

# **ADOT Bridge Preservation Program**

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11th International Bridge and Structure Management Conference

Mesa, Arizona

4/26/17

# Bridge Preventive Maintenance Peer Review

## March 15 – March 18, 2016

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Reference: FHWA Bridge Preservation Guide, 2011

# ADOT Bridge Preservation Program

Federal-aid highway funds are authorized by congress and provide for:

- construction,
- reconstruction,
- improvement of highways and bridges on eligible Federal-aid highway routes, and
- for other special purpose programs and projects

# Bridge Preservation Program - Continuous Improvement Acts

- Intermodal Surface Transportation Efficiency Act (**ISTEA**) of 1991-1997
- Transportation Equity Act for the 21<sup>st</sup> Century (**TEA-21**) of 1998-2004
- Safety, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (**SAFETEA-LU**) of 2005-2011
- Moving Ahead for Progress in the 21<sup>st</sup> Century Act (**MAP-21**) of 2013-2014
- Fixing America's Surface Transportation Act (**FAST**) of 2016-2020

Under ISTEA each state is required to submit a Statewide Transportation Improvement Program (**STIP**)

Under **TEA-21**, Highway Bridge Replacement and Rehabilitation Program (**HBRRP**) funds may be obligated for Preventive Maintenance (**PM**) on Federal-aid highway bridges (other than bridges on roads classified as local roads or rural minor collectors). A **PM** activity is eligible for federal assistance if the State demonstrates, to the satisfaction of the Secretary, that the activity is a cost effective means of extending the useful life of a Federal-aid highway.

The Safety, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (**SAFETEA-LU**) of 2005-2011 extended reimbursable systematic bridge preventive maintenance activities to include bridges off the Federal-aid system; specially, local streets and rural minor collectors.

In 2008, the Highway Bridge Rehabilitation and Replacement Program was renamed the Highway Bridge Program (HBP). Effectively, this means all non-toll public highway bridges with span greater than 20 feet and toll bridges meeting the requirements of **23 U.S.C 144 (1)** are eligible to receive Highway Bridge Program funding for preventive maintenance activities.

## Moving Ahead for Progress in the 21<sup>st</sup> Century Act (**MAP-21**) of 2013-2014 Goals:

- Improving safety,
- Maintaining infrastructure,
- Reducing traffic congestion,
- Improving efficiency of the system and freight movement,
- Protecting the environment, and
- Reducing delays in project delivery.



Fixing America's Surface Transportation (**FAST**) **Act** is the first multi-year transportation bill since **SAFETEA-LU** in 2005 and provides a measure of financial stability for highway, highway and motor vehicle safety, public transportation, rail, research, and technology programs are funded through September 20, 2020. The **FAST ACT** maintains our focus on safety, keep intact the established structure of various highway-related programs we manage, continues efforts to streamline project delivery and, for the first time, provide a dedicated source of federal dollars for freight projects.

As part of the **FAST Act**, congress has fixed the “donut hole” to allow non-National Highway System bridges on Federal-aid highways to be funded with **NHPP** funding.

The Surface Transportation Program (**STP**) has now been converted into the Surface Transportation Block Grant Program (**STBGP**), acknowledging the flexibility of this particular category of funding. Under **FAST Act**, the funding for Highway Bridge Program will be covered under **NHPP** and **STBGP** programs.

# Bridge Preservation Program

**Authority:** Moving Ahead for Progress in the 21<sup>st</sup> Century Act (**MAP-21**) of 2013-2014 and Fixing America's Surface Transportation Act (**FAST**) of 2016-2020.

**Purpose:** Meet challenges facing U.S. transportation network.

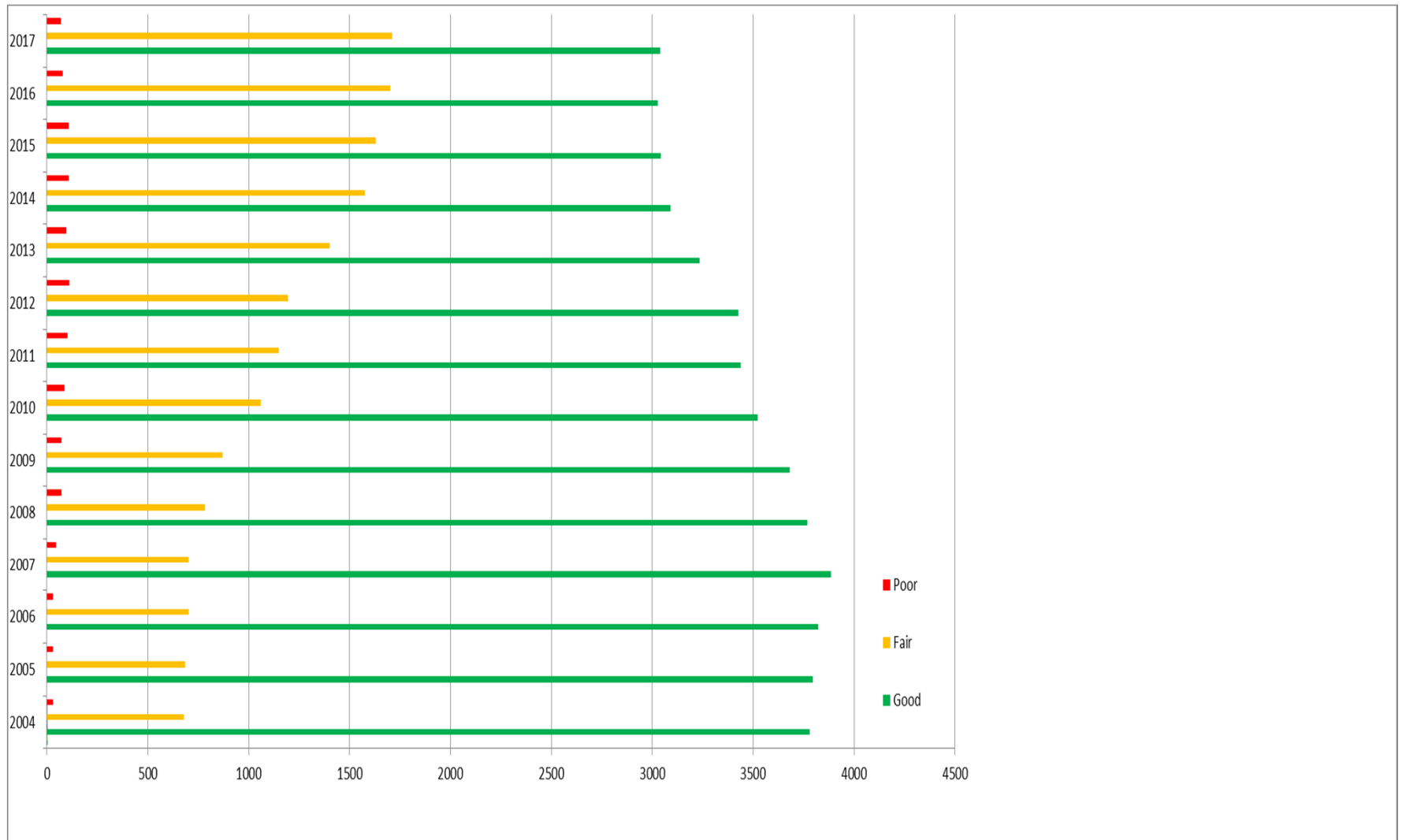
**Method:** Streamlined, performance-based, and multimodal approach

