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A Smart Framework in Bridge Management Systems to Move Beyond MAP-21

Mohammad Sayyar, PhD, PE, PMP
Consultant | Bridge SME

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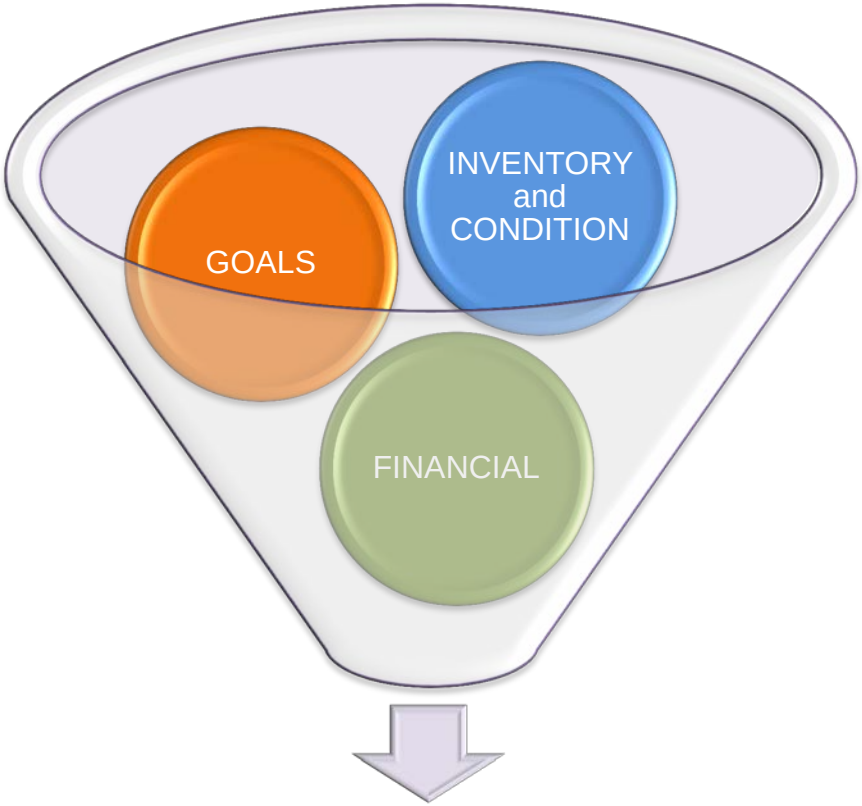
Agenda

- Introduction on Asset Management
- Map-21 Performance Measures
- Bridge Analyst System
- Case Study
- Summary

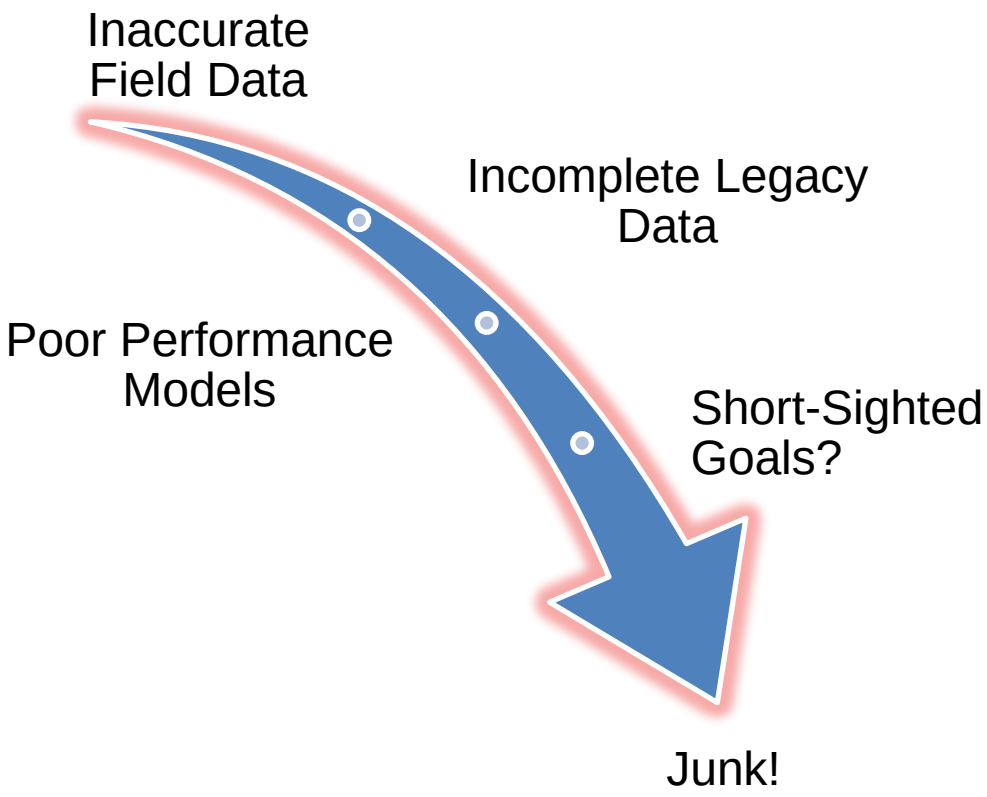
Asset Management Plan



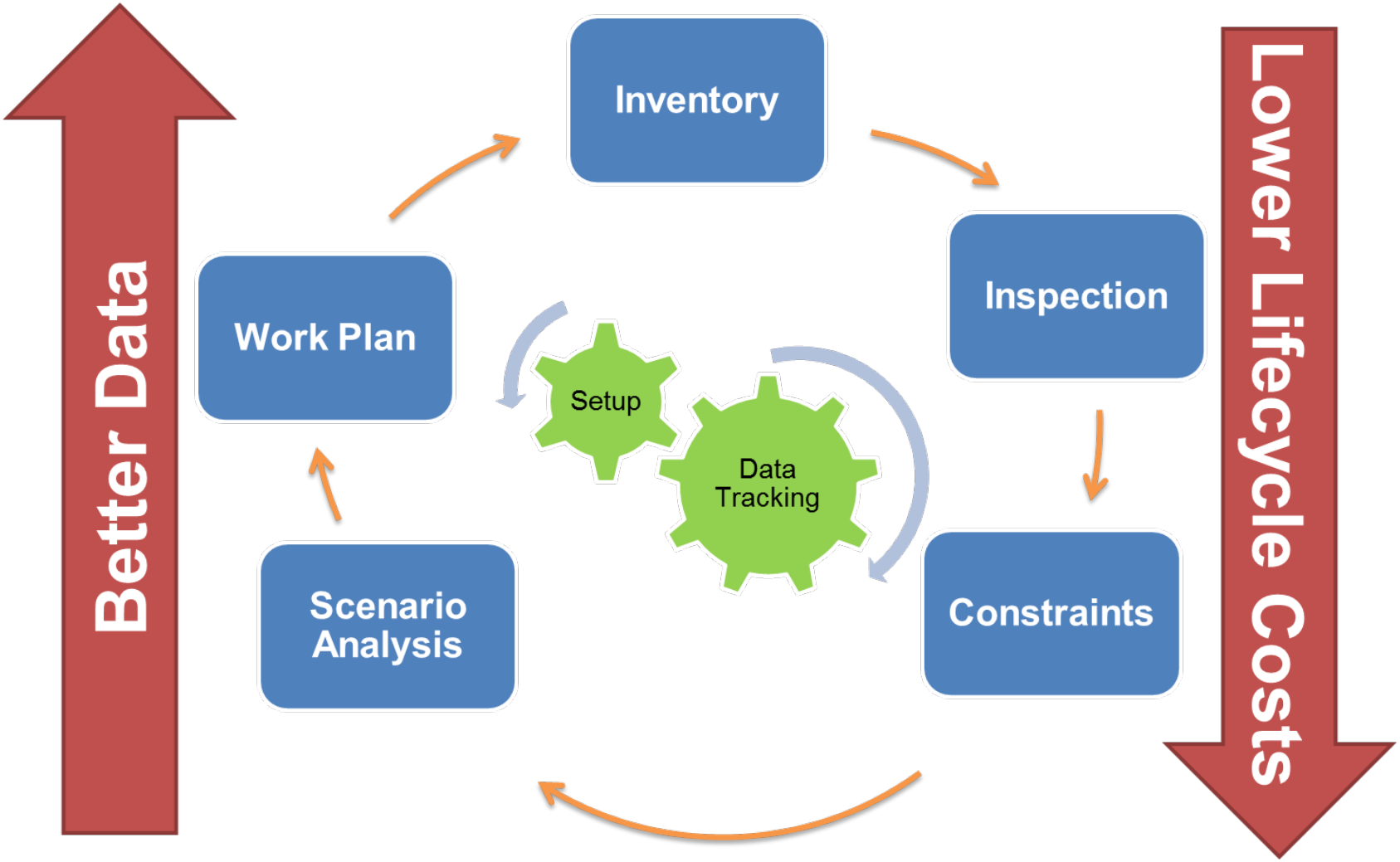
MAXIMIZE SYSTEM CONDITION
and PERFORMANCE

