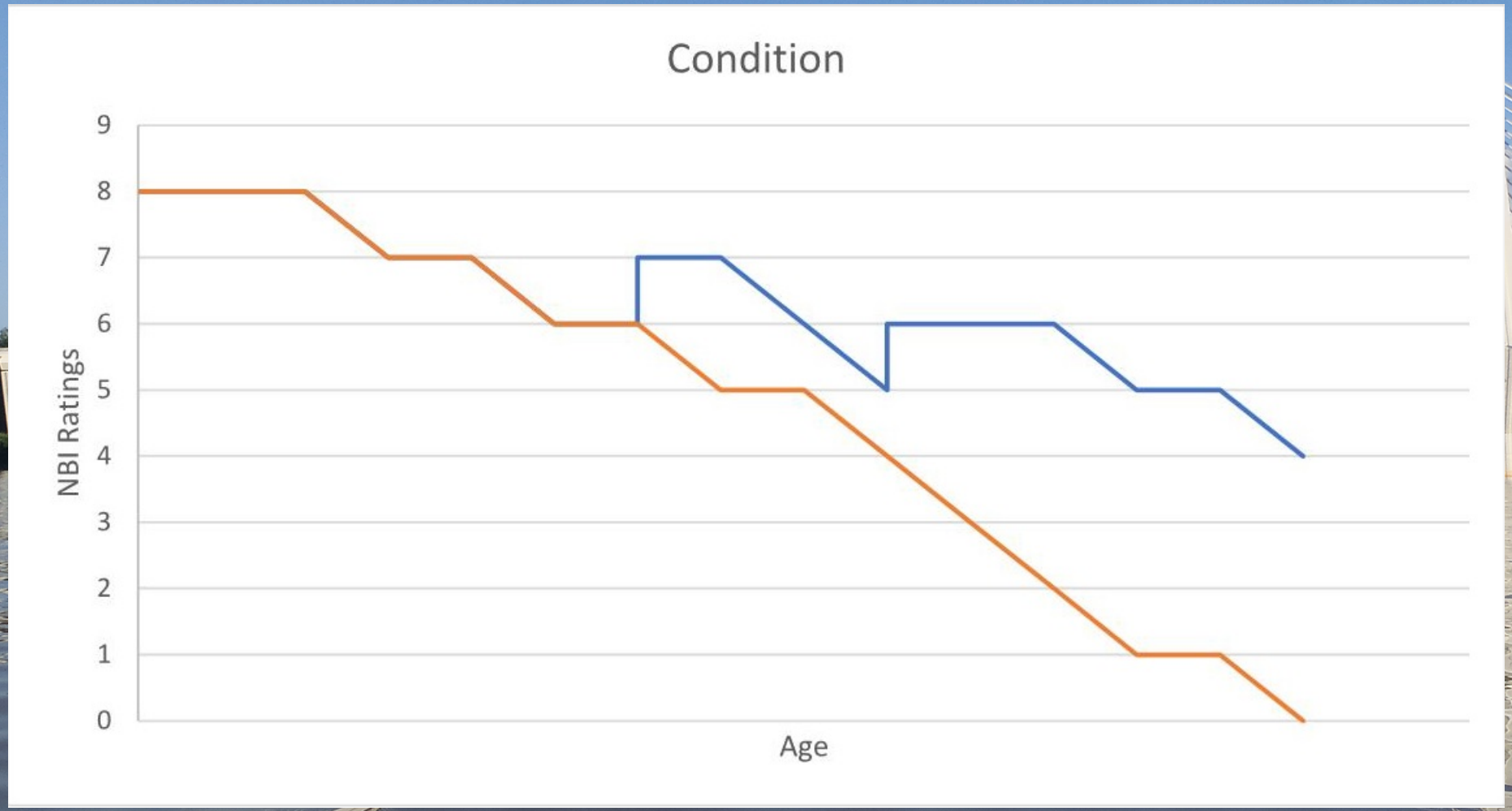
Benefits of Asset Management



Benefits of Asset Management



Benefits of Asset Management



Treatment Options and Costs

Treatment	Benefit	Cost/SF Deck
Seal Deck	Adds 5 years of service life to Deck	$2-3
Replace Joints	Adds 10 years of service life to Superstructure Adds 5 years of service life to Substructure	$850-925/LF Joint
Spot Paint	Adds 5 years of service life to Superstructure Adds 5 years of service life to Paint System	$80-120
Superstructure Rehabilitation	Adds 5 years of service life to Deck Increases Superstructure NBI condition rating +2 Adds 8 years of service life to Substructure Steel Protective Coating reset to Good condition	$80-100
Deck Overlay	Increases Deck NBI condition rating +2	$45-60
Substructure Rehabilitation	Increases Substructure NBI condition rating +2 Adds 10 years of service life to Superstructure Adds 5 years of service life to Deck	$90-100