# Bridge Preservation Program

## Arizona, 2016/2017 bridge inventory

	Total # of structures	Structurally Deficient	Functionally Obsolete
2016	7,714	159 (2%)	536 (7%)
2017	7,968	154(1.9%)	507(6.4%)

# The number of structurally deficient and functionally obsolete bridges continues to grow.



# ADOT Bridge Preservation Program

Due to increasing travel demands, limited funding, and increasing costs of labor and materials, most bridge owners have become more reactive than proactive in their approach to managing and addressing the following needs:

- Bridge Replacement
- Bridge Rehabilitation
- Bridge Maintenance

# ADOT Bridge Preservation Program

Bridge Systematic Preventive Maintenance Program Guidelines provide State and Local Public Agencies in detail with reference to issues such as:

- needs
- funding source,
- eligibility,
- selection process/Prioritization process
- report/feedback
- re-adjust program funding and approach

## **Bridge Preventive Maintenance Treatment Goals:**

- a. Being cost-effective,
- b. Preserving the roadway system and its appurtenances,
- c. Retarding future deterioration, and
- d. Maintaining or improving the functional condition of the system without substantially increasing structural capacity



## **Bridge Preventive Maintenance – cyclical (non-condition based) activities**

Cyclical Preventive Maintenance  
Activities performed on a pre-  
determined interval and are intended  
to preserve existing bridge element or  
component conditions.

Deterioration is expected to be delayed.

## Cost Consideration of Cyclical Activities

### 1. Identify program parameters such as bridge condition ratings

- Bridges that are in Satisfactory to Good condition

### 2. Identify qualifying activities and associated frequencies, for example:

- Bridge cleaning- 1 to 5 years
- Lubricate bearing/pins – 2 to 5 years
- Beam end painting/coating – (10 to 15 years)
- Installation of thin bonded epoxy overlay such as epoxy polymer concrete or polyester polymer concrete – (10 to 15 years)
- Concrete deck sealing such as Methacrylate or other sealers to seal abutment caps and seats, pier caps and seats, pier columns/walls and barriers– (3 to 5 years)

### 3. Query bridge inventory to identify eligible bridge candidates

### 4. Identify unit cost for the aforementioned activities

### 5. Calculate the total cost of cyclical **PM** needs based on the inventory and cost data (from previous two steps, step 3 and step 4)

# **Bridge Preventive Maintenance - condition-based activities**

Activities are typically performed on a bridge that is in overall good to Satisfactory condition and try to restore bridge elements to a better condition than before. The condition-based preventive maintenance activities are designed to extend the useful life of bridges.

# Cost Consideration of Condition Based Maintenance Activities

1. Identify program parameters such as bridge condition ratings

- Bridges are in satisfactory to good condition

2. Identify qualifying activities. Example of regular **PM** activities:

- Sealing or replacing leaking deck joints
- Eliminating deck joints
- Painting steel bridges
- Installation of rigid deck overlays
- Installation of scour countermeasures
- Seismic retrofit of superstructure or substructure
- Removing channel debris or cleaning brush from underneath and around bridges
- Deck patching and repair
- Rehabilitation/ Installation of new deck drain
- Replacing or repairing damaged substructure, including foundations
- Repairing slope paving
- Repairing, restoring and strengthening major structural elements such as beams, girders, abutments, piers, and foundations

3. Query bridge inventory to identify eligible bridge candidates

4. Identify unit cost for the abovementioned activities

5. Calculate the total planned or non-cyclical **PM** needs based on the inventory and cost data (from the previous two steps, step 3 and step 4)

# Structurally Deficient (SD) Bridges

A bridge is structurally deficient if its load carrying elements are found to be in poor condition due to deterioration and/or damage or overtopping which causes intolerable traffic interruptions

**SD** is numerically defined as follows:

- A bridge component (deck, superstructure, substructure or culvert) having an **NBI** General Condition Rating of 4 or less (poor condition)

or

- Structural Evaluation or Waterway Adequacy rated 2 or less

# Functionally Obsolete (FO) Bridges

Bridges are considered **FO** when the deck geometry, load carrying capacity, clearance, or approach roadway alignment no longer meet the usual criteria for the system of which it is an integral part.

In general, **FO** means that the bridge was built to standards that are not used today.

**FO** is numerically defined as follows:

- An Appraisal rating of 3 or less for deck geometry, underclearances and approach roadway alignment
- An appraisal rating of 3 for structural evaluation and waterway adequacy

# Sufficiency Rating (SR)

The sufficiency rating is a method of evaluating highway bridges which is indicative of bridge's ability to remain in service. The following scale in percentages is used:

- a. 100 % = entirely sufficient bridge, and
- b. 0% = entirely insufficient or deficient bridge.

The rating considers the structural adequacy, functional obsolescence, level of service, and necessity for public use.

# Bridge Eligibility for Rehabilitation/Replacement

1. Deficiency Classification (SD/FO)

And

2. Sufficiency Rating (SR)

Rehabilitation  $50 < SR \leq 80$

Replacement  $SR \leq 50$



# Bridge Rehabilitation

- Rehabilitation typically requires significant engineering resources for design, a lengthy construction schedule, and considerable costs to restore the structural integrity of a bridge and to correct major safety defects as necessary.
- Functional improvements such as adding a travel lane or raising vertical under clearance, are not considered bridge preservation.

## Cost Consideration of Rehabilitation:

1. Identify program parameters, such as bridge in fair to poor condition (**NBI** General Condition Rating of 5 and 4) or  $50 < \text{Sufficiency Rating} \leq 80$
2. Establish criteria for deck replacement projects (i.e. deck in poor condition but superstructure and substructure are in fair to good condition)
3. Establish criteria for superstructure replacement project (i.e. deck and/or superstructure in poor condition with substructure in fair to good condition)
4. Establish criteria for substructure enhancement project
5. Identify activities. For examples:
  - ◇ Partial or complete deck replacement
  - ◇ Retrofit fatigue prone details
  - ◇ Retrofit fracture critical members (FCM) or add redundancies to remove FCM status
  - ◇ Superstructure replacement
  - ◇ Strengthening
  - ◇ Incidental widening
6. Query inventory to identify eligible bridges
7. Identify unit cost for the abovementioned activities
8. Calculate the total planned rehabilitation needs based on the inventory and cost data (from the previous steps, step 6 and step 7)

# Bridge Replacement

Total replacement of a structure constructed in the same general traffic corridor that meets the current geometric, construction and structural standards.

Bridge replacement projects require engineering resources for design, a substantial and complex completion schedule, and considerable cost.