MAP-21 and Performance Management

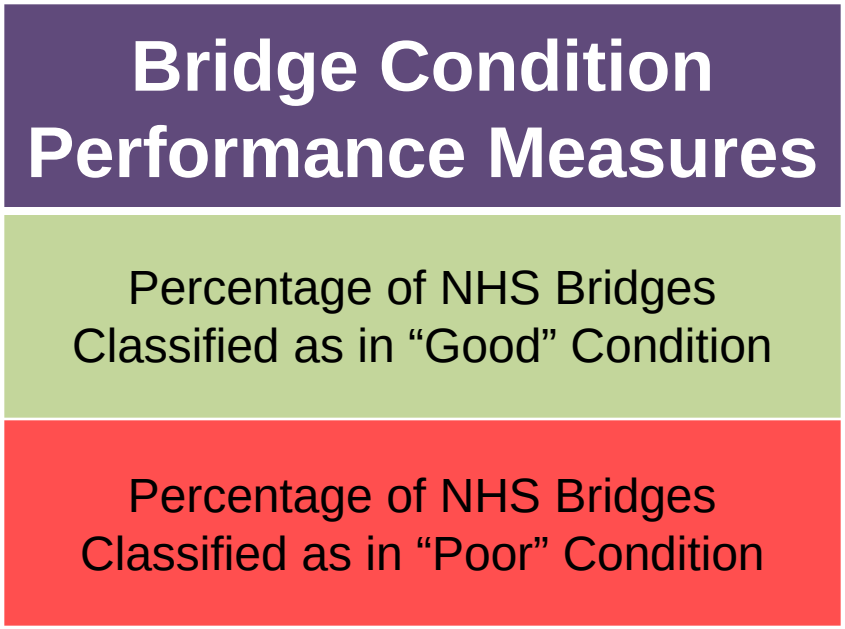
- Any Asset Management System needs GOOD data!



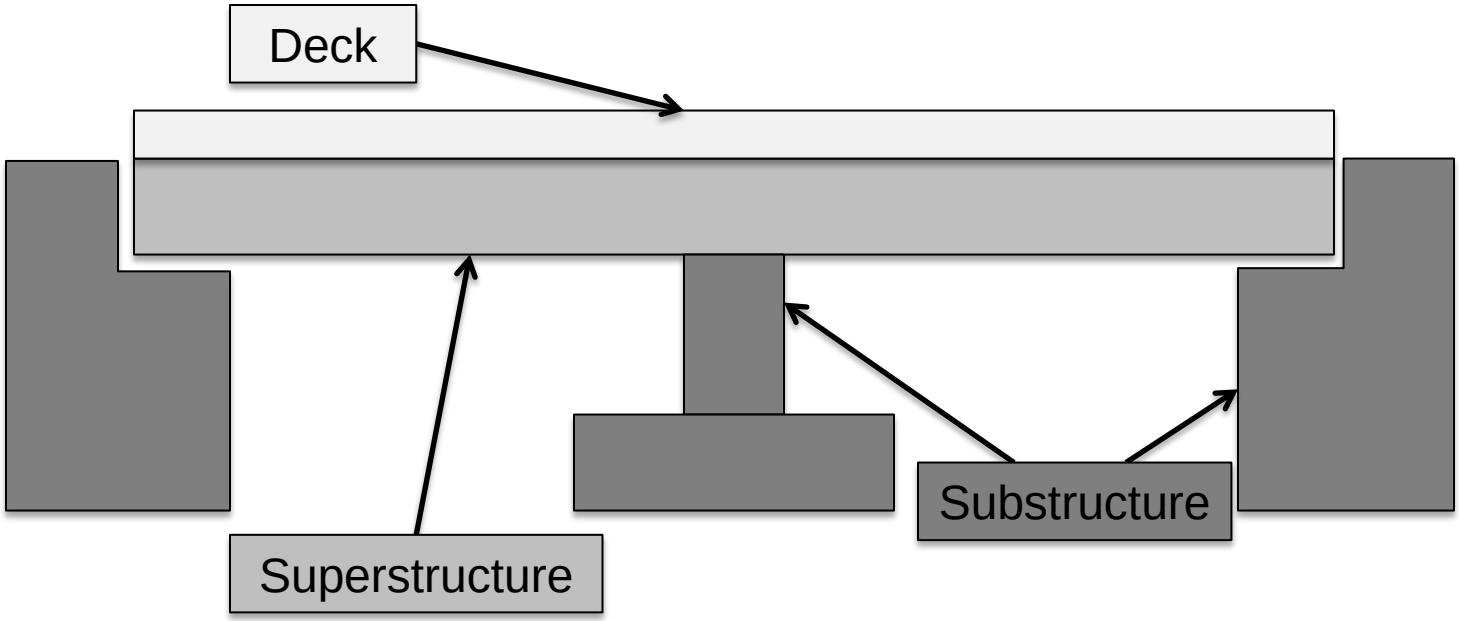
MAP-21 and Performance Management



NHS Bridge Condition Performance Measures (490.407)

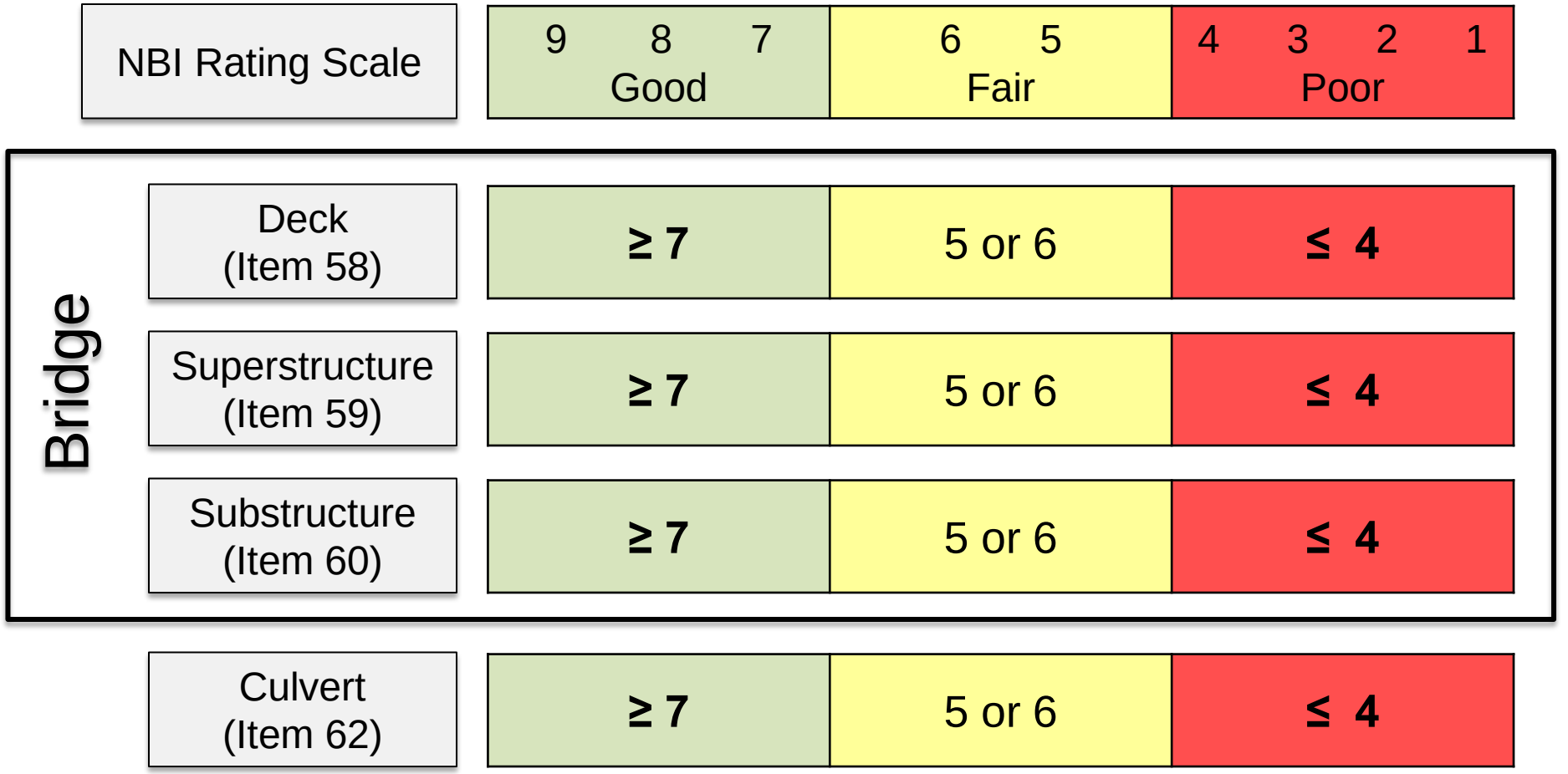


Data Source and Bridge Components



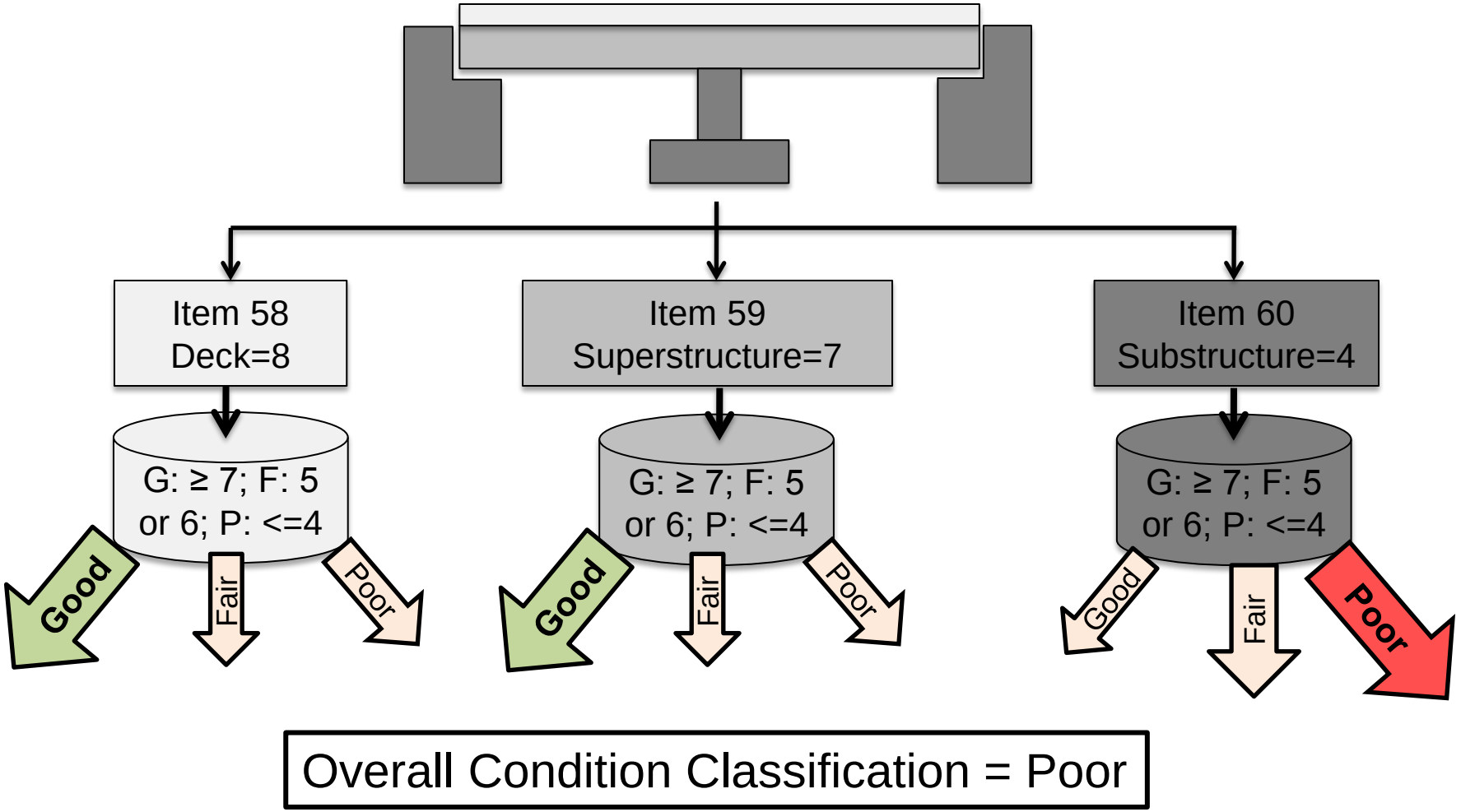
Bridge NBI Items			Culvert NBI Item
Item 58- Deck	Item 59- Superstructure	Item 60- Substructure	Item 62- Culvert

NBI Bridge Condition Rating Thresholds for NHS Bridges



Data Source and Bridge Components

Example for Bridge



Overall Condition Classification = Poor

Calculating NHS Bridge Condition Performance Measures (490.409)

	Structure Type		
	Bridges	Culverts	Measures
Overall Bridge Condition Rating	3 metric classification (58-Deck, 59-Superstructure, 60-Substructure)	1 metric classification (62-Culverts)	
Good	ALL metrics rated “Good”	Metric rated “Good”	percentage of deck area classified as in “Good” condition
Poor	Any metrics rated “Poor”	Metric rated “Poor”	percentage of deck area classified as in “Poor” condition
Fair	Minimum rated metric “Fair”	Metric rated “Fair”	

Minimum Condition and Penalty for Structurally Deficient Bridges (490.411 and 490.413)

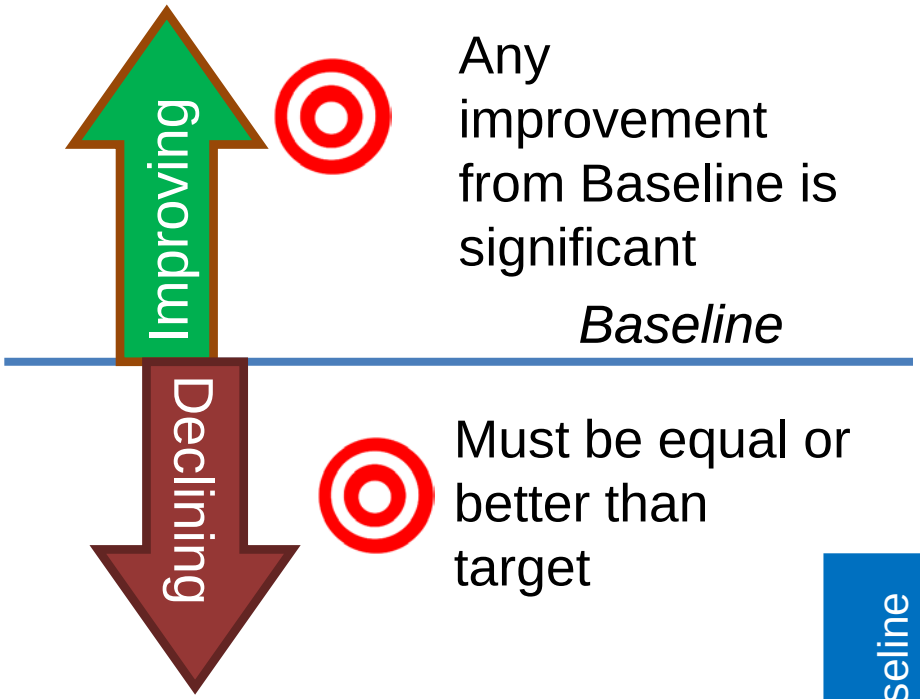
Minimum condition level: **≤ 10% of total deck area of NHS bridges classified as <u>Structurally Deficient</u>**

Calculation:

$$100 \times \frac{\text{Total Deck Area of NHS Bridges classified as Structurally Deficient}}{\text{Total Deck Area of NHS Bridges in a State}}$$

Penalty: If for 3 consecutive years the minimum condition level is not met, State must set aside and obligate NHPP funds for eligible projects on bridges on the NHS

Determining Significant Progress Toward the Achievement of Performance Targets



Any improvement from Baseline is significant

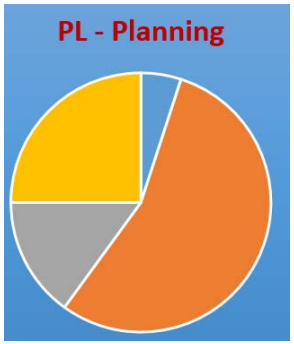
Baseline

Must be equal or better than target

- Actual meet target?
- If not, actual better than baseline?

	Baseline	Target	Actual Condition	Significant Progress?
Percentage of NHS bridges in **Good** Condition	35%	33%	34%	**Yes-** by achieving the target
Percentage of NHS bridges in **Poor** Condition	10%	7%	8%	**Yes-** by actual better than the baseline

Bridge Analyst - Planning



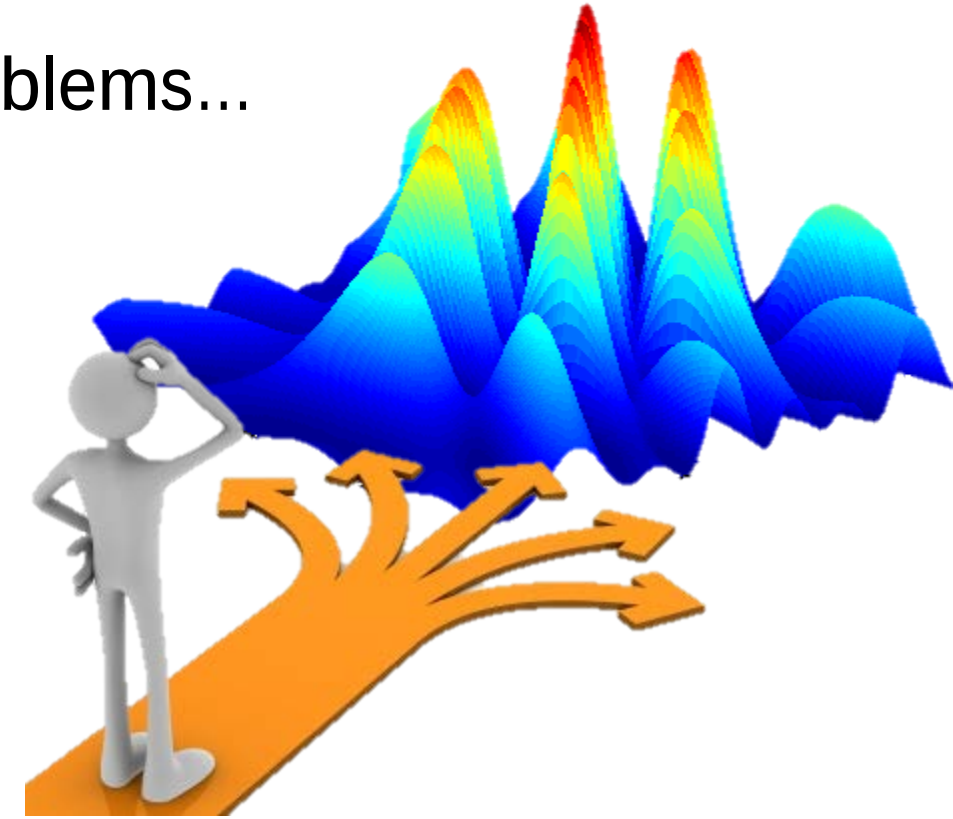
Asset Management Director

Questions?

1. What is the minimum required cost($) to achieve set goals (MAP-21) ?
2. What is the best strategy to set the Map-21 targets?
   - ❑ Focus on Poor or Good bridges?
   - ❑ Planning Period?

Problem Statement

We have Optimization Problems...



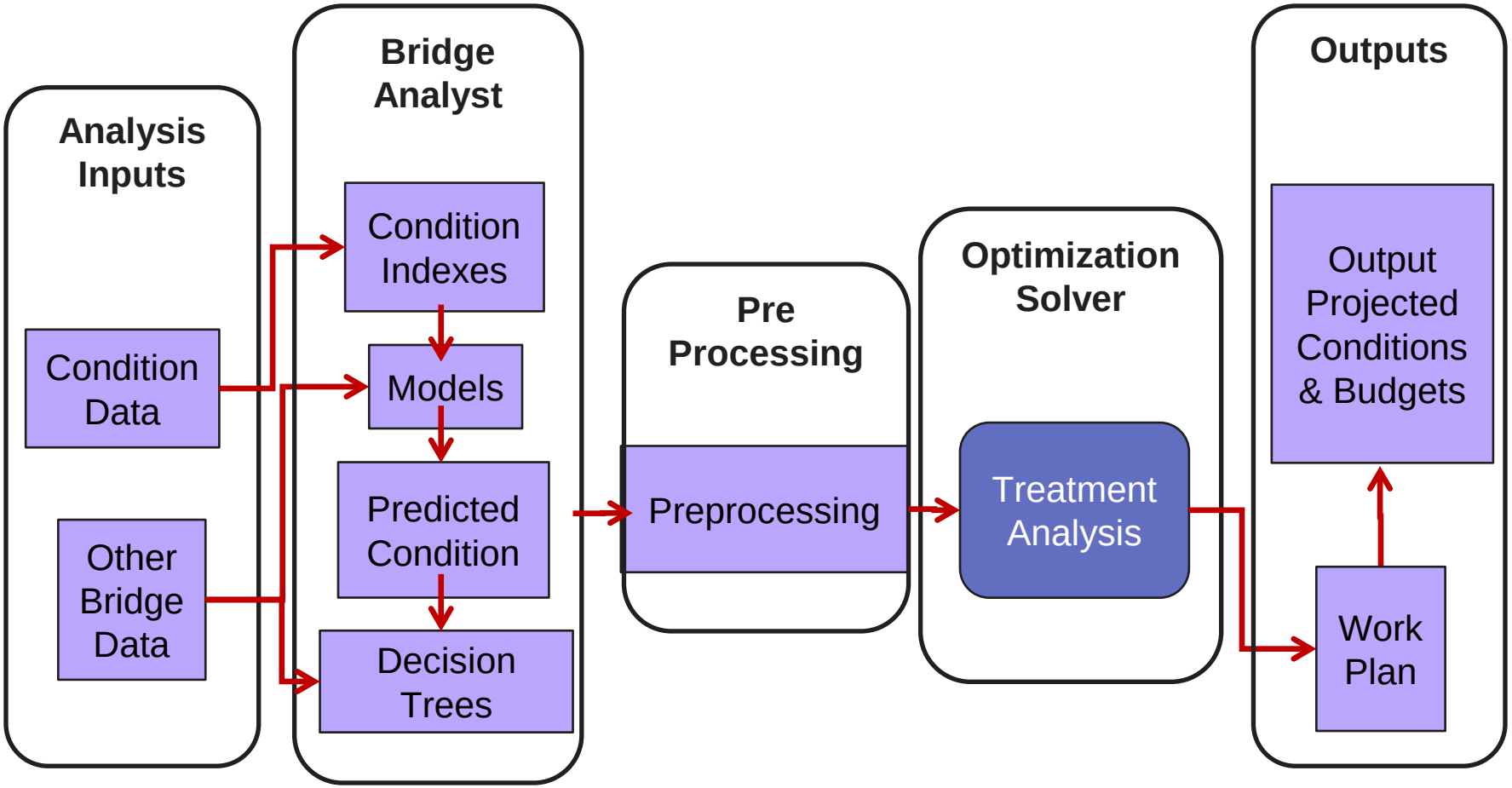
Objective/Constraint:

- Average Network Condition
- Remaining Service Life
- Budget
- % of network below a threshold
- % of network above a threshold

Solution:

- An “optimal” work plan is the work plan that generates max/min objective while meeting all constraints.

Bridge Analyst Framework



Case Study – Georgia Bridge Network

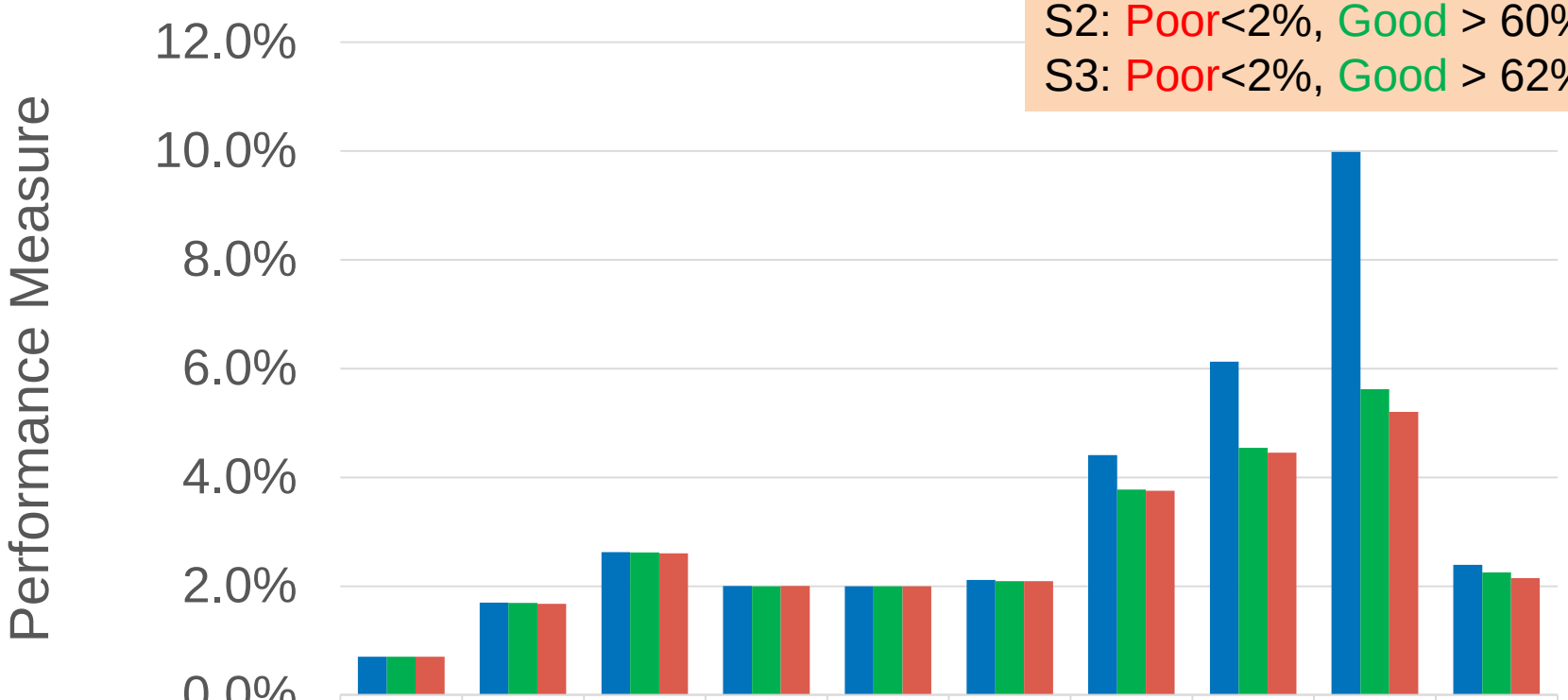
Analysis Period: 10 Years

Scenarios:

1. Minimize cost, **Target:** less than 2% poor bridges
2. Minimize cost, **Target**: Less than 2% poor bridges, More than 60% good bridges
3. Minimize cost, **Target**: Less than 2% poor bridges, More than 62% good bridges

Poor Condition Before Applying Treatment

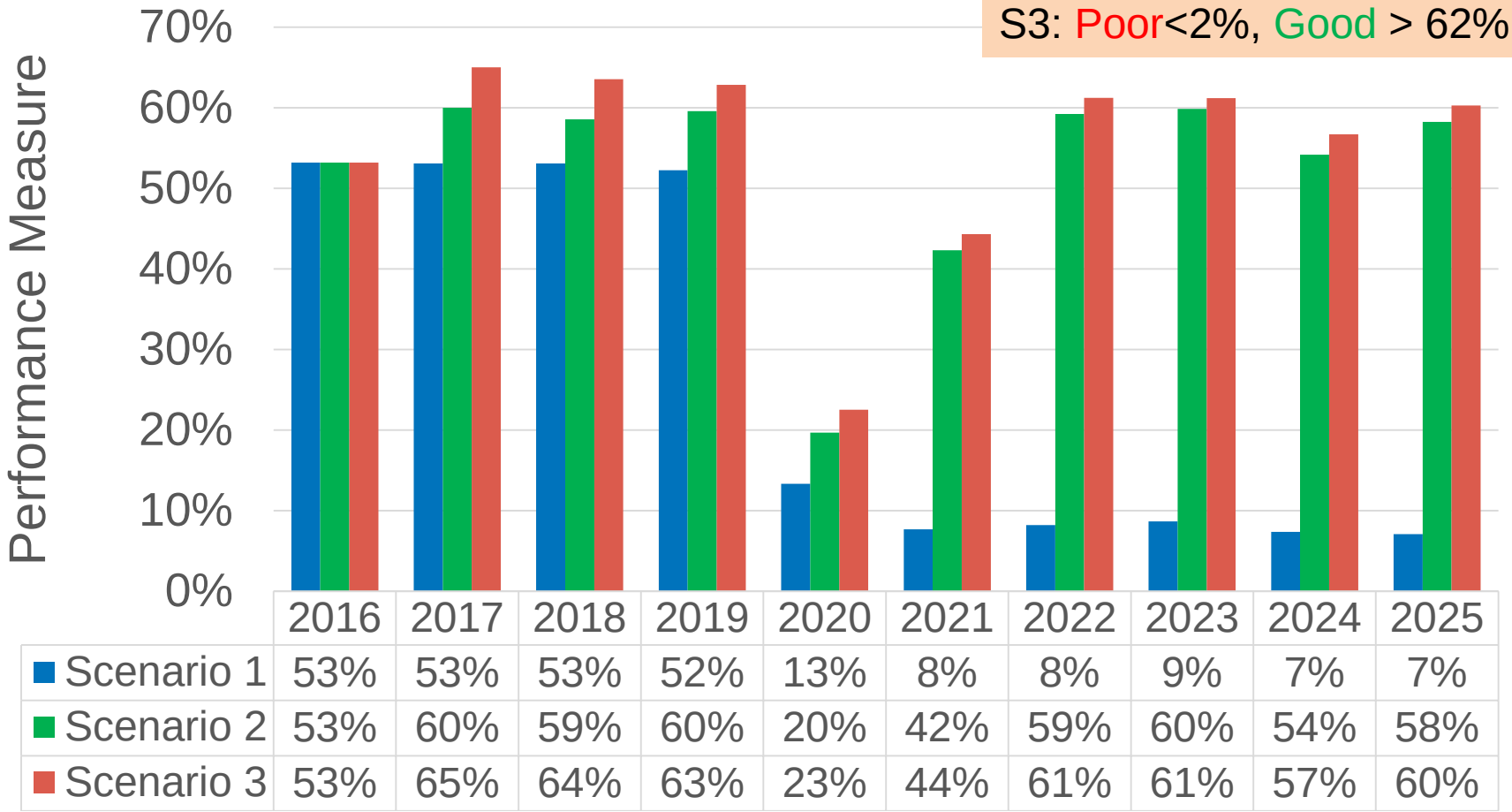
S1: Poor<2%, Good: n/a
S2: Poor<2%, Good > 60%
S3: Poor<2%, Good > 62%



	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Scenario 1	0.7%	1.7%	2.6%	2.0%	2.0%	2.1%	4.4%	6.1%	10.0%	2.4%
Scenario 2	0.7%	1.7%	2.6%	2.0%	2.0%	2.1%	3.8%	4.5%	5.6%	2.3%
Scenario 3	0.7%	1.7%	2.6%	2.0%	2.0%	2.1%	3.8%	4.5%	5.2%	2.1%

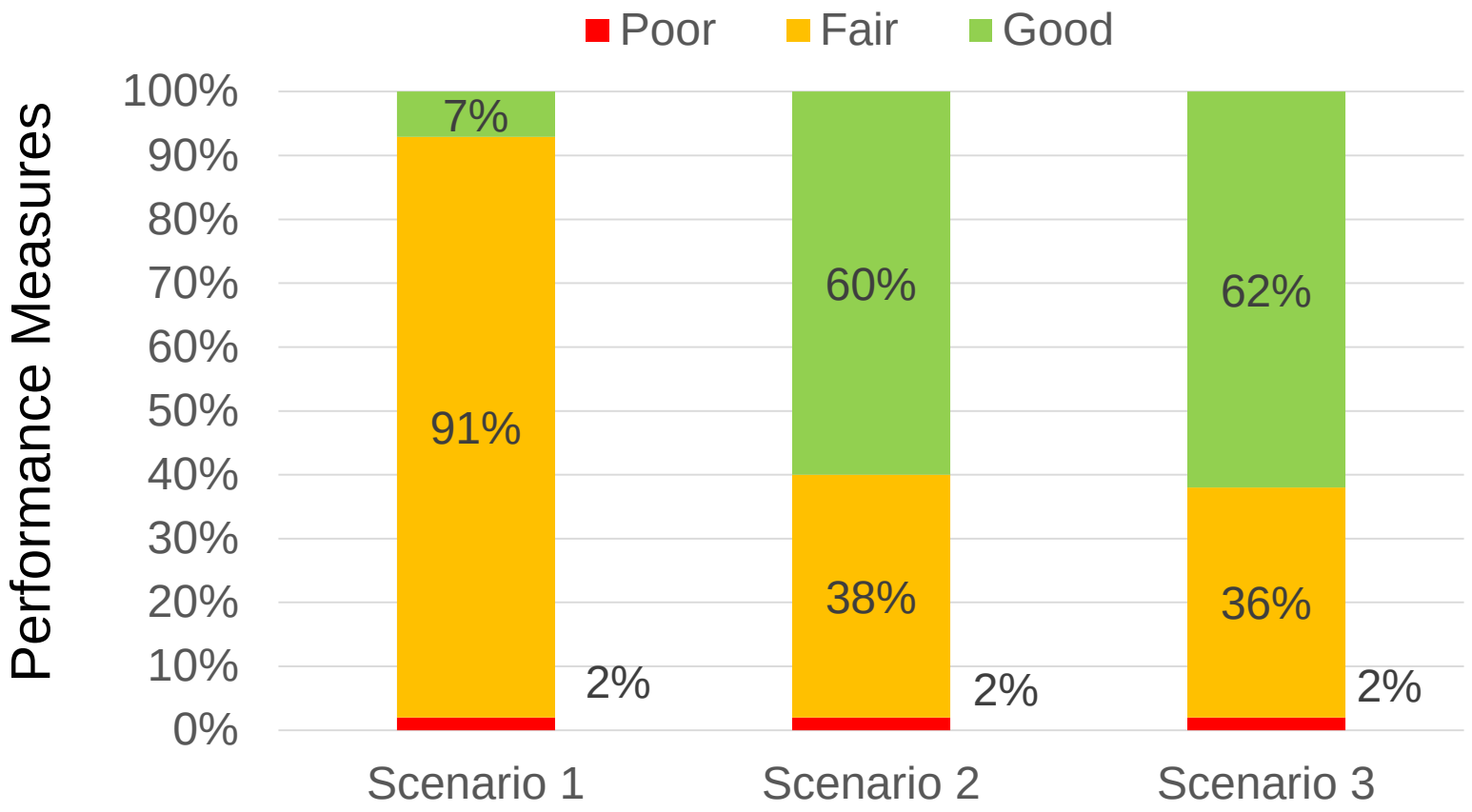
Good Condition Before Applying Treatment

S1: Poor<2%, Good: n/a
S2: Poor<2%, Good > 60%
S3: Poor<2%, Good > 62%

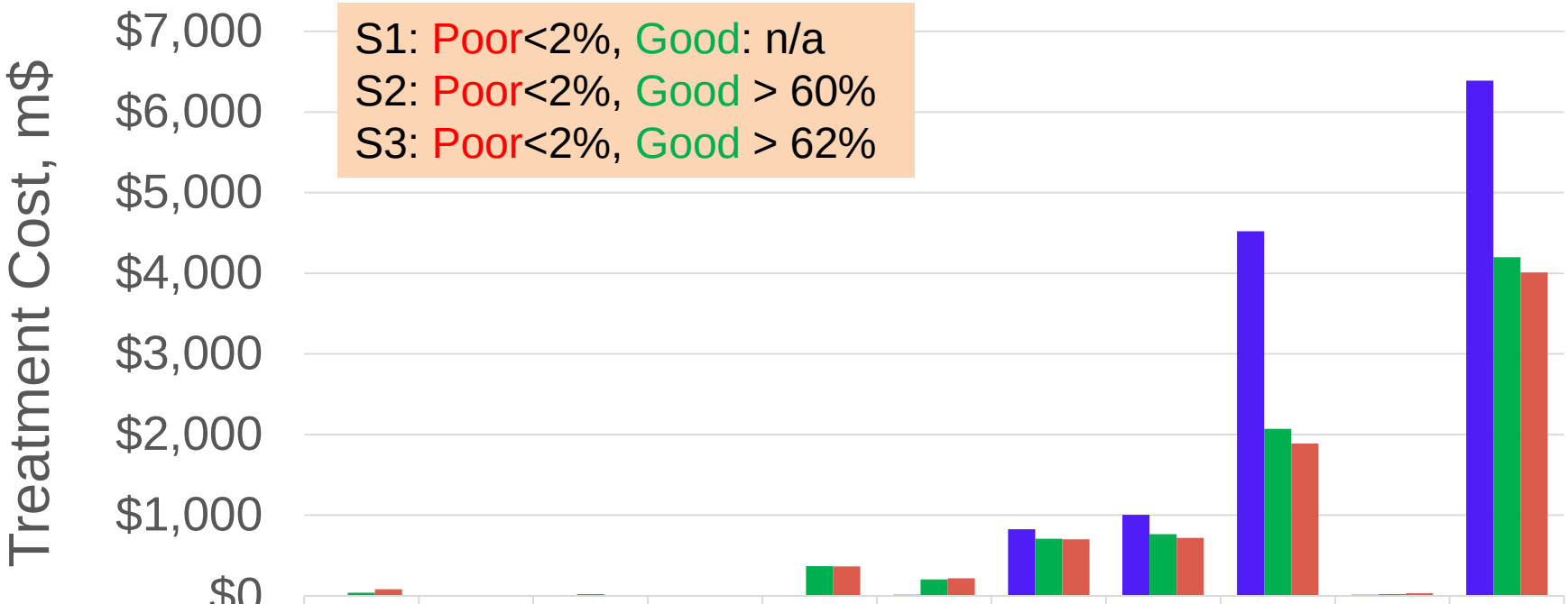


	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Scenario 1	53%	53%	53%	52%	13%	8%	8%	9%	7%	7%
Scenario 2	53%	60%	59%	60%	20%	42%	59%	60%	54%	58%
Scenario 3	53%	65%	64%	63%	23%	44%	61%	61%	57%	60%

Long-term Network Performance Measures



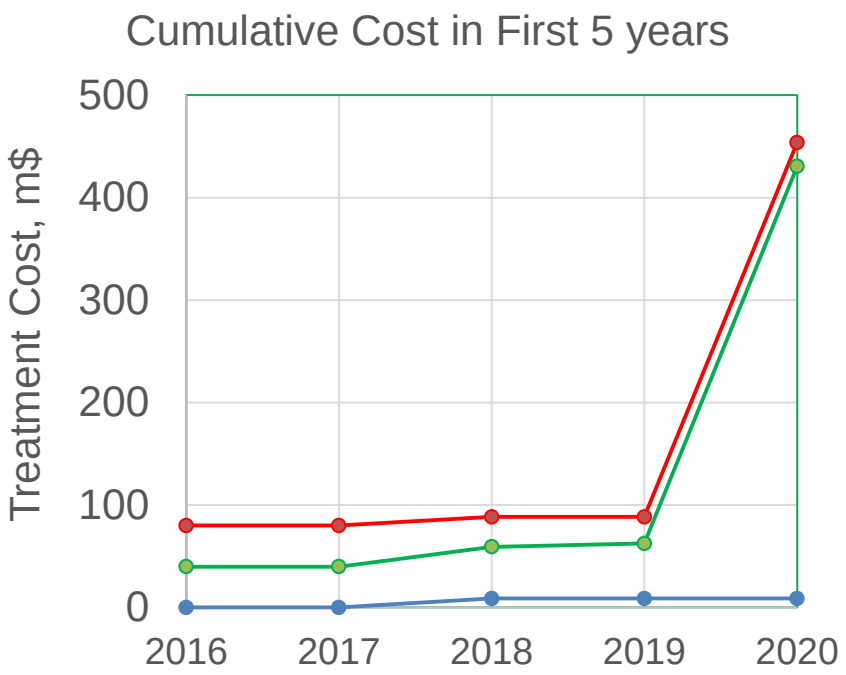
Treatment Cost vs Time

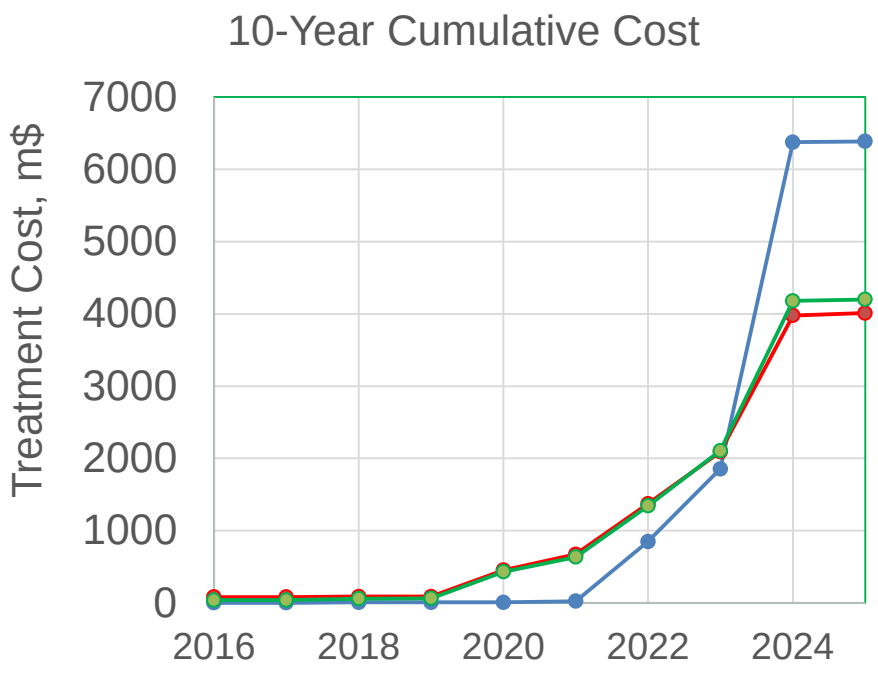


	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	Total
Scenario 1	0	0	9	0	0	14	827	1004	4521	13	6388
Scenario 2	40	0	19	3	368	205	708	764	2072	22	4200
Scenario 3	80	0	8	0	365	218	700	718	1888	32	4010

Short-term vs Long-term Cost

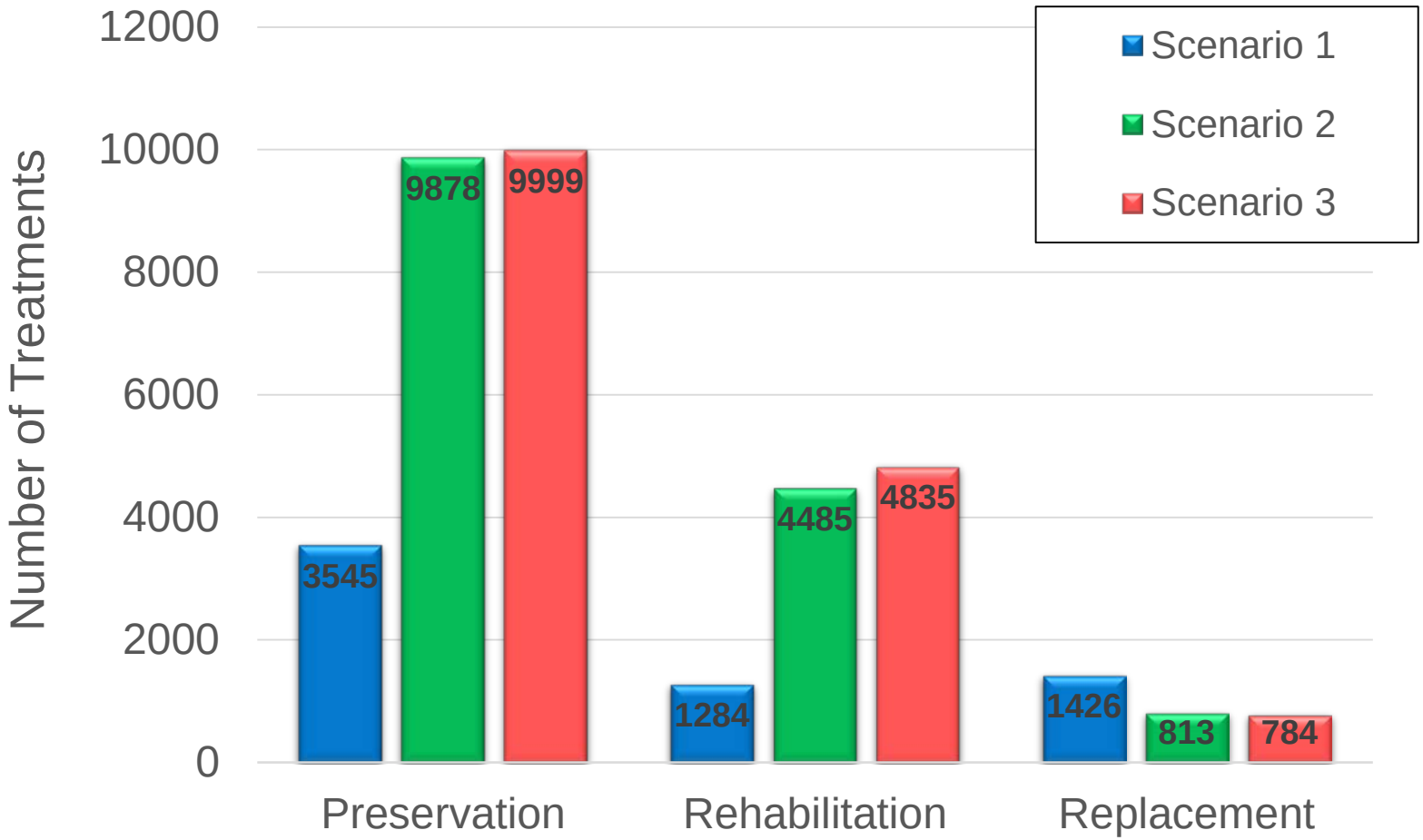
S1: Poor<2%, Good: n/a
S2: Poor<2%, Good > 60%
S3: Poor<2%, Good > 62%





Scenario 1 Scenario 2 Scenario 3

Distribution of Treatments



Summary and Conclusions

- Map-21 performance measures can be used as constraints to determine minimum cost to achieve performance targets.
- Compliance with annual performance targets does not guarantee lower network maintenance costs: in scenario 1 where targets are being met in first 5 years at low cost, but more bridges are deteriorating and need to be fixed in last 5 years.
- Comparison of alternative scenarios, each with varying annual performance targets required to balance available budget with achieved annual condition and better distribute funds across years.
- Focusing on ‘Good’ Performance Measures yields to spending more on preservation and lower total cost in long term planning.

Question?

Thank You!