



Suppression Rule (Formerly 'Look Ahead Rule')



BrM User Group Meeting September 15, 2021

H-3 Freeway, Hawaii

CONTACT



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BACKGROUND

**LOOK AHEAD
RULES**

THE PROBLEM

**WORK
AROUNDS**

DRAFT FDS

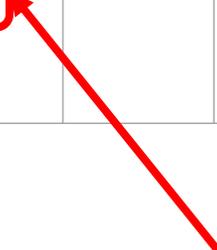
**POSSIBLE
SOLUTIONS**

WHAT'S NEXT

BACKGROUND

Back in 2019...

2019 Vote Rank	Total Votes	State Rank	Count States	Priority Enhancement	JIRA Ticket
5	198	3	19	Optimizer look ahead rule (Suppression Rule)	BRMSD-1392



Ranked No. 5 on the User Group Priority list



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The Application Formerly know as



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**POSSIBLE
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WHAT'S NEXT



Brad Pitt



BACKGROUND

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BACKGROUND

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Tom Cruise

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**LOOK AHEAD
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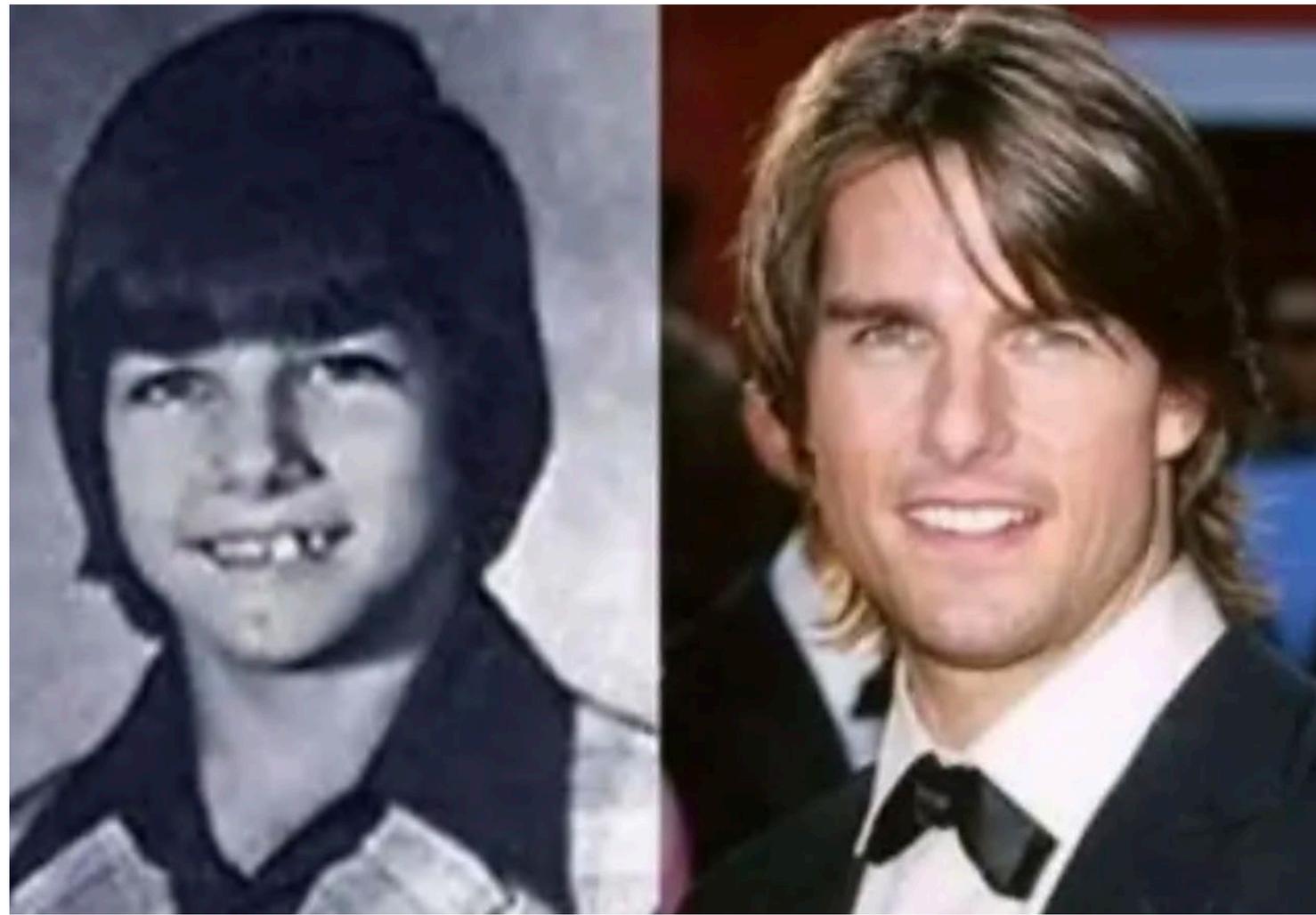
THE PROBLEM

