

# Topeka Asset Management System

## Bridge Management Program

Department of Public Works

Mar 15, 2021



*City of Topeka*

# Agenda

- Asset Management System Overview and Updates
- Bridge Management Program Updates



# Definitions – Asset Management

**Assets**—are something with potential value to an organization and for which the organization has a responsibility (Municipality owned and contributed)

**Asset system**—group of assets that interact and/or are interrelated so as to deliver a required business function or service

**Asset management**—coordinated activities of an organization to realize value from assets

**Asset management system**—set of interrelated and interacting elements of an organization to establish policies, objectives and processes



# Definitions – National Bridge Inspection Standards

**Bridge** - A structure including supports erected over a depression or an obstruction, such as water, highway, or railway, and having a track or passageway for carrying traffic or other moving loads, and having an opening measured along the center of the roadway of more than 20 feet (6.1 m) between under-copings of abutments or spring lines of arches, or extreme ends of openings for multiple boxes.

**Culvert** - A structure designed hydraulically to take advantage of submergence to increase hydraulic capacity. Culverts, as distinguished from bridges, are usually covered with embankment and are composed of structural material around the entire perimeter, although some are supported on spread footings with the streambed serving as the bottom of the culvert.

According to AASHTO the definition of bridges includes culverts with openings measuring **more than 20 feet (6.1m)** along the centerline of the road and also includes multiple pipes where the **distance between openings is less than or equal to half of the pipe opening.**



# Definitions – National Bridge Inspection Standards

**Condition Rating** – are used to describe the existing, in-place bridge as compared to the as-built condition.

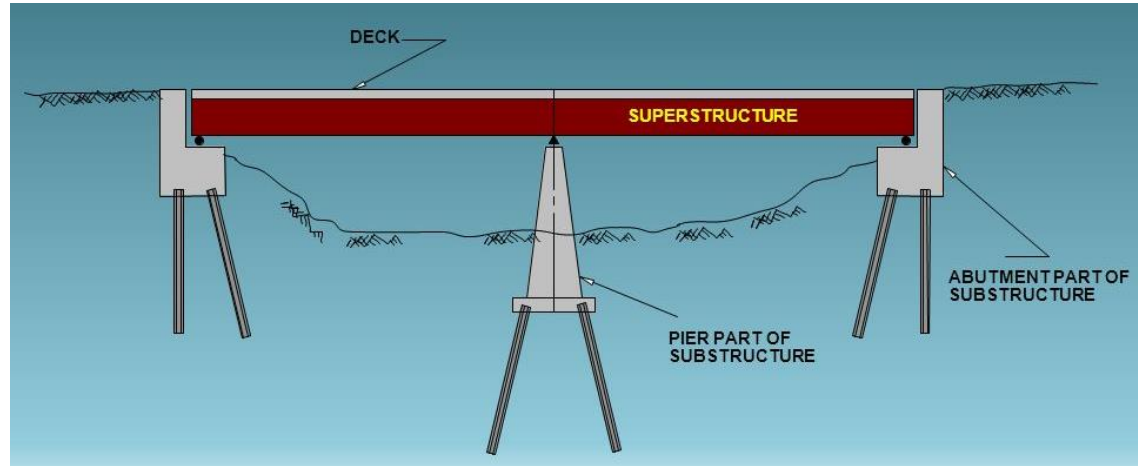
Item 58: Deck

Item 59: Superstructure

Item 60: Substructure

Item 61: Channel and  
Channel Protection

Item 62: Culverts



0 (Failed)

1 (Imminent Failure)

2 (Critical)

3 (Serious)

4 (Poor)

5 (Fair)

6 (Satisfactory)

7 (Good)

8 (Very good)

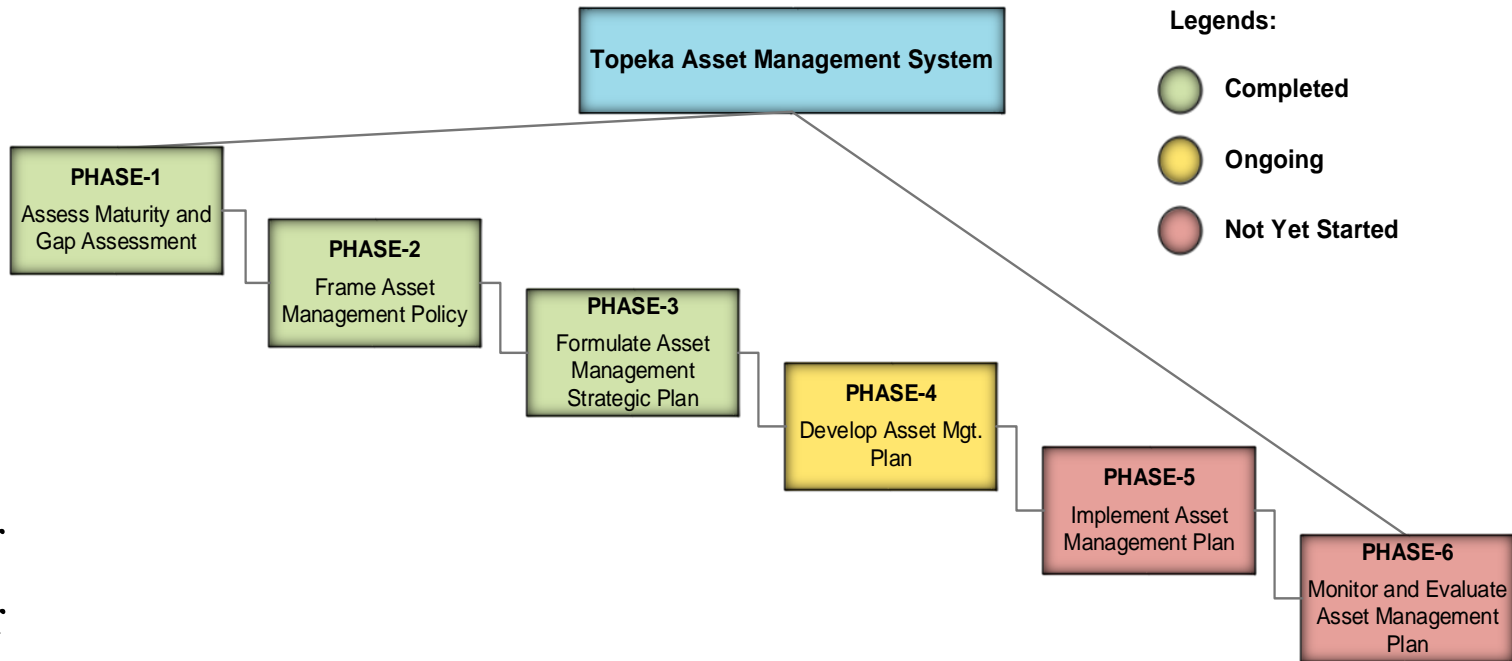
9 (Excellent)