Clean and Paint	Adds 10 years of service life to Superstructure	$25-35
Replace Deck	Deck Condition reset to 8 Increases Superstructure NBI condition rating +1 if < 6 Deck Joints reset to Good condition	$125-160
Superstructure Replacement	Deck Condition reset to 8 Superstructure Condition reset to 8 All Element Condition States set to Good	$100-115
Structure Replacement	Deck Condition reset to 8 Superstructure Condition reset to 8 Substructure Condition reset to 8 All Element Condition States set to Good	$250-300
Reline Culvert	Increases Culvert NBI condition rating +3	$85-110
Culvert Replacement	Culvert Condition reset to 8	$345-375

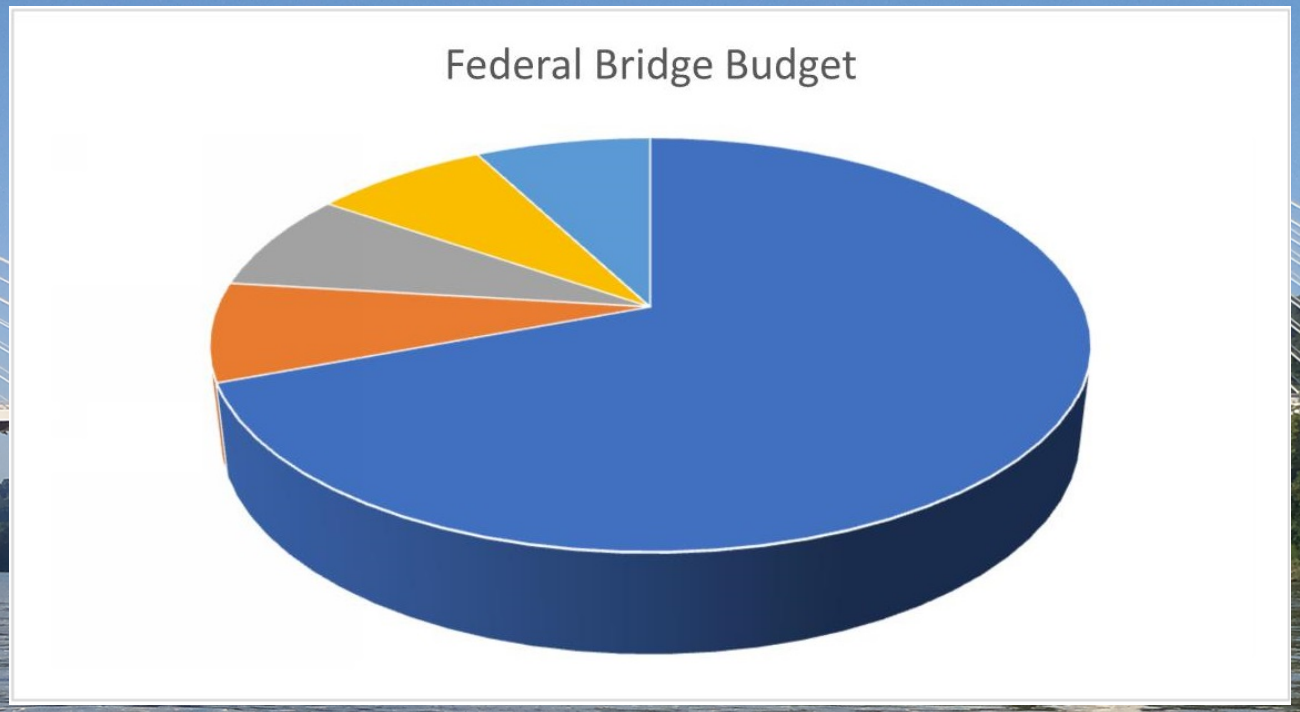
Benefit vs Cost

For each treatment option considered, what is the cost of implementation?