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WHAT'S NEXT



Not all change is Bad

- BACKGROUND
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- WORK
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- DRAFT FDS
- POSSIBLE
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- WHAT'S NEXT





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LOOK AHEAD RULES

LOOK AHEAD RULES

BACKGROUND

LOOK AHEAD RULES

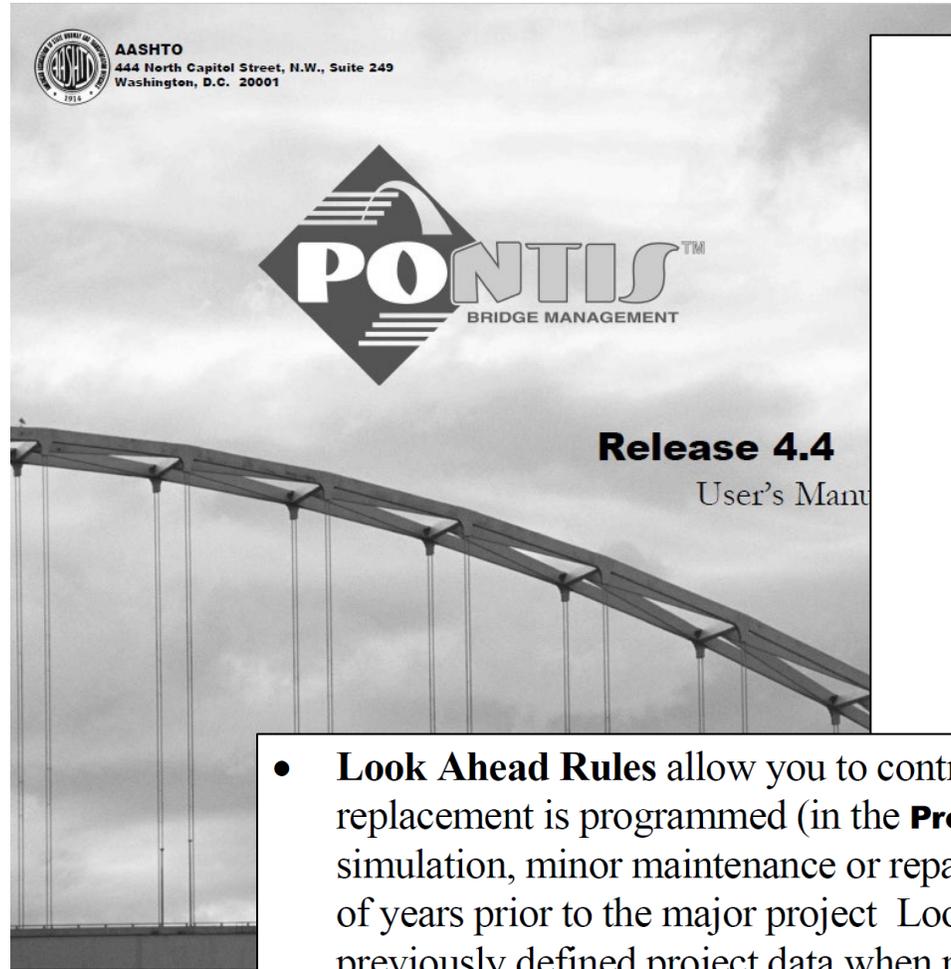
THE PROBLEM

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BRIDGE PROGRAM SIMULATION

5.5 Entering Simulation Rules

Overview of Simulation Rules

A variety of simulation rules have been established in Pontis to tune the simulation's behavior to match with agency practice for structure project development, and to improve the quality of the system's recommendations for bridge-level work (also called Pontis work candidates). The ability to define these rules addresses the fact that while the system's approach to determining preservation and improvement needs preservation optimization models is sufficient for addressing network-level needs, more careful consideration of a range of detailed factors is needed for making realistic bridge-level recommendations. In addition, agencies may have preservation policies for specific elements that they wish to see reflected in Pontis, but that consider factors or conditions outside of the scope of the Pontis preservation model (e.g. smart flag conditions triggering work on deck elements).