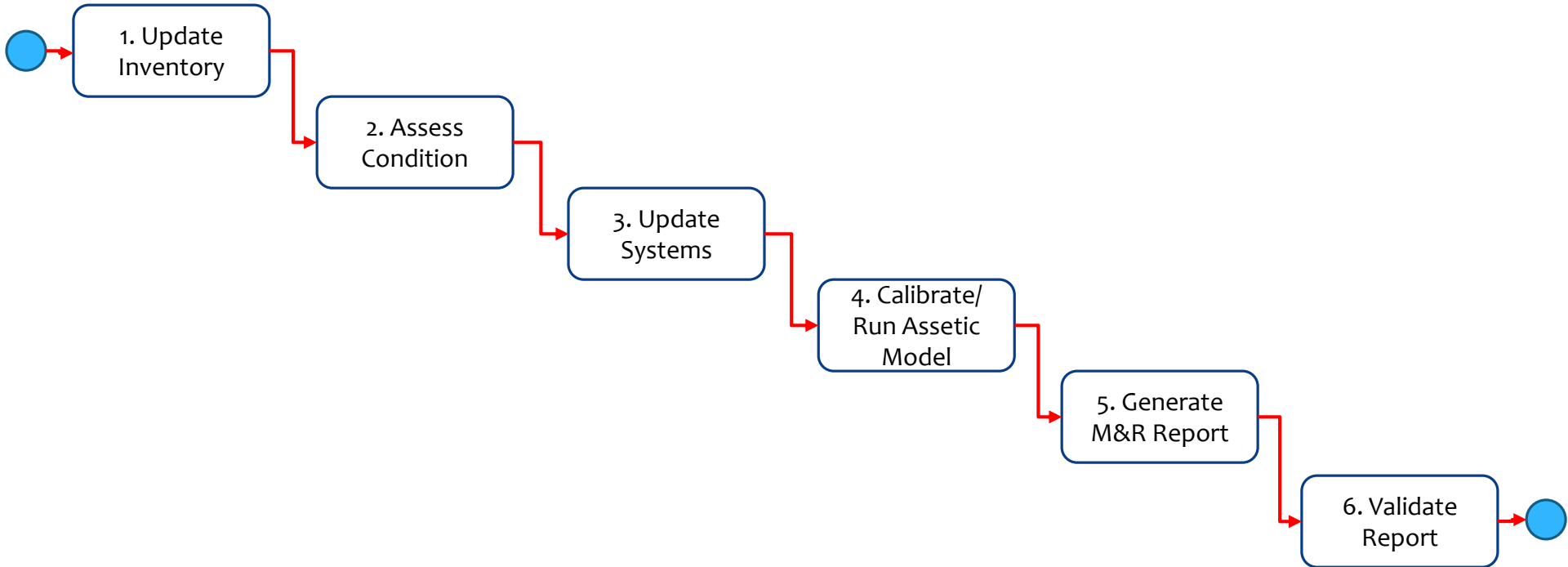
# Asset Management System Overview and Updates

## Service Areas:

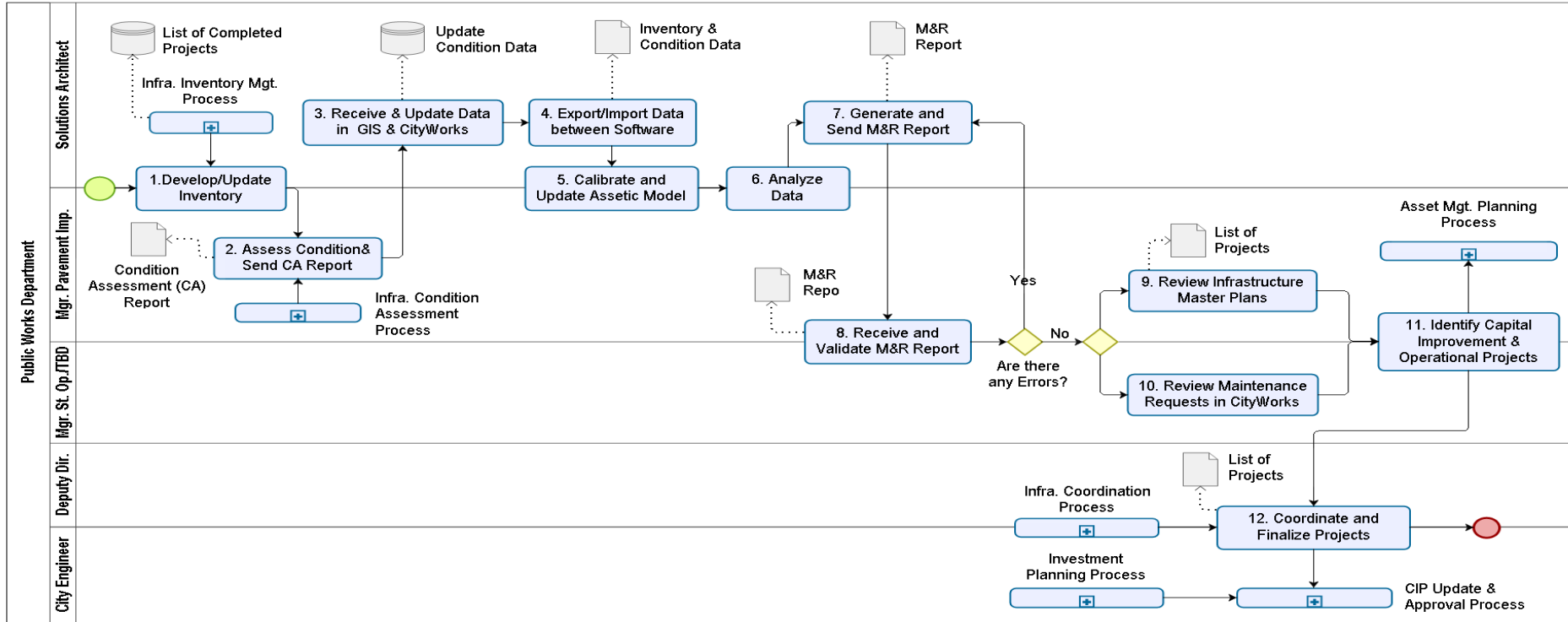
- Street
- Bridge
- Traffic
- Facility
- Fleet
- Water
- Wastewater
- Stormwater