# Cost Consideration of Replacement

1. Identify program parameters, such as bridge in poor condition (**NBI** General Condition Rating of 4 or less) or Sufficiency Rating  $\leq 50$
2. Establish criteria for bridge replacement projects (i.e. deck in poor condition but the superstructure and substructure in fair to poor condition)
3. Deficient bridge with sufficiency rating between 50 to 80 may be replaced if it can be shown to be more cost effective than rehabilitation based on the current bridge conditions, safety, service life, level of service, and life cycle cost analysis
4. Replacement may be considered when the rehabilitation cost reaches 60% of the replacement cost pending on **ADOT** and **FHWA** approval.
5. All deficiencies must be corrected including safety feature such as: bridge rail, approach rail, and transitions. Geometric and structural features must meet current standards for replacement, or deviations must be approved
6. Bridges replaced or rehabilitated to current standards are not eligible for federal funding for a 10-year period, unless the work is part of a specially approved phased set of construction project. The 10-year rule does not apply to projects which include only seismic retrofit, scour retrofit or structural steel painting.
7. Query bridge inventory to identify eligible bridge candidates
8. Identify unit cost for the abovementioned activities
9. Calculate the total planned replacement needs based on the inventory and cost data (from the previous two steps, step 7 and step 8)

# Bridge Preservation Program Funding

## Bridge Inspection and Minor Repair Subprogram

Type of Activity and Eligible Agency	Funding Amount
Bridge Inspection for State including LPAs structures (on/off system)	\$4.0 million
Bridge Inspection for Self-Inspecting LPAs (on system)	\$1.0 million
Scour Retrofit & Bridge Minor Repair projects for State	\$3.0 million

## Bridge Preservation Program Funding Bridge Rehabilitation and Replacement Subprogram

This program has two components:

1. **BR** (Bridge Fund) - dedicated for eligible bridges on the Federal-Aid routes (on system)
2. **BROS** (Bridge Fund) - dedicated for eligible bridges on non-Federal-Aid routes (off system)

Component	Funding Amount
<b>BR for On-System</b>	\$52 million (present, may subject to change)
<b>BROS for Off- System</b>	\$3.9 million (present, may subject to change)

# Initial Funding Distribution

Categories	Funding Apportionment by %	Funding Amount
Preventive Maintenance	15%	\$8.0 million
Rehabilitation	50%	\$26.0 million
Replacement	35%	\$18.0 million

# Selection and Programming Process

Identify eligible structures through bridge inspection, field review and District input

Rank the structures and interact with P2P process

Consolidate the list into 5 year tentative program

Transportation Board Approval

Official ADOT 5 Year Transportation facilities Construction Program

Project development process through scoping, final design and construction

Inspected and opened to traffic with proper maintenance



# Prioritization Process

Ranking Score =  $\sum$  NBI Item x Weight Factor

NBI Items:

Maximum score of 20 for bridges

Maximum Score of 15 for culverts

Weight Factors:

0.25, 0.50, 0.75 & 1

depending on significance

# Applicable NBI Items

## **Bridges:**

ADT, ADTT, Weight Restriction, Detour, Deficiency Classification, S.R., Deck Rtg, Super Rtg, Sub Rtg, Year Blt, Op Rtg, Func Class, Deck Width, FCM, Scour, Vertical Clearances, Horizontal Clearances, Waterway Adequacy, Approach alignment, Elevation

## **Culverts:**

ADT, ADTT, Weight Restriction, Detour, Deficiency Classification, S.R., Culvert Str Rtg, Year Blt, Op Rtg, Func Class, Deck Width, Scour, Waterway Adequacy, Approach alignment, Elevation

# Example of Applicable NBI Items Weighing Factors

NBI Item	Weighing Factor			
	0.25	0.50	0.75	1.00
N29- Average Daily Traffic (ADT)	0 - 200	201 - 1000	1001 - 6500	>6500
Deficiency Classification	-	-	-	Structurally Deficient or Functionally Obsolete
Sufficiency Rating, S.R.	80-70	70-60	60-50	<50
N58- Condition Rating of deck (N/A to culvert)	6	5	4	<4
N59- Condition Rating of Superstructure (N/A to culvert)	6	5	4	<4
N60- Condition Rating of Substructure (N/A to culvert)	6	5	4	<4
N62- Condition Rating of Culvert (N/A to bridge)	6	5	4	<4

Bridge			
NBI #	Description	Value	Score
N29	ADT	6,500	1
N109	ADTT	16	1
N41	Weight Post Status	P	0.75
N19	Detour, miles	9	0.50
	Def. Classification	S	1
	Suff. Rating	65	0.50
N58	Deck	5	0.50
N59	Superstructure	6	0.25
N60	Substructure	7	0
N27	Year Built	1975	0.5
N64	Operating Rating	34	0.25
N26	Functional Class.	Interstate	1
N51	Bridge Deck Width	Y	1
N92A	FCM Status	Y	1
N113	Scour-vulnerable	Y	1
N53/54	Vertical Clr- On/Under	Y	1
N55/56	Horizontal Clr- R/L	Y	1
N71	Water Adequacy	Y	1
N72	Approach Alignment	Y	1
	Elevation, feet	4,200	1
	Total		15.25

Culvert			
NBI #	Description	Value	Score
N29	ADT	6,500	1
N109	ADTT	16	1
N41	Weight Post Status	P	0.75
N19	Detour, miles	9	0.50
	Def. Classification	S	1
	Suff. Rating	65	0.50
N62	Culvert- Structural	5	0.50
N27	Year Built	1975	0.50
N64	Operating Rating	34	0.25
N26	Functional Class.	Interstate	1
N51	Bridge Deck Width	Y	1
N113	Scour-vulnerable	Y	1
N71	Water Adequacy	Y	1
N72	Approach Alignment	Y	1
	Elevation, feet	4,200	1
	Total		12