Five different sets of simulation rules may be defined in Pontis to control the behavior of the program simulation. These include:

- **Scoping Rules** allow you to ensure that when the preservation optimization model recommends a particular type of work (e.g. replace deck), that related work (e.g. replace joints) is scheduled at the same time. Scoping rules help address issues created by the fact that the preservation optimization model considers each element independently of the others.
- **Look Ahead Rules** allow you to control the timing of work so that if a major rehab or replacement is programmed (in the **Project Planning** module) within the timeframe of the simulation, minor maintenance or repair work won't be scheduled for a specified number of years prior to the major project. Look ahead rules help Pontis make the best use of previously defined project data when performing a program simulation.
- **Major Rehab Rules** allow you to force the simulation to schedule a major rehabilitation

- **Look Ahead Rules** allow you to control the timing of work so that if a major rehab or replacement is programmed (in the **Project Planning** module) within the timeframe of the simulation, minor maintenance or repair work won't be scheduled for a specified number of years prior to the major project. Look ahead rules help Pontis make the best use of previously defined project data when performing a program simulation.



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WHAT'S NEXT

What it is ~~NOT~~

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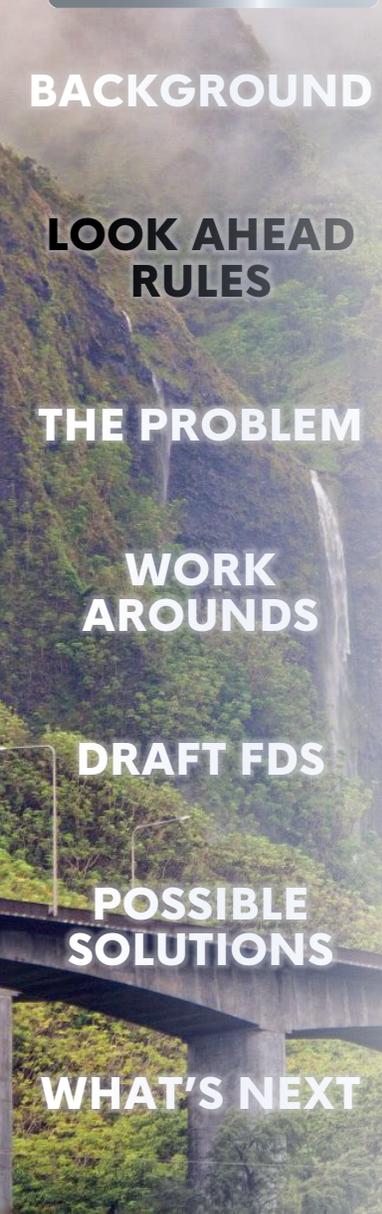
DRAFT FDS

**POSSIBLE
SOLUTIONS**

WHAT'S NEXT



**Deferral
Rules**



DEFERMENT RULES



SUPPRESSION RULES

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**ROUND 1
FIGHT!**



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DEFERMENT RULES

DEFER specific actions for a certain number of years **AFTER** an action is applied

SUPPRESSION RULES

SUPPRESS an action from being applied a certain number of years **BEFORE** a bridge replacement action



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THE PROBLEM

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WHAT'S NEXT

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
BRIDGE PROGRAMMING LIST

NHS - FY22 Bridge Program - \$50M per year

Program Years: 2022 - 2031

Rank	Bridge No.	Feature Inersected	Facility Carried	District	
117	003000800300071	NF KAUKONAHUA(K THOT)	KAM HWY	Oahu	
	<u>Recommended Action</u>	<u>Action Cost</u>	<u>Total Cost</u>	<u>Prog Year</u>	<u>CON Year</u>
	Substructure Repair	\$642,273	\$642,273	2022	2026
	Bridge Replacement	\$38,838,583	\$38,838,583	2024	2029

Condition: POOR

THE PROBLEM

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117	003000800300071	NF KAUKONAHUA(K THOT)	KAM HWY	Oahu
		<u>Recommended Action</u>	<u>Action Cost</u>	<u>Total Cost</u>
		Substructure Repair	\$642,273	\$642,273
		Bridge Replacement	\$38,838,583	\$38,838,583
			<u>Prog Year</u>	<u>CON Year</u>
			2022	2026
			2024	2029

Condition: POOR

- The Optimizer selected a Substructure Repair 3 years before selecting a Bridge Replacement.
- Network Policy conditions can reduce the frequency this happens, but there may still be cases where it occurs.