# Infrastructure Planning Process (Abstract)



# Infrastructure Planning Process (Detailed)





# Bridge Management Program Updates



# Bridge Inventory Management

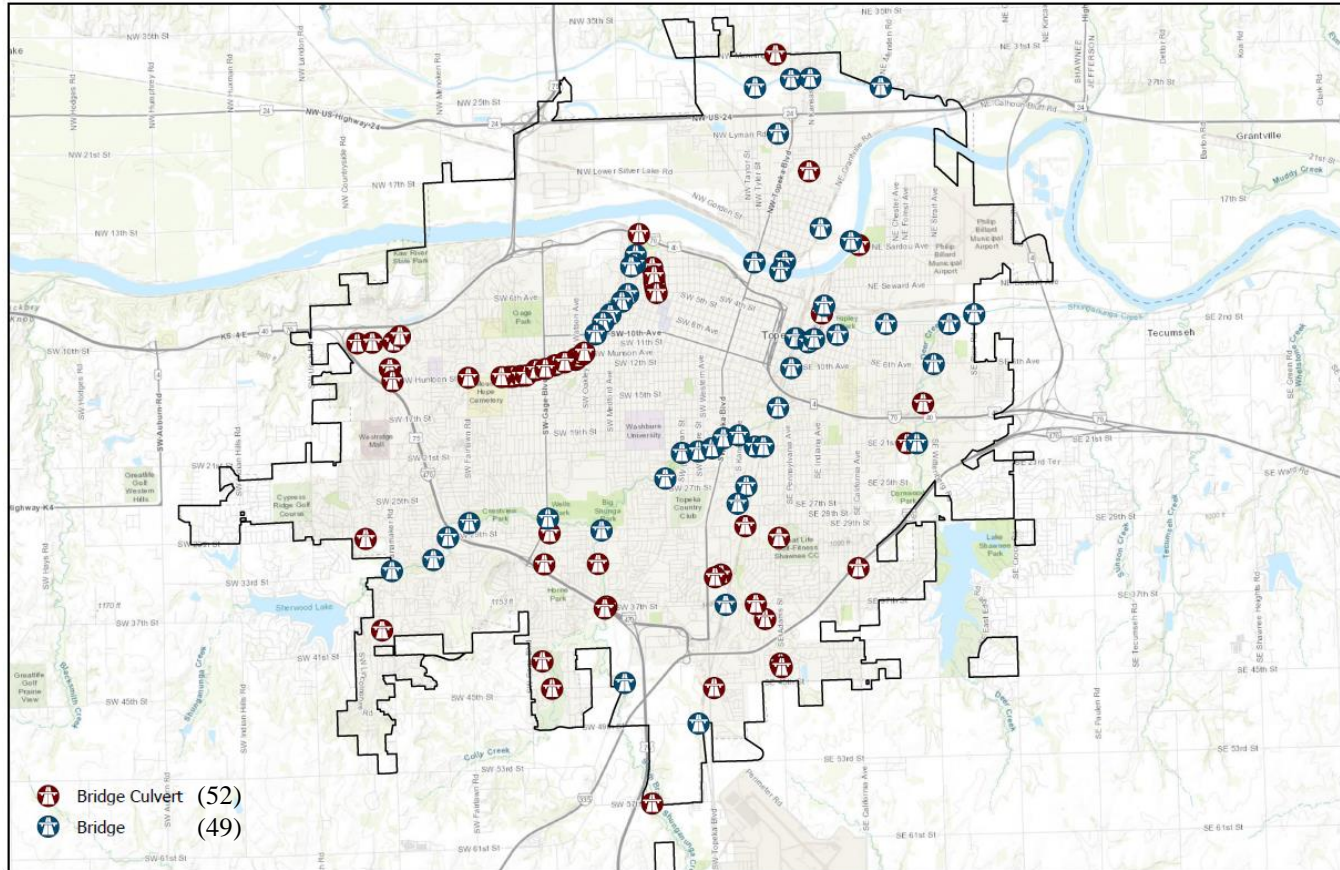
Asset Category	Asset Type	Useful Life (Yrs)	Inventory/Quantity	Unit	Unit Replacement Cost (\$000's)	Replacement Value (\$000's)
Bridge	Bridge (Culvert more than 20 ft)	80-100	52	Ea.	432,415	22,485,600
	Reinforced Concrete (RC) Decks/RC Superstructure	80-100	29	Ea.	1,016,666	29,483,300
	RC Decks/Painted Steel Superstructure	80-100	13	Ea.	6,180,177	80,342,300
	RC Decks/Weathering Steel Superstructure	80-100	7	Ea.	9,425,314	65,977,200
	Total:		101			198,288,400