Structure #	A209 - Project Name	Route	MP	ADT	Type of work	Comment	Score
01326	Red Top Wash EB		8	22.9	6683 Deck rehabilitation	PPC	7
01327	Red Top WashWB		8	22.9	6116 Deck rehabilitation	PPC	7.5
01554	Sauceda Wash WB		8	113.27	5051 Deck rehabilitation	PPC	7
01681	Watson Rd OP EB		10	116.97	34057 Deck rehabilitation	PPC	7.5
01682	Watson Rd OP WB		10	116.97	31466 Deck rehabilitation	PPC	7.5
01214	Casa Blanca TI UP		10	175.81	7313 Deck Rehabilitation	PPC	9
00941	Sunland Gin TIUP		10	200.12	1600 Deck rehabilitation	PPC	8.25
00592	Red Rock TIUP		10	226.45	510 Deck rehabilitation	PPC	7.75
05524	RCB		10	232.8	42000 Sediment	WB #05525 was combined into EB #05524	7.5
01229	E Wilcox TIUP		10	344.51	991 Deck replacement		7.75
00649	US 191 TIUP		10	355.97	698 Deck replacement		7.25
01231	Roberts Farm OP EB		10	363.7	5843 PPC overlay	Under H8910	9.25
01232	Roberts Farm OP WB		10	363.7	4350 PPC overlay	Under H8910	9.5
01233	Apache Pass OP EB		10	364.79	5843 PPC overlay	Under H8910	9.5
01234	Apache Pass OPWB		10	364.79	4350 PPC overlay	Under H8910	9.5
01115	Black Rock TIUP NB		15	27.3	100 Super replacement		9.5
01116	Black Rock TIUP SB		15	27.3	100 Super replacement		9.5
01734	SR 169 TIUP		17	278.4	5000 Deck replacement		7
01061	SR 179 TIOP SB		17	298.96	10000 Deck rehabilitation	PPC	9.25
01240	Ruby Road TI UP		19	7.7	1178 Deck Rehabilitation		7.25
00937	Palo Parado TI UP		19	15.65	125 Deck rehabilitation	PPC	7.25
01837	Clack Canyon Wash EB		40	49.7	17250 Deck rehabilitation	PPC	6
01838	Clack Canyon Wash WB		40	49.7	17250 Deck rehabilitation	PPC	6
01610	Anvil Rock TI UP		40	109.65	100 Deck rehabilitation		7
00896	A1 Mountain TI UP		40	190.54	500 Super replacement	SD	9
01180	Long Tree TIOP EB		40	196.26	20828 Pier cap repair		9.75
01181	Long Tree TIOP WB		40	196.26	20600 Pier cap repair		9.75
01084	Winona TI UP		40	211.16	400 Super replacement		8.25
01368	Hermosa Dr UP		40	288.27	120 Deck replacement		7.75
00956	Allentown TIUP		40	351.35	1000 Deck replacement		8
00117	Centennial Wash		60	62.03	1600 Deck rehabilitation	PPC/MMC	9.25
00181	Wildcat Wash		60	371.74	Deck replacement	Replaced by #2605 : Mallory Draw Bridge	-
04179	Red Lake wash RCB		64	193.7	4402 Repair	Pavement Preservation	11
00981	Post Office Canyon Br		73	348.9	4205 Deck rehabilitation	PPC/MMC	8.25
00501	Gila River BR		79	135.54	9582 Bridge Replacemebnt	Proposed PA study	7.25
04473	RCB		80	297.68	6568 Sediment		8
04479	RCBC		80	301.9	4345 Sediment		8
00412	Comoro Canyon		82	9.61	1769 Deck rehabilitation	PPC	10
00403	San Pedro River Br		82	61.2	650 Scour		9
00898	Coyote Wash		87	374.94	1595 Deck replacement	Prestressed Box Beam	8.5
00582	Wash Bridge		89	481.89	4000 Deck/Substructure rehabilitation	SD	10.75
01321	Bouse Wash		95	131.33	2564 Deck rehabilitation	PPC	7.75
01915	Mockingbird Wash		95	178.26	13504 Deck rehabilitation	PPC	7.25
00948	Five Mile Wash		180	309.11	1037 Super replacement/repair		10
00667	Little Colorado Br		180	310.41	1037 Deck replacement		9.25
02243	Mills Canyon Br		188	247.2	682 Joint seal/erosion		5.5
01424	Ash Creek Br		188	255.15	682 Joint/erosion		5.5
00621	Meonkopi Wash		264	324.1	839 Deck replacement		9.75
00889	Two Mile Wash		389	21.5	2171 Deck rehabilitation	PPC	9
00890	Cottonwood Wash		389	30.07	1843 Deck rehabilitation	PPC	9
00782	Kanab Wash		389	32.05	1843 Deck rehabilitation	PPC	8.75

# A simplified Deterioration Model

## 1. Design service life

Existing bridge → 50 years or more

New constructed bridge → 75 years or more

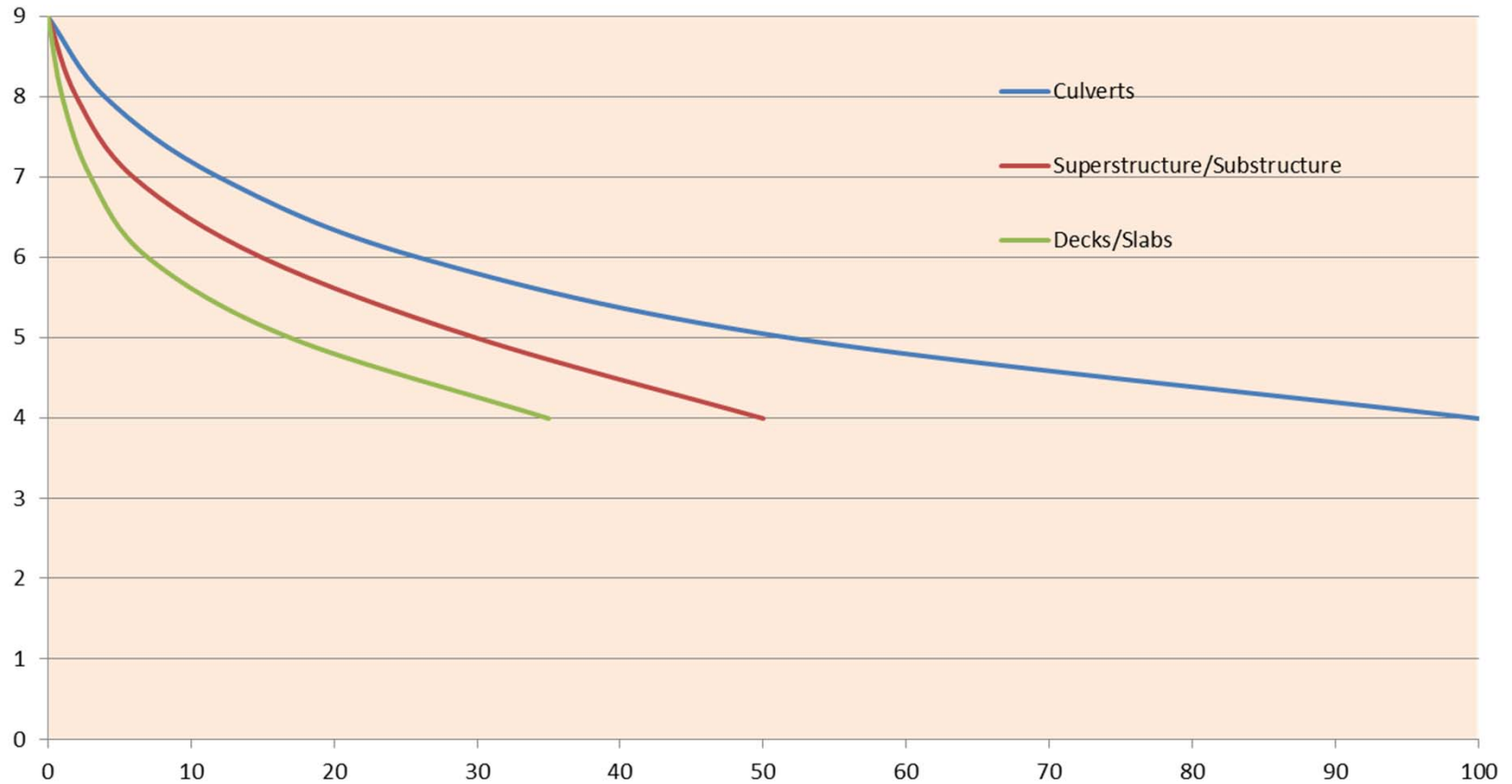
Culvert → 100 years or more

2. The simplified deterioration model is based on the deterioration of deck (25/30/35 years), superstructure & substructure (50/75/100 years) and culvert (100 years) during their life spans