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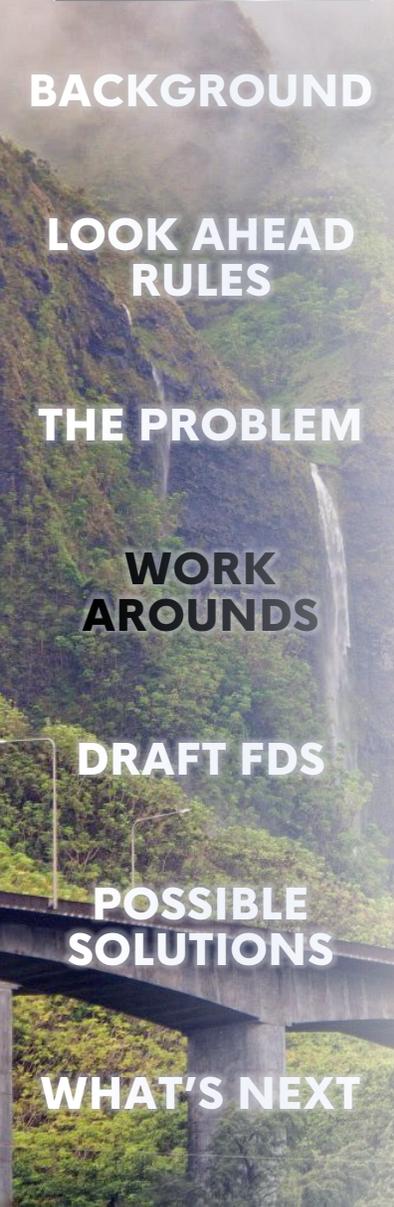
**WORK
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WORKAROUNDS



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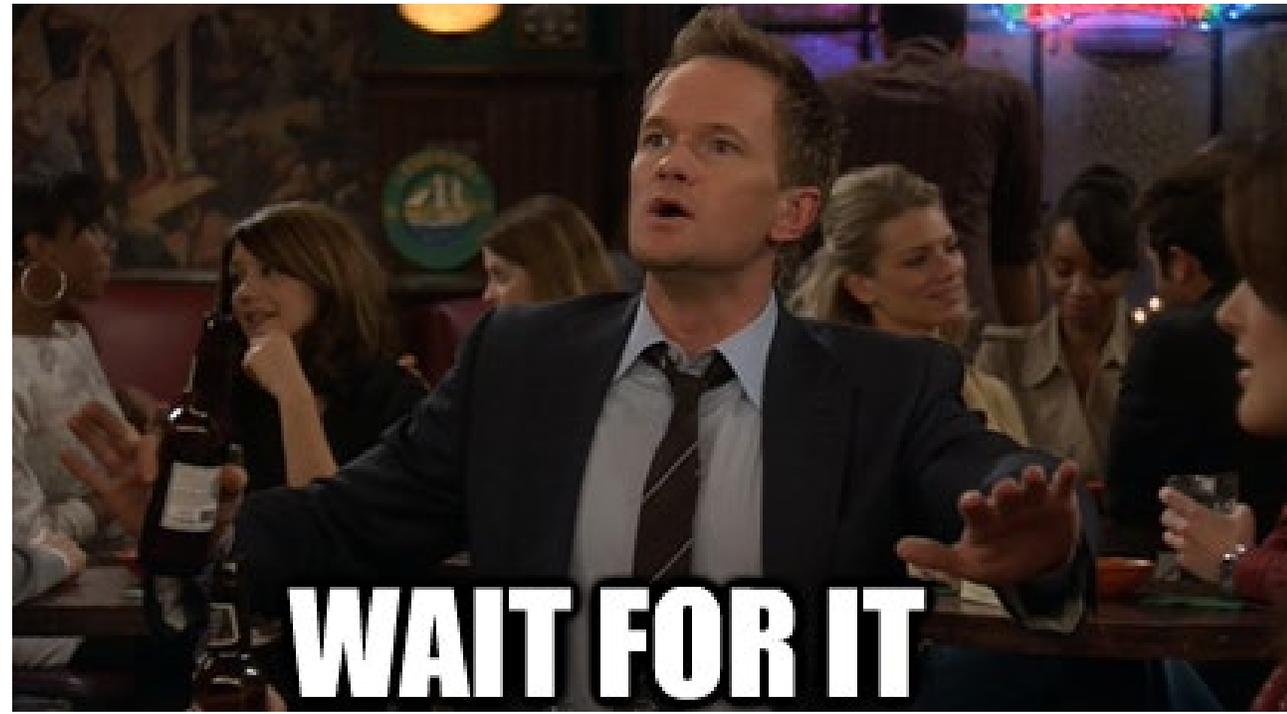
**WORK
AROUNDS**