In line with NBIS, FHWA and KDoT requirement:

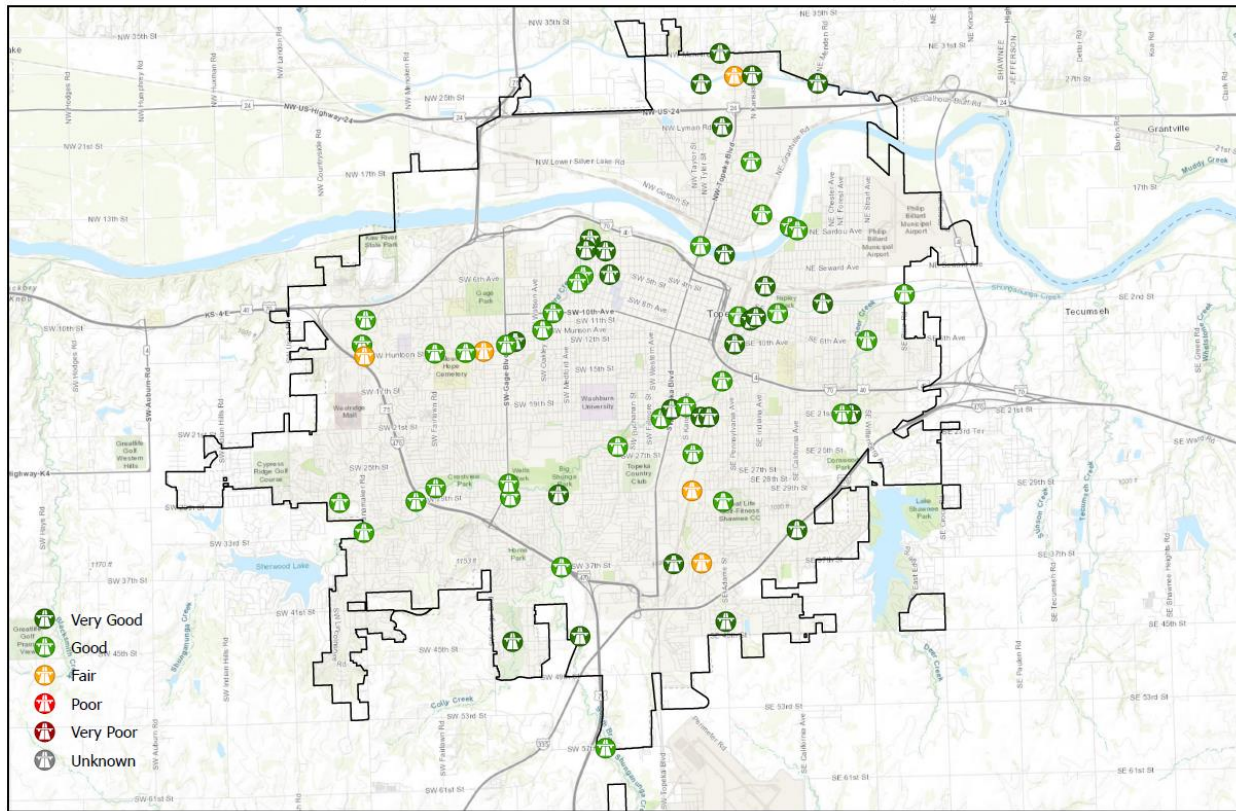
- Urban Arterial Bridges = 64 (Designated urban routes approved by FHWA/KDoT)
- Off-System Bridges = 37