3. Deck service life may be limited to 35 years due to environmental conditions

4. Steel bridge painting system will be treated as a special case which also will be impacted by the environmental condition

# Deterioration Model



# Average Cost of Bridge Improvement

The average cost of bridge improvement based on work type is summarized in the following table:

Type of Activity	Condition Rating Upgrade	Cost (\$/Sq. ft.)
Preventive Maintenance	Satisfactory (6) to Good (9-7)	10 - 50
Rehabilitation	Poor/Fair (5-4) to Good (9-7)	150 – 200
Rehabilitation	Poor (4 or less) to Fair (6-5)	50 - 150
Replacement	Poor (4 or less) to Good (9-7)	200 – 300



- Question?

# APPENDIX A

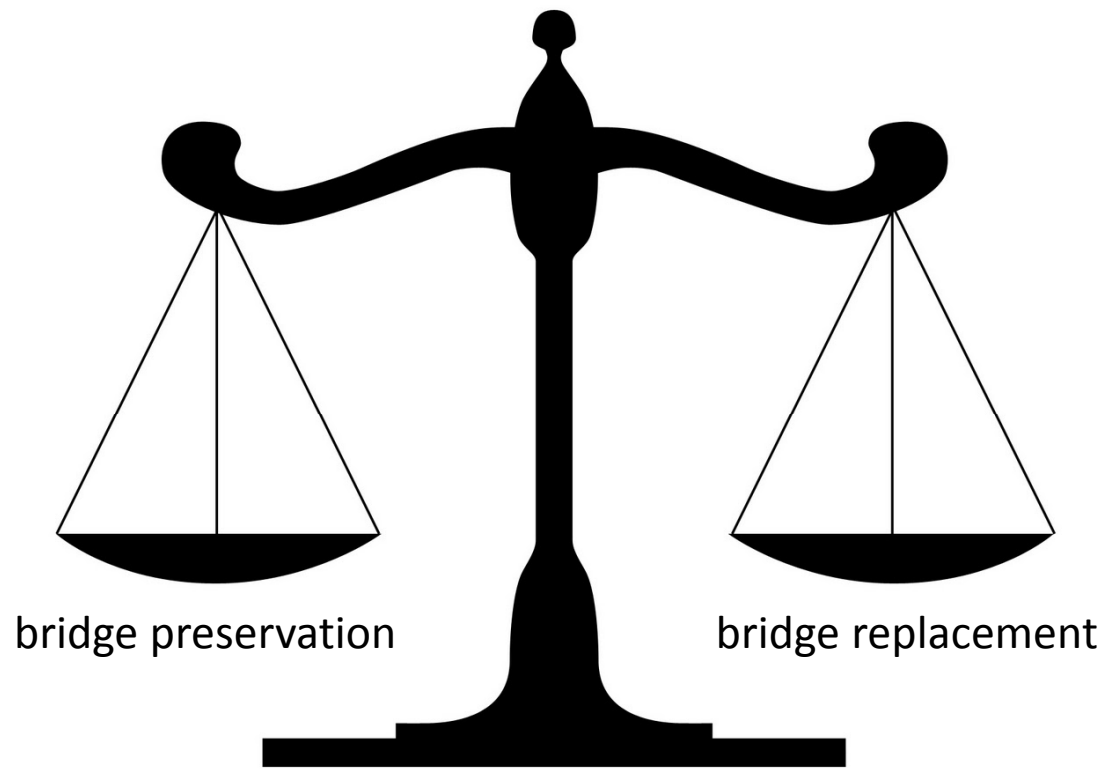
## **Bridge Systematic Preventive Maintenance Program Guidelines For State and Local Agencies**

# **Bridge Systematic Preventive Maintenance (BSPM)**

Description/ Purpose:

“A planned strategy of cost effective treatments to existing bridges that are intended to maintain or preserve the structural integrity and functionality of elements and/or components, and retard future deterioration, thus maintaining or extending the useful life of a bridge.”

# SPM Strategy – Balanced Approach



# Eligible Bridge Preventative Maintenance activities and treatments

Bridge activities such as crack sealing, joint repair, seismic retrofit, scour countermeasures, painting, deck overlays, clean deck drains and concrete spall repair. Many other activities, previously considered routine maintenance, may be now considered as preventive maintenance (i.e. extending the service life). See the list in Appendix B.

## Appendix B- Bridge Maintenance Activities

State Force Code	By Contract Code	Activity Name	Activity Description	Unit of Measure
S100	C100	Ordinary Maintenance – Deck	Minor Maintenance work that preserves/extends the life of the deck or corrects minor defects. Examples: bridge deck cleaning, temporary deck patching.	EA
S101	C101	Deck Patching	Permanent patching to bridge decks.	EA
S102	C102	Seal Cracks – Deck	Sealing of cracks in bituminous or concrete deck surfaces.	EA
S103	C103	Thin Overlay	Application of thin-bonded epoxy/polyester concrete overlay to bridge decks.	EA
S104	C104	Joint rehabilitation	Maintenance of bridge deck joints. Examples: removal/replacement of joint material, repair/patching of joint walls.	EA
S105	C105	Rigid Overlay	Application of latex/silica fume overlay to bridge decks.	EA
S106	C106	Rail Repair	Repairing or maintaining the rail system on a bridge. This includes rails, parapets, curbs, safety walks and all associated supports and connections. Some of the activities is mainly maintenance items and will not subject to federal reimbursement unless it is programmed systematically	EA
S107	C107	Asphalt Overlay	Application of Asphalt overlay to bridge deck	EA
S200	C200	Ordinary Maintenance – Superstructure	Minor maintenance work that preserves/extends the life of superstructure or corrects minor defects. Examples: superstructure clearing, clean/lubricant bearings.	EA
S201	C201	Concrete Superstructure Repair	Repairs to concrete bridge superstructures and all related supporting activities, such as blocking and jacking of the superstructure.	EA
S202	C202	Steel Superstructure Repair	Repairs to steel bridge superstructures and all related supporting activities, such as blocking and jacking of the superstructure.	EA
S203	C203	Bearing Repair	Repair, realignment or replacement of bridge bearing devices.	EA
S204	C204	Paint – Superstructure	Painting or coating structural steel on a bridge. Examples: spot painting, overcoating, recoating, and zone coating.	EA
S300	C300	Ordinary Maintenance – Substructure	Minor maintenance work that preserves/extends the life of the substructure or corrects minor defects. Examples: substructure cleaning, erosion stabilization, debris/vegetation removal.	EA
S301	C301	Substructure surface repair	Repairs to the exposed surfaces of bridge substructures.	EA
S302	C302	Substructure – Repair Undermining	Filling scour holes, installing rip-rap or other scour countermeasures to prevent or stabilize scour at bridge substructure.	EA
S400	C400	Ordinary Maintenance – Culvert	Minor maintenance work that preserves/extends the life of other elements of a structure or corrects minor defects. Examples: culvert cleaning, erosion stabilization, debris/vegetation removal.	EA
S401	C401	Culvert – Surface Repair	Repairs to culvert and all related supporting activities. Examples: patching spalls/delaminations, sealing cracks, repairing damaged headwalls/endwalls.	EA
S402	C402	Culvert – Repair Undermining	Filling scour holes, installing rip-rap or other scour countermeasures to prevent or stabilize scour at culvert.	EA
S500	C500	Ordinary Maintenance – Miscellaneous	Minor maintenance work that preserves/extends the life of other elements of a structure or corrects minor defects. Examples: stream bank stabilization, debris/vegetation removals.	EA
S501	C501	Approach Slab Repair	Maintenance of bridge approach slabs. Examples: repairing settlement, repairing cracks, patching, installing/repairing pressure relief joints, replacing overlay	EA

## Appendix B- Bridge Rehabilitation and Replacement Activities

	C1000	Deck Replacement	Replacement of bridge deck	EA
	C1200	Superstructure Replacement	Replacement of bridge superstructure	EA
	C1300	Substructure Rehabilitation Major	Replacement/major rehabilitation of bridge substructure.	EA
	C1400	Culvert Major Rehabilitation	Rehabilitation/restoration of culvert. Examples: extending existing pipe or box culvert, sleeve installation, flowline restoration.	EA
	C1500	Culvert Replacement	Replacement of culvert.	EA
	C1600	Bridge Replacement	Replacement of total bridge structure	EA
S1700	C1700	Safety Inspection – State	Inspection of state owned bridges	EA
S1800	C1800	Safety Inspection – Locals	Inspection of local owned bridges	EA
S1900	C1900	Safety Inspection – Self-Inspecting Agencies	Inspection of local owned bridges	EA
S2000	C2000	Bridge Rating – State	Perform load rating analysis for state bridges	EA
S2100	C2100	Bridge Rating - Local	Perform load rating analysis for local bridges	EA
S2200	C2200	Bridge Rating – Self-Inspecting Agencies	Perform load rating analysis for self-inspecting agencies bridges	EA
S2300	C2300	Bridge Management	Management tasks performed. Examples: developing bridge maintenance work schedules, planning and budgeting future work needs, overseeing work associated with structures.	EA
S2400	C2400	Preliminary Engineering	Development of plans, specifications and/or contract documents for structures identified as needing rehabilitation or replacement.	EA

# **Bridge Systematic Preventive Maintenance Program (BSPMP) Goals and Objectives**

- Maintain the existing inventory of bridges in a structurally safe and serviceable condition.
- Correct minor structural deficiencies in a timely manner in order to avoid later costly rehabilitation, reconstruction or replacement.
- Extend the service lives of existing bridges.
- Make efficient use of limited resources.



# When & Why Preventive Maintenance Should Be Performed?

When	Why
At optimal time	To preserve the structural condition of bridges
At specified intervals	To extend the service life of bridges
At optimal condition (Satisfactory to Good)	Minor repairs are less costly

# BMSP for Rehab/Replacement Bridges

Bridges that are currently programmed for rehabilitation or replacement are not eligible for funding under this program.

State/local agencies may still pursue a preventive maintenance scope but justification must be documented in the project files for future audit purposes. The work should be limited to the minimum needed to keep the bridge operable until the rehabilitation or replacement project can be advertised. In this case, preventive maintenance activities may be incorporated into and funded as part of regular bridge rehabilitation projects.

# NBI Rating of Components/Elements

Structurally sound bridges are defined as having an overall NBI General Condition Rating of 6 or greater for the deck, superstructure, substructure, or culvert components

or

**AASHTO** Element Condition State of 1 or 2 for the elements associated with the deck, superstructure, substructure, and the culvert units.

# Strategic Investment Plan

To meet the **BSPM** program goal, **ADOT** is developing a strategic investment plan to maintain 90 percent of State bridges in **Satisfactory** or **Good** condition by 2017.

An NBI (item 58, 59, 60 and 62) rating of 6 is considered as **Satisfactory** and ratings of 7 to 9 are considered **Good** in Arizona.

This National Performance Measurement Criteria proposed by **MAP 21** can assist **ADOT** to meet the goal for State bridges.

# Local Public Agencies

A local public agency may wish to consider establishing different goals and objectives for different highway systems, different functional classifications, or Average Daily traffic (**ADT**) ranges. These goals and objectives will be subject to approval by **ADOT LPA Section** and **FHWA** when local public agency submits **BSPM** for funding request.

# Inventory and Condition Assessment

**ADOT** performs bridge inspections according to the National Bridge Inspection Standards (**NBIS**) and collects **NBI** General Condition Rating data for bridge components, elements and additional Arizona-specific data not reported to NBI.

Early communication of bridge inspection maintenance and repair recommendations to **ADOT** Districts and feedback from them is a good strategy to generate preventive maintenance and rehabilitation projects in time.

# BSPM Needs Assessment

Bridge Management Section (**BMS**) maintains bridge inspection database. **BMS** can generate a spreadsheet for the “**Bridge Preservation Program**” showing all bridges with suggested bridge preventive maintenance, rehabilitation and replacement needs based on NBI data (inventory and condition) and prioritization process.

When sufficient data including deterioration rates for various bridge components and unit cost of many maintenance work items are introduced into Bridge Inspection database (**BrM**), then **BrM** will be able to generate:

1. prioritized list of **BSPM** projects
2. Preliminary **BSPM** program funding needs.

Specific bridges with unique **PM** needs are examined further during review sessions to compile final **BSPM** needs.

# BSPM Needs Assessment - Continued

Bridges that are structurally sound, and not recommended for replacement or rehabilitation are considered candidates for **BSPM**.

The condition-based **PM** needs are prioritized by assigning an Optimum Year and a Critical Year. Optimum is the first year when **PM** strategy can be cost effectively implemented. Critical is the year after which a proposed **PM** strategy is no longer cost effective. Typically, after the critical year, a more costly action would be required. For instance, coating of a steel superstructure would be highly prioritized if localized zones indicate more advanced corrosion relative to the overall corrosion of the girder



# Cost Effective PM Activities

The **FHWA Bridge Preservation Guide** provides examples of **PM** activities. These **PM** activities can be considered cost effective when applied to the appropriate bridges at the appropriate time using quality materials and workmanship.

It is important to address the root cause of deterioration that may eventually lead to deterioration of significant bridge components. For example, joint seal replacement or joint repairs can reduce the damage of the substructure elements such bearings, seats, and pier caps due to contaminants in conjunction with water.

In some cases, some condition-based **PM** activities will eliminate the need for follow-up cyclical **PM** activities. For example, elimination of the deck joints on the bridges will provide long term protection of girders, beams, bearings, etc. Cyclical **PM** activities such as cleaning/washing deck joints, girders, bearings and seats may no longer be needed.

# District Maintenance ORGs

A list of eligible bridges and their corresponding cyclical **PM** needs is prepared by the **BMS** based on field inspection data and will be provided to the District Maintenance Engineer. The work feasible to be done by District ORGs will be programmed by the District Maintenance Engineer in accordance with the desired frequency for given activities.

# District Maintenance ORGs - Continued

**ADOT** also like to evaluate and develop District maintenance crews skills and abilities to perform preventive maintenance activities. The activities that can be performed by the District maintenance crews will be identified with available unit cost. Training for preventive maintenance will be made available for District maintenance crews and can be obtained through NHI training courses under FHWA-NHI-130107A/130108/130109A/130109B.

Other qualifying activities may be presented to the **FHWA** Division Office for consideration and approved on a case by case basis.

# How Preventative Maintenance Work Gets Done?

**ADOT** and **Local PLAs** will implement **BSPM Program**, both committed to the program and ensure adequate resources are dedicated to manage the program. **BMS** from **Bridge Group** and **LPA Section** from **Infrastructure Delivery and Operations Division (IDO)** will :

- 1.create **PM** projects for State and Local Public Agencies
- 2.prioritize the projects
- 3.allocate the budget
- 4.develop **PS & E** package for advertisement, monitor the construction/maintenance activities and report the status of projects.
- 5.Project or activity will be done by a combination of :
  - contractors
  - district maintenance crews.

# Reporting & Evaluation

- **BMS/LPA/Districts** will be responsible for tracking, evaluating, and reporting the planned and accomplished PM work on an annual and/or as needed basis.
- Formalized process should be established by **BMS/LPA/District** when the bridge work has been completed so that bridge data remains current.
- The **BSPMP** should track expenditures over time. In most cases this would be the dollars expended annually for the **BSPMP** to allow the expenditures to be compared with the condition of the system to ensure that the investment is providing the return expected.

# Funding Availability

- The current amount of **BSPM** funds will be determined based on the funding availability and will be programmed in Arizona Department of Transportation (**ADOT**) 5 Year Highway Construction Program.
- For state owned **BSPM**, the initial funding is limited to \$6,000,000 per year
- For local agency owned **BSPM**, the initial funding is limited to \$200,000 per year per agency with a total cap of \$2,000,000 per year

# Prequalification

1. In order to pre-qualify for **BSPM** funding, bridge projects must be programmed into :
  - a. Transportation Improvement Program (**TIP**) for a **COG/MPO**,
  - b. State Transportation Improvement Program (**STIP**) for the State.
2. Component Ratings for deck, superstructure, substructure or culvert
  - c. General Condition Rating of **6** or greater
  - d. AASHTO Element Condition State of 1 or 2 for the elements associated with the components

Some of the preventive maintenance items such as cleaning, sealing, painting and debris removal will not be subjected to item 2 limitation

# Eligible BSPM Applicants

1. State and all Arizona Local Public Agencies (**LPAs**)
2. All other non-federal (Tribes, etc.) or federal agencies (Forest Service, etc.) are excluded from this **BSPM** program.

## Eligible Works

Two types of treatments are considered to be eligible for BSPM funding:

**Preventive (Cyclical) Maintenance** – Specific activities that are scheduled on a fixed cycle, intended to maintain a structure at its current level and prevent deterioration.

**Corrective (Condition-Based) Maintenance** – Specific activities are not scheduled and are reactive in nature, intended to correct more extensive damage and prevent further deterioration but limited to localized areas of a specific structural element.



# Ineligible Projects

- 1. Major bridge rehabilitation or replacement (deck, superstructure and substructure).
- 2. The increase of facility capacity (widening and strengthening).
- 3. Routine Maintenance (responsibility of the **State** and **LPA**s).
- 4. Bridge Inspection

# Project Prioritization

- **ADOT** and **LPAs** must develop objective procedures to prioritize their preventive/corrective maintenance projects and submit to **FHWA** (for state and locals) and **ADOT LPA Section** (for locals) for review and approval. These procedures must be included in the project files for review in future audits.
- The highest priority projects include repair of scour countermeasure, embankment erosion control and repair, restoration, and strengthening of structural elements.
- Priority should be given to bridges that are not eligible for rehabilitation or replacement under the federal restrictions. The intent of the program is to keep these bridges in structurally good condition, to maximize their service life and to conserve limited funds available for bridges that do require major rehabilitation or replacement.
- Please refer to the **Prioritization Process** list in the **Bridge Preservation Program**.

# Project Development Process

## Major scope changes

- Design Standards for state preventive/corrective maintenance projects are defined in **Bridge Practice Guidelines** under **ADOT Bridge Group** website and **AASHOTO LRFD Bridge Design Specifications**.

Local agencies are required to specify the appropriate design standards in their project files for future audit purposes. This is critical to avoid jeopardizing federal funds and potential tort liabilities against local agencies. In order to use federal funding for **LPA** projects, design standard from **LPAs** shall comply with federal design standards and regulations. For non-NHS routes, design standard should comply with **ADOT** design standards.

- Scope changes that result in project work beyond preventive maintenance must have documented justification that is reviewed and approved by **ADOT** and the **FHWA** following customary project development procedures.
- State and locals will prepare scope changes document with back up data and obtained the approval from **FHWA** (for state and locals) and **ADOT LPA Section** (for locals) by delaying other preventive/corrective maintenance projects in their **BSPM** to pay for the cost increase.
- If the funding increases due to major scope changes and exceeds the funding limitation, further discussion with **FHWA** (for state and locals) and **ADOT LPA Section** (for locals) to resolve excessive funding issues.

# Project Development Process Implementation

Participating state and local agencies will need to develop a Bridge Systematic Preventive Maintenance Program (**BSPMP**). The program shall be submitted to the **FHWA** coordinator (for state and locals) and **ADOT LPA Section** Coordinator (for locals) in electronic spreadsheet format. The highest priority projects will be at the top of the spreadsheet

Project Name	Project #	Route	MP	Project Priority	Type of Preventive Maintenance	Project Cost
State						
Santa Cruz Riv	xx-xx	19	25	1	Deck sealing	\$20,000
Pima Mine	xx-xx	19	40	1	Deck sealing	\$20,000
Ash Fork 1	xx-xx	40	146	2	Deck flushing	\$5,000
Ash Fork 2	xx-xx	40	148	2	Deck flushing	\$4,000
LPA1						
Phoenix – Sky Harbor	xx-xx	–	–	1	Seal joint	\$50,000
Phoenix – Northern Ave Canal	xx-xx	-	-	2	Spot paint	\$50,000
LPA2						
Maricopa Co – Estrella Ave UP	xx-xx	-	-	1	Deck sealing	\$20,000
Maricopa Co – RR OP	xx-xx	-	-	2	joint lubricant	\$5,000

Each spreadsheet shall include as a minimum:

1. For each bridge: Bridge Name/Number, Project Number, Route, MP, the priority for funding (lowest number is highest priority), county geographic location, name of implementing agency, facility carried, feature intersected, location, Sufficiency Rating, Structurally Deficiency/Functional Obsolete status, all Preventive Maintenance (**PM**) and Corrective Maintenance (**CM**) treatments for each bridge, unit cost of **PM/CM** (related to bridge elements), federal funds, running summary of federal funds, state/local matching funds, and running summary of state/local matching funds. The federal reimbursement rate is 94.3% of the eligible project cost.
2. If a local agency wants to be reimbursed for the future costs of developing a **BSPMP**, a line in the spreadsheet must be added (priority=1) that includes the costs to develop future year BSPMs.

3. All references to cost include only reimbursable costs: preliminary engineering (**PE**), indirect costs, Right of Way (**R/W**) acquisition, obtain Temporary Construction Easement (**TCE**), construction and construction engineering, and contingency. Contingency is not to exceed 25% for programming purposes. Contingency shall be reduced to 10% maximum for construction authorization.
4. Other fields may be included for convenience by the local agency.
5. The Department will accept updated **BSPMP** no more than twice a year from local agencies. The **ADOT LPA Section** Coordinator must receive the **BSPMP** by September 30<sup>th</sup> - for funds to be obligated in the next fiscal year, and January 30<sup>th</sup> of each year for adjustments. No time extensions will be granted.

The local agency must have qualified in-house or contracted staff to develop the **BSPMP** for that local agency. Minimum qualifications for staff or consultants developing the **BSPMP** are:

1. Be professionally licensed civil engineers in Arizona
2. Have expertise in bridge preventive maintenance treatments,
3. Have expertise in interpreting information in the NBI Bridge Inspection Reports including element level inspection items.



Cities and other local entities may contract with **ADOT** to develop and implement their **BSPMPs**. If the **State** is implementing the **BSPMP** for their agencies, the name of the agency implementing the **PM** in the **BSPMP** will be the **State** even though another agency may own the bridge.

The costs of developing the **BSPMP**, including approved indirect costs are federally reimbursable and may be included in the **BSPMP**.

State needs to set up a lump sum item for “Planning of the Bridge Systematic Preventive Maintenance Program for **State** and **LPAs**” in the **ADOT** 5 Year Highway Program. This will allow **State** and **LPAs** to hire consultants or fund staff to develop their **BSPMPs**. This item will be only funded in FY 2017 and after as described in the previous **Funding Availability**.

### **Steps to implement the BSPMs:**

1. During the planning stage, the **State/LPA** staff will automate the process by using bridge inventory data (including conditional data) and applying statewide preventive maintenance criteria for identifying and prioritizing work based on the benefit of the type of work performed.
2. If there are potential projects and **State/LPA** wants to be reimbursed for developing its **BSPMP**, the **State/LPA** must submit a request for **PE** authorization. Reimbursable work may only commence after the **State/LPA** has received notice that the work is authorized.
3. The **State/LPA** should then proceed to perform a detailed review of their bridge inspection reports and maintenance history of bridges in their inventory. Note that not all the work recommendations in the inspection reports are necessarily eligible for preventive maintenance reimbursement. Many recommendations are advisory routine maintenance activities. The **State/LPA** qualified staff or consultants need to review all their bridge inspection reports to properly scope projects and prioritize projects for incorporation into the **BSPMP**.

4. The **State/LPA** should finalize their procedures for prioritizing projects. (A copy must be kept in the project files needed for future audits.)

5. The **State/LPA** transmits the **BSPMP** with cover letter certifying compliance with these program guidelines. The electronic copy (any spreadsheet format) should be included on a CD with the paper transmittal letter. The **ADOT LPA Section** Coordinator must receive the **BSPMPs** by **September 30<sup>th</sup>** - for funds to be obligated in the next fiscal year, and **January 30<sup>th</sup>** - of each year for adjustments. **No time extensions will be granted.**

6. Based on the LPA submittal of **BSPMPs**, the **ADOT LPA Section** Coordinator will create a **BSPM** item in the lump sum **TIP** backup list for each Council of Governments (**COG**)/Metropolitan Planning Organization (**MPO**) and allocate funds in the lump sum item for each **COG/MPO** under **TIP**.

7. The **ADOT** will provide each **COG/MPO** the **TIP** lump sum backup list and each **BSPM** in the **COG/MPO's** region.

8. The **COG/MPOs** will amend their **TIPs** appropriately.

9. The **LPA** will initiate the project(s) through the **ADOT LPA Section** in accordance with the **ADOT LPA Manual**.

10. After the **TIP** is adopted and the project(s) has been initiated, **PE** may be obligated at the local agency level for all projects included in their **BSPM** using one federal aid project. These **PE** projects will be closed out after 4 years and then new **PE** projects may be initiated. Complex projects should not use the “grouped” **PE** federal aid project number to avoid excessive future paperwork. **LPAs** should contact their **ADOT LPA Section** Coordinator for further advice. JPA will be required before the PE projects can be authorized and started.

11. **LPAs** may then proceed with preliminary engineering and National Environmental Policy Act (**NEPA**) clearance at the bridge specific level following the standard federal aid process defined in the Local Assistance Procedures Manual.

12. The **R/W** and Construction activities for one or more projects will be implemented under new federal aid projects and follow the normal federal aid process. **R/W** and Construction will only be funded if sufficient funds are available in the **COG/MPOs** lump sum for this activity. Excessive **R/W** cost for **PM/CM** projects have the lowest priority in the **BSPMP** program. **LPAs** and the **ADOT LPA Section** Coordinator must consult the **BSPMP** which shows the allocated amounts for each project. If the actual project costs come in higher than what has been allocated to a project, then other projects may need to be deferred until a new **BSPMP** can be developed and amended into the **TIP**.

13. Only **LPAs** with **CA** status can advertise for construction.

14. All federal aid requirements must be followed.

## **Insufficient Funds:**

In the event there are insufficient funds to implement all the **BSPMPs**, the **ADOT LPA Section** will determine how much **BSPMP** total funds are available and will properly distribute what is available to each **BSPM** based on total cost for each **BSPMP**. Only those projects above the “cut off” running total in the **BSPMP** will be eligible for available funds.

Another way to deal with insufficient funds is based on the first come first serve basic criteria for now.

**ADOT/LPA Section** will develop the proper selection criteria in the coming years.

## **Department Oversight for LPA's BSPMP:**

As noted in some of the above items identifying eligible **PM** work, some Department oversight will be required for complex situations. In addition, if preventive maintenance activities exceed \$50/ sq ft (total deck area basis), the scope of the **PM** must be approved by **ADOT Bridge Group** on a case by case basis. The **ADOT LPA Section** will review the **BSPMPs** to determine which projects need review. All **BSPMP** projects are subject to full oversight and review by the **ADOT LPA Section** as defined in the **ADOT LPA Manual**.

The unit cost threshold for oversight may change at the discretion of the **ADOT LPA Section** as the Department gains experience administering this program for local agencies. The Department, in coordination with **FHWA**, will conduct periodic program reviews or audits to determine compliance with these guidelines and to monitor the performance of the **Local Bridge Systematic Preventive Maintenance Program**.