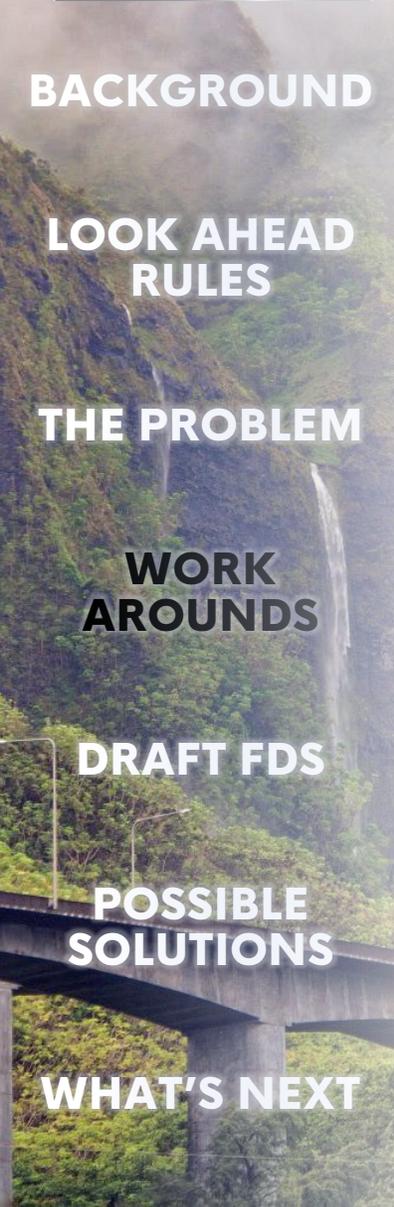
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WHAT'S NEXT

The first Workaround which I Call...





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Workaround One

Step 1. Run an Optimization

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WHAT'S NEXT

Programs > Program Planning

Optimize Program

Program: NHS - FY22 Bridge Program

Scenario: \$50M per year

Optimization Method: Maximize Utility

Keep assigned projects: No

Respect external frozen projects: No

Recalc Structure Weight Annually: Yes

Respect LCCA Plans: No

Add to Queue

Optimization Queue:
NHS - FY22 Bridge Program, \$50M per year

Abort Selected

Program Information

Start Year: 2022
End Year: 2031

Utility Weight Profile: HDOT Optimizer Profile

Assigned Network Policies:

- Seismic Retrofit (HDOT)
- Bridge - Replace (HDOT)
- Superstructure - Rehab (HDOT)
- Substructure - Repair (HDOT)
- Superstructure - Repair (HDOT)
- Deck - Overlay & Repair (HDOT)
- Deck - Rehab (HDOT)
- Paint Structure (HDOT)

Subdivision Profile: Network-Wide
NBI Deterioration Method: ComponentLevelDeterioration

Optimization Progress

Optimizing Program...