$$\frac{\text{BENEFIT}}{\text{COST}}$$

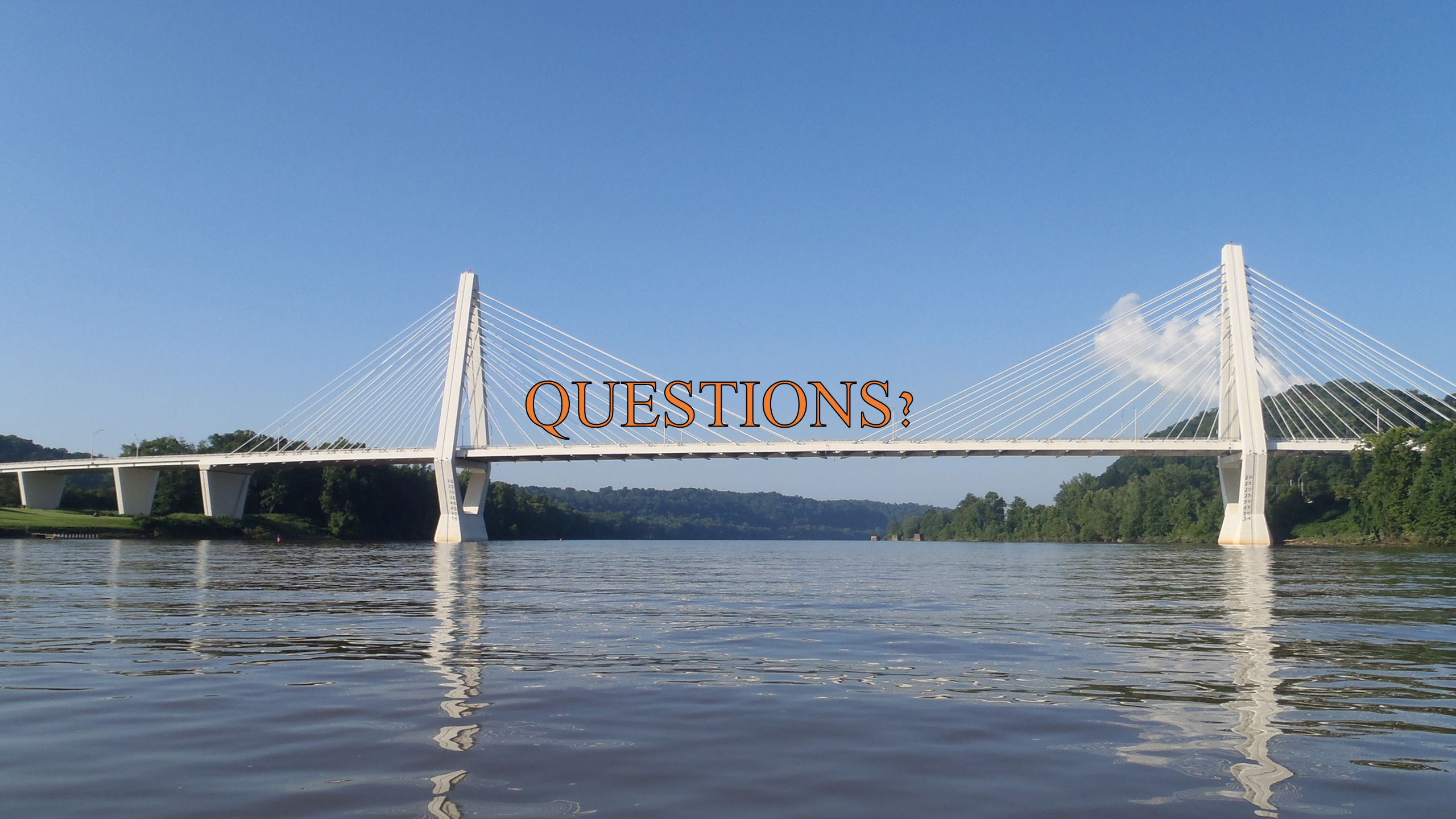
Filling Out The Federal Budget

Expend federal dollars on projects with the most benefit for the least cost.



Requirements for Good Asset Management

- Accurate revenue stream forecast
- Correct assessment of infrastructure being managed
  - Proper NBI Safety Inspections
  - What deficiency is driving the assigned condition codes?
  - Is everything that is important to you being considered?
- Are considered treatment options reasonable for a particular bridge?
- Accurate costs for each treatment option being considered
- Correctly calibrated deterioration curves


QUESTIONS?

THANK YOU!