# Bridge Inventory Map

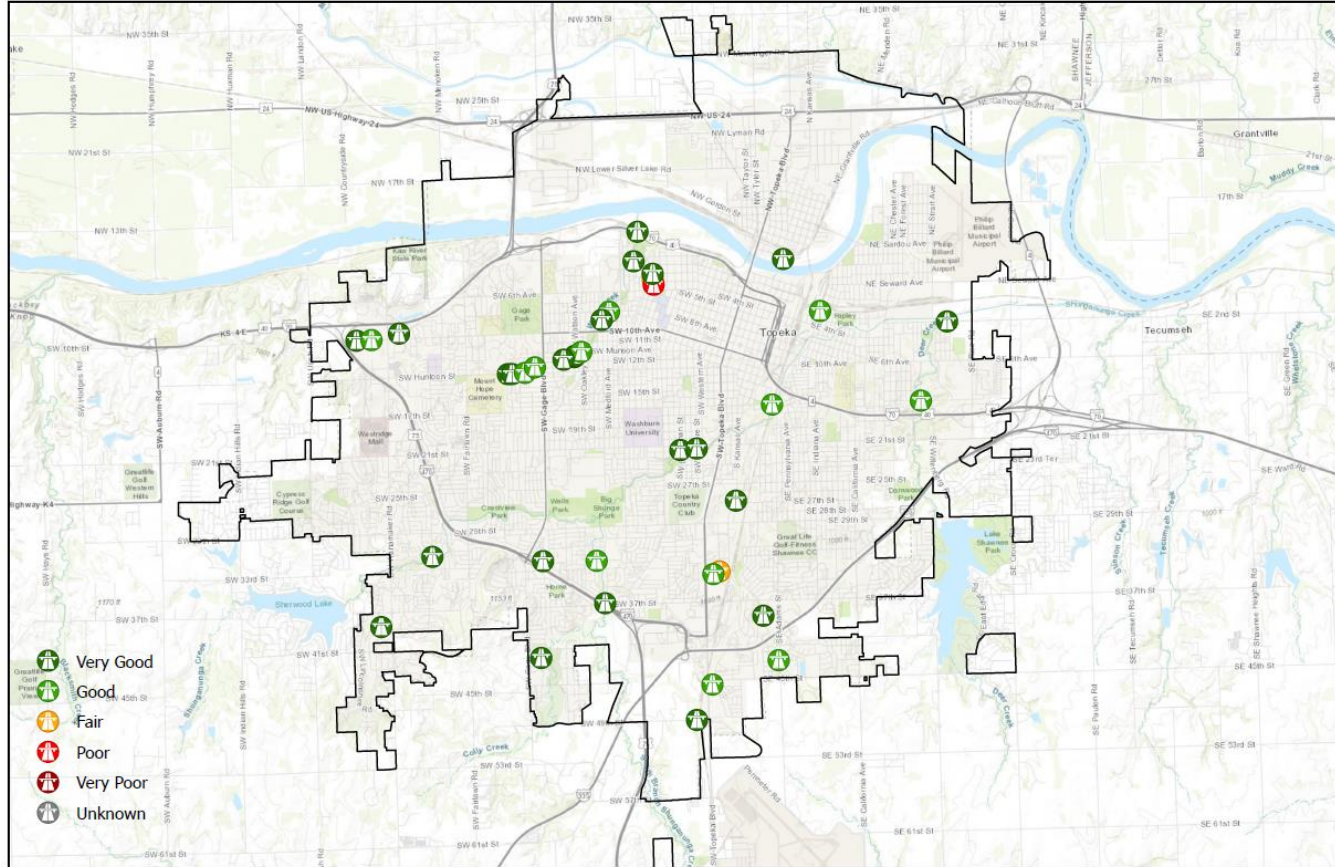


# Condition Map – Urban Arterial Bridges (64)





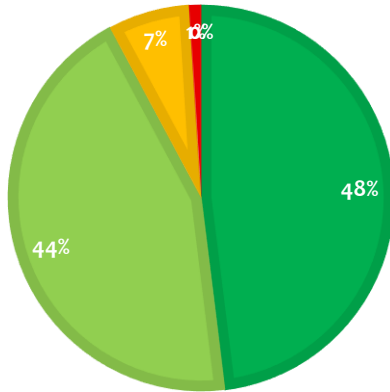
# Condition Map – Off-System Bridges (37)



# Bridge Condition Assessment

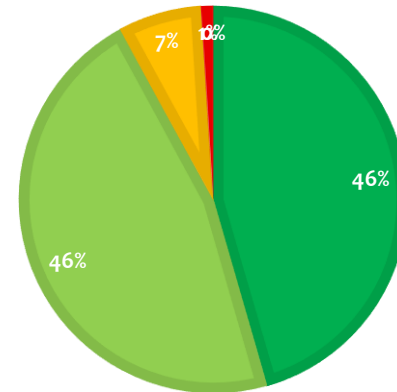
## RATING 2019

Very Good Good Fair Poor Very Poor



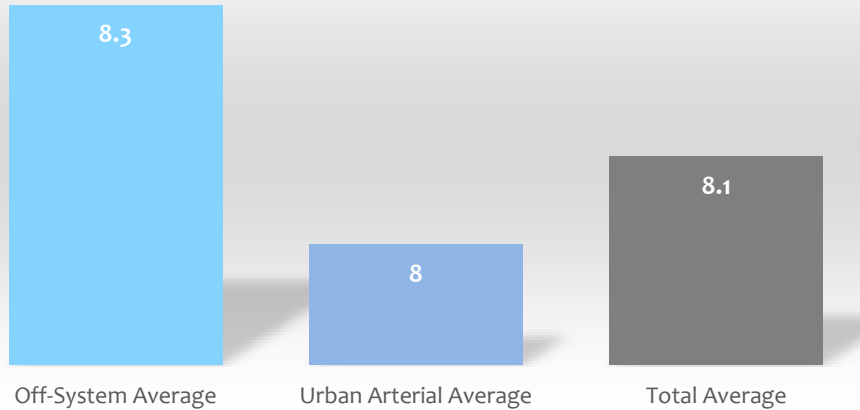
## RATING 2017

Very Good Good Fair Poor Very Poor

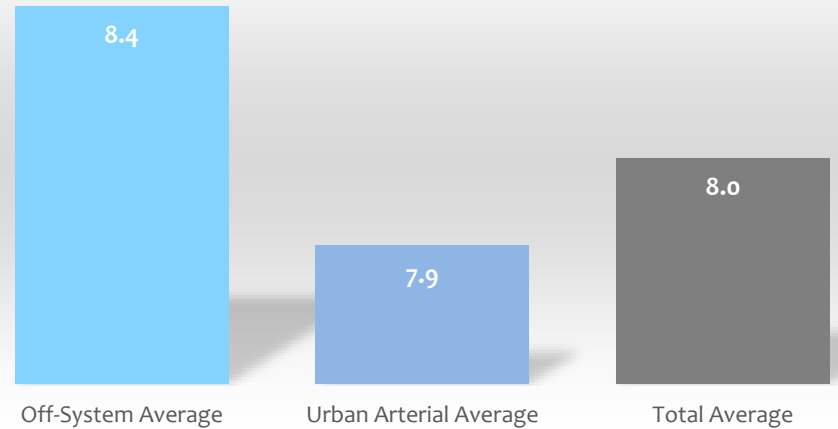


# Bridge Condition Assessment – Condition Rating

## Bridge BCR Average 2019



## Bridge BCR Average 2017



# Existing Approach

## Bridge Capital Project Identification and Prioritization

- Reactive based on condition rating
  - No treatment
  - Maintenance
  - Minor Rehabilitation
  - Major Rehabilitation
  - Reconstruction