43%



Step 2. Manually delete projects in Excel

BACKGROUND

LOOK AHEAD
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WHAT'S NEXT

Bridge No.	Feature Intersect	Facility Carried	District	Source	Action	Action Cost	Project Cost	Prog Year	CON Year	Condition	Deck Area	Scour Critical	Deck Geometry
003000830302412	N PUNALUU STRM	KAM HWY	Oahu	BrM NHS - FY22 Bridge Program - \$50M per year	Bridge Replacement	\$1,759,716	\$1,759,716	2021	2026	POOR	969	3 SC - Unstable	2 Intolerable - Re
003000800300071	NF KAUKONAHUA(K THOT)	KAM HWY	Oahu	BrM NHS - FY22 Bridge Program - \$50M per year	Substructure Repair	\$642,273	\$642,273	2022	2026	FAIR	8,557	8 Stable Above Footing	2 Intolerable - Re
003000800300071	NF KAUKONAHUA(K THOT)	KAM HWY	Oahu	BrM NHS - FY22 Bridge Program - \$50M per year	Bridge Replacement	\$38,838,583	\$38,838,583	2024	2029	FAIR	8,557	8 Stable Above Footing	2 Intolerable - Re
003000830301785	KAHAWAINUI STRM-LAIEWAI	KAM HWY	Oahu	BrM NHS - FY22 Bridge Program - \$50M per year	Substructure Repair	\$54,888	\$54,888	2022	2026	POOR	2,476	8 Stable Above Footing	2 Intolerable - Re
003000H10201344	HIC STRUCT #3A	RAMP H1EB 13AA	Oahu	BrM NHS - FY22 Bridge Program - \$50M per year	Deck Repair	\$161,521	\$210,101	2022	2026	FAIR	11,367	N Not Over Waterway	5 Above Tolerabl
003000H10201344	HIC STRUCT #3A	RAMP H1EB 13AA	Oahu	BrM NHS - FY22 Bridge Program - \$50M per year	Joint Replacement	\$48,579	\$210,101	2022	2026	FAIR	11,367	N Not Over Waterway	5 Above Tolerabl
003000H10100537	KUNIA SEP IB	FAI-H1	Oahu	BrM NHS - FY22 Bridge Program - \$50M per year	Joint Replacement	\$104,931	\$104,931	2022	2026	FAIR	8,934	N Not Over Waterway	4 Tolerable
003000H10202706	WAIALAE VIA IB-HWY OP	FAI-H1	Oahu	BrM NHS - FY22 Bridge Program - \$50M per year	Deck Repair	\$1,186,144	\$1,197,783	2022	2026	FAIR	108,479	N Not Over Waterway	4 Tolerable
003000H10202706	WAIALAE VIA IB-HWY OP	FAI-H1	Oahu	BrM NHS - FY22 Bridge Program - \$50M per year	Substructure Repair	\$11,638	\$1,197,783	2022	2026	FAIR	108,479	N Not Over Waterway	4 Tolerable
003000830302637	S KAHANA STRM	KAM HWY	Oahu	BrM NHS - FY22 Bridge Program - \$50M per year	Substructure Repair	\$86,747	\$86,747	2022	2026	FAIR	2,357	8 Stable Above Footing	2 Intolerable - Re
003000610300638	PALI BR #8A OB	PALI HWY	Oahu	BrM NHS - FY22 Bridge Program - \$50M per year	Substructure Repair	\$25,465	\$64,711	2022	2026	FAIR	5,716	8 Stable Above Footing	2 Intolerable - Re
003000610300638	PALI BR #8A OB	PALI HWY	Oahu	BrM NHS - FY22 Bridge Program - \$50M per year	Deck Repair	\$39,245	\$64,711	2022	2026	FAIR	5,716	8 Stable Above Footing	2 Intolerable - Re
003000780400393	MOANALUA STRM	MOANALUA RD OB	Oahu	BrM NHS - FY22 Bridge Program - \$50M per year	Joint Replacement	\$87,443	\$87,443	2022	2026	FAIR	7,632	8 Stable Above Footing	5 Above Tolerabl

Figure – Custom Excel Report Designed for Hawaii DOT

BACKGROUND

LOOK AHEAD
RULES

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WHAT'S NEXT

~~PROS~~

CONS

1. MANUAL PROCESS – CAN BE VERY TEDIOUS, ESPECIALLY FOR STATES WITH LARGE BRIDGE INVENTORIES
2. PERFORMANCE MEASURE CHANGES NOT REFLECTED IN THE SCENARIO EXPLORER GRAPH
3. UNALLOCATED FUNDS FROM DELETED PROJECTS ARE NOT SPENT ON ADDITIONAL WORK



Workaround One

BACKGROUND

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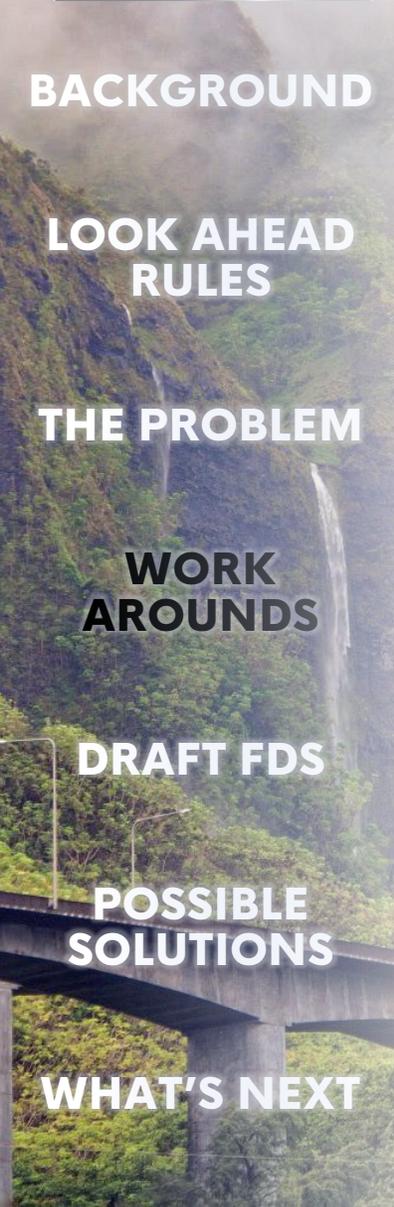
WORK
AROUNDS

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WHAT'S NEXT





BACKGROUND

**LOOK AHEAD
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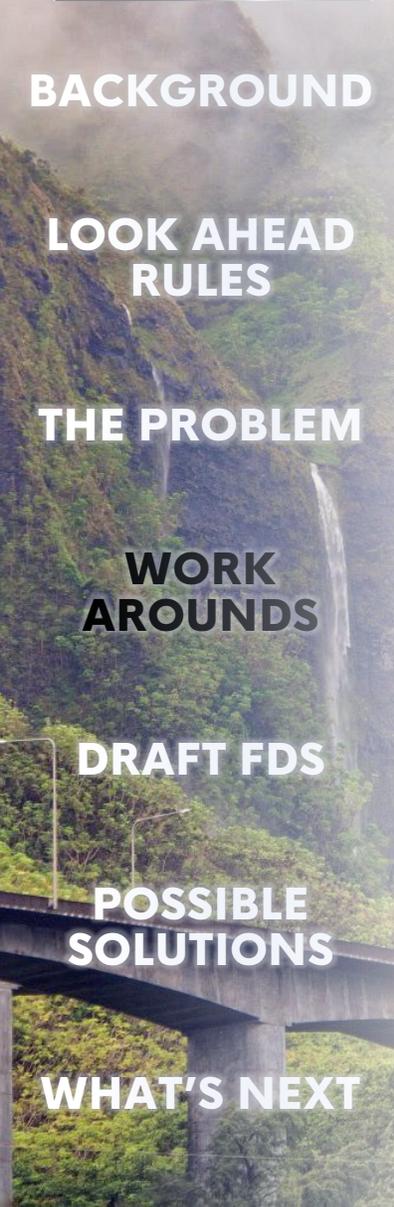
**WORK
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NOT THE ONLY OPTION



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Workaround **TWO**

Step 1. Run an Optimization

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WHAT'S NEXT

Programs > Program Planning

Optimize Program

Program: NHS - FY22 Bridge Program

Scenario: \$50M per year

Optimization Method: Maximize Utility

Keep assigned projects: No

Respect external frozen projects: No

Recalc Structure Weight Annually: Yes

Respect LCCA Plans: No

Add to Queue

Optimization Queue:
NHS - FY22 Bridge Program, \$50M per year

Abort Selected

Program Information

Start Year: 2022
End Year: 2031

Utility Weight Profile: HDOT Optimizer Profile

Assigned Network Policies:

- Seismic Retrofit (HDOT)
- Bridge - Replace (HDOT)
- Superstructure - Rehab (HDOT)
- Substructure - Repair (HDOT)
- Superstructure - Repair (HDOT)
- Deck - Overlay & Repair (HDOT)
- Deck - Rehab (HDOT)
- Paint Structure (HDOT)

Subdivision Profile: Network-Wide
NBI Deterioration Method: ComponentLevelDeterioration

Optimization Progress

Optimizing Program...

43%



Step 2. Manually delete projects in BrM

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WHAT'S NEXT

Programs > Assign Projects

Assign Projects

Projects List

Filter: Layout: Program: Scenario:

<input type="checkbox"/>	Name	Alt Id	Start Date	End Date	Create Date
<input type="checkbox"/>	<input type="text" value="0071"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
<input checked="" type="checkbox