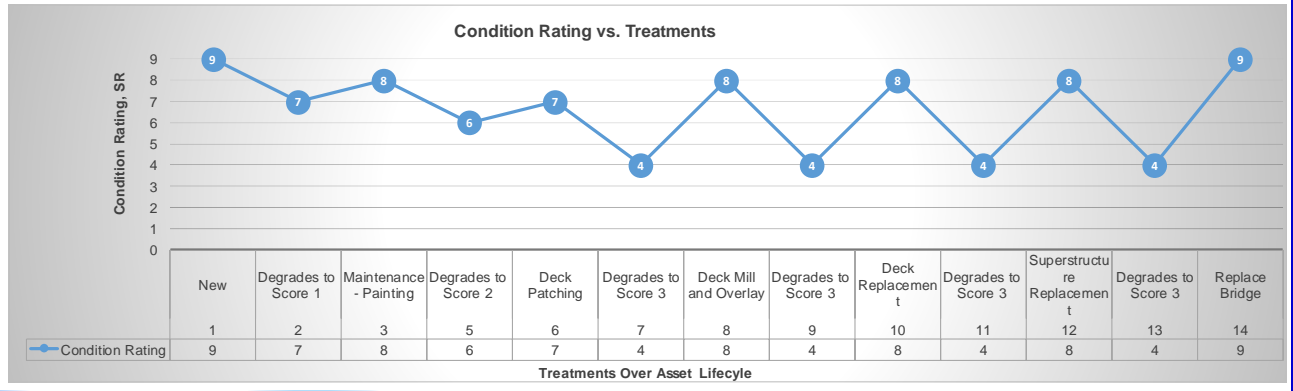
# Moving Forward Approach – Project Identification & Prioritization

- Computerized Assetic – based project identification and prioritization
- Service criteria – Condition rating
- Treatment trigger criteria - road class and bridge type
- Scenario analysis – Constrained budget scenario
- Capital works program – Treatment type, cost, and schedule
- Validate and visualize



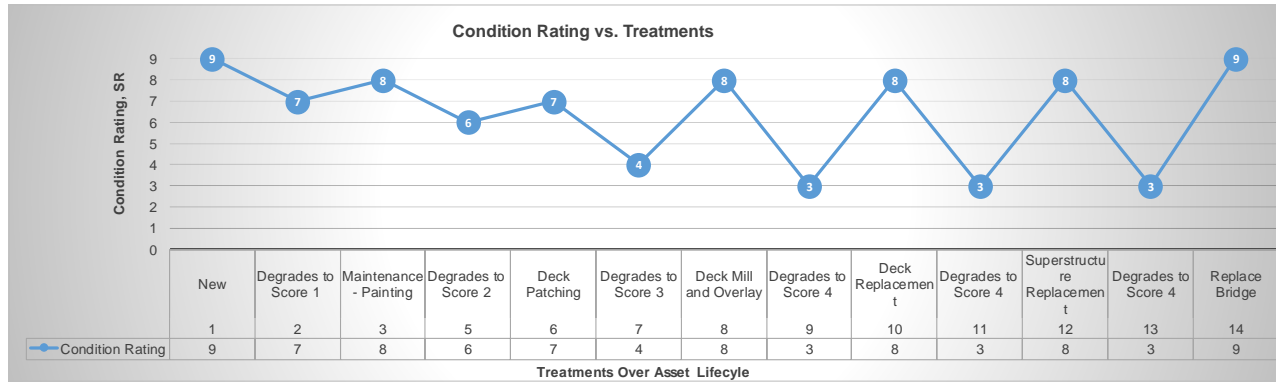
# Treatment Triggers – Decision Making – Urban Arterial Bridges

Urban Arterial Bridges - Collector and Arterial Streets					Steps	Treatment Strategy	Condition Rating
Asset Strategy	Assetic Scale 0-6	Bridge Condition					
		Threshold	Condition Rating	Sufficiency Rating, SR			
	0	9	8.1-9	81-100	1	New	9
Maintenance - Painting	1	8	7.1-8	71-80	2	Degrades to Score 1	7
Deck Patching		7	6.1-7	61-70	3	Maintenance - Painting	8
Deck Mill and Overlay	2	6	5.1-6	51-60	4	Degrades to Score 2	6
Deck Replacement		5	4.1-5	41-50	5	Deck Patching	7
Superstructure Replacement	3	4	3.1-4	31-40	6	Degrades to Score 3	4
Replace Bridge		3	2.1-3	21-30	7	Deck Mill and Overlay	8
		2	1.1-2	11-20	8	Deck Replacement	8
		0	0-1	0-10	9	Degrades to Score 3	4
					10	Superstructure Replacement	8
					11	Degrades to Score 3	4
					12	Replace Bridge	9
					13	Degrades to Score 3	4
					14	Degrades to Score 3	4



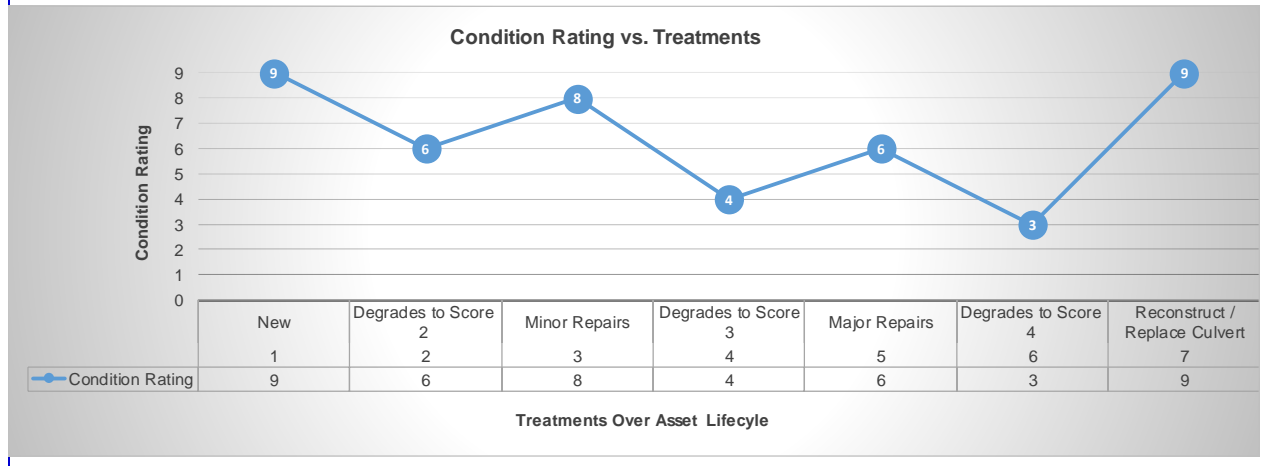
# Treatment Triggers – Decision Making – Off System Bridges

Off-System Bridges - Local Streets					Steps	Treatment Strategy	Condition Rating
Asset Strategy	Asstic Scale 0-6	Bridge Condition					
		Threshold	Condition Rating	Sufficiency Rating, SR			
	0	9	8.1-9	81-100	1	New	9
	1	8	7.1-8	71-80	2	Degrades to Score 1	7
Maintenance - Painting		7	6.1-7	61-70	3	Maintenance - Painting	8
Deck Patching	2	6	5.1-6	51-60	4	Degrades to Score 2	6
Deck Mill and Overlay		5	4.1-5	41-50	5	Degrades to Score 2	6
Deck Replacement	3	4	3.1-4	31-40	6	Deck Patching	7
Superstructure Replacement		3	2.1-3	21-30	7	Degrades to Score 3	4
Replace Bridge	4	2	1.1-2	11-20	8	Deck Mill and Overlay	8
		0	0-1	0-10	9	Degrades to Score 4	3
	5	2	1.1-2	11-20	10	Deck Replacement	8
	6	0	0-1	0-10	11	Degrades to Score 4	3
					12	Superstructure Replacement	8
					13	Degrades to Score 4	3
					14	Replace Bridge	9



# Treatment Triggers – Decision Making – Culverts

Culvert - Local, Collector, Arterial Streets					Steps	Treatment Strategy	Condition Rating
Asset Strategy	Assetic Scale 0-6	Bridge Condition					
		Threshold	Condition Rating	Sufficiency Rating, SR			
Monitor and Clean	0	9	8.1-9	81-100	1	New	9
Monitor and Clean	1	8	7.1-8	61-80	2	Degrades to Score 2	6
Minor Repairs	2	6	4.1-6	41-60	3	Minor Repairs	8
Major Repairs	3	4	3.1-4	31-40	4	Degrades to Score 3	4
Reconstruct / Replace Culvert	4	3	2.1-3	21-30	5	Major Repairs	6
	5	2	1.1-2	11-20	6	Degrades to Score 4	3
	6	0	0-1	0-10	7	Reconstruct / Replace Culvert	9



# THANKS





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## Definitions – National Bridge Inspection Standards

**Bridge Sufficiency Rating, BSR**—represents a percentage value that is indicative of the bridge sufficiency to remain in service. The BSR is based on four factors, S1 (Structural Adequacy and Safety), S2 (Serviceability and Functional Obsolescence), S3 (Essentiality for Public Use), and S4 Special Reduction.

$$\text{BSR} = \text{S1}(54\% \text{ Max}) + \text{S2} (30\% \text{ Max}) + \text{S3} (15\% \text{ Max}) - \text{S4} (13\% \text{ Max})$$

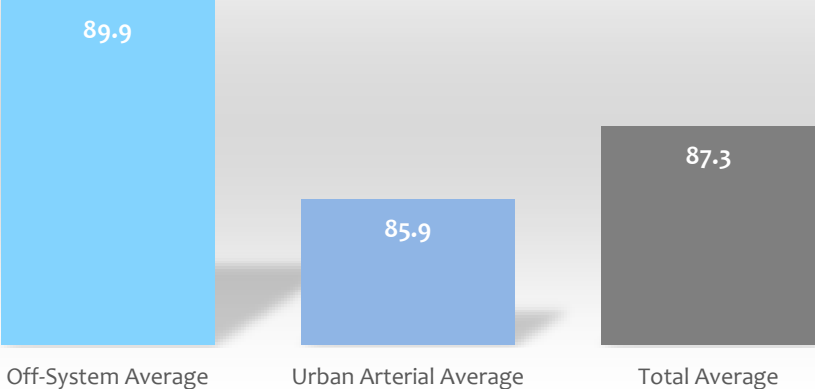
$$\text{S4} = \text{N/A if } \text{S1} + \text{S2} + \text{S3} < 50$$

BSR = 100% (Entirely Sufficient Bridge) and 0% (Entirely Deficient Bridge)

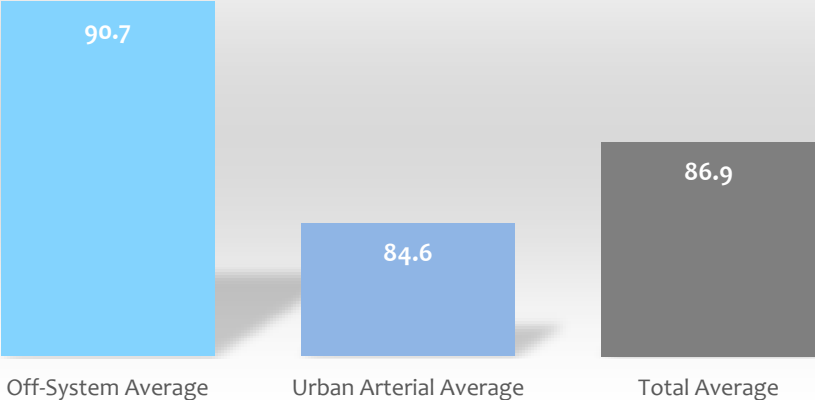


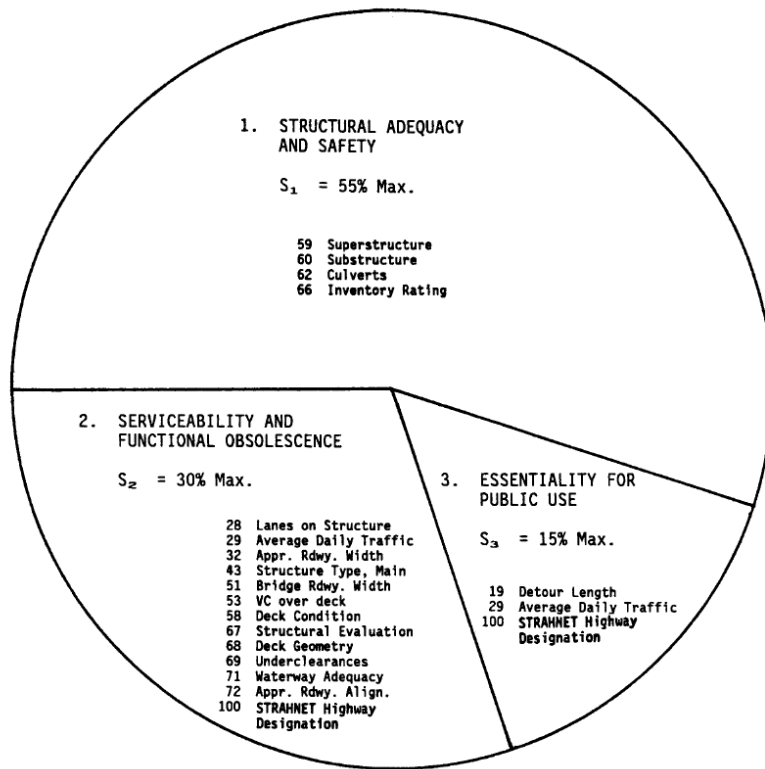
# Bridge Condition Assessment – Sufficiency Rating

### Bridge SR Average 2019



### Bridge SR Average 2017





4. SPECIAL REDUCTIONS  
 $S_4 = 13\% \text{ Max.}$

- 19 Detour Length
- 36 Traffic Safety Features
- 43 Structure Type, Main

SUFFICIENCY RATING =  $S_1 + S_2 + S_3 - S_4$

Sufficiency Rating shall not be less than 0% nor greater than 100%



# Moving Forward Approach – Project Identification & Prioritization

Asset Management Strategies						
Asset Condition Rating	Strategies	Asset Lifecycle (Remaining Useful Life, %)/ Sufficiency Rating/Condition Rating	Asset Category - Bridge			
			Asset Type			
			Bridge Culvert (More than 20 ft)	Reinforced Concrete (RC) Decks/RC Superstructure	RC Decks/Weathering Steel Superstructure	RC Decks/Painted Steel Superstructure
Very Good	Preventative Maintenance	81-100/ (9)	Monitor and clean	Monitor and allow wearing surface to become $\geq 7.5\%$ delaminated. Monitor approach and departure pavements.	Monitor and allow wearing surface to become $\geq 7.5\%$ delaminated. Monitor approach and departure pavements.	Monitor and allow wearing surface to become $\geq 7.5\%$ delaminated. Monitor approach and departure pavements.
Good	Preventative Maintenance	61-80/ (7-8)	Clean or Patch or line concrete barrel floor(s)	Patch delaminated wearing surface $\geq 7.5\%$ and other pavement distresses	Patch delaminated wearing surface $\geq 7.5\%$ and other pavement distresses	Patch delaminated wearing surface $\geq 7.5\%$ and other pavement distresses
Fair	Minor Rehabilitation	40-60/ (5-6)	Clean or Patch or line concrete barrel floor(s), barrel walls, and deck soffit(s).	Patch and overlay wearing surface and rip-rap channel	Patch and overlay wearing surface and rip-rap channel	Patch and overlay wearing surface and rip-rap channel
Poor	Major Rehabilitation	21-40/ (3-4)	Inject 4mm to 20mm cracks with epoxy. Patch delaminations in floor level, walls, & deck soffit. True up wings.	Replace superstructure Repair and rip-rap channel Replace pavement and/or substructure elements.	Replace superstructure Repair and rip-rap channel Replace pavement and/or substructure elements.	Replace superstructure Repair and rip-rap channel Replace pavement and/or substructure elements.
Very Poor	Reconstruction	0-20/ (0-2)	Reconstruct (in-kind or change structure type)	Reconstruct (in-kind or change structure type)	Reconstruct (in-kind or change structure type)	Reconstruct (in-kind or change structure type)



# Federal and State Funding

## Federal Funding - Federal Fund Exchange Program:

- All transportation projects including bridge maintenance, rehabilitation, and reconstruction

The Sufficiency Rating is considered by the federal government when a state requests federal bridge dollars to improve the condition of the bridge. Bridges with low sufficiency ratings are eligible for more funds.

Sufficiency Rating	Funding Eligibility
80 – 100	Not available
50 – 79	Eligible for costs to rehabilitate bridge
0 – 49	Eligible for costs to rehabilitate bridge



# Federal and State Funding

## State Funding - Kansas Local Bridge Improvement Program

### Eligibility:

Structurally deficient as per latest inspection (NBI compliant)

- Functionally obsolete - NBI appraisal rating of 3 or less for items: structural condition, deck geometry, under-clearance, waterway adequacy, and approach road alignment
- Load rating require to post a weight limit less than legal loads
- Immediate rehabilitation is required to keep the bridge open
- Closed due to structural inadequacy



# Federal and State Funding

## Program Focus:

- Bridges between 20-50 ft in length
- Traffic counts 100 VPD or less
- Low cost design option

## Funding:

- Up to \$150K for rehabilitation or replacement of eligible bridge
- 90% State funds and 10 % local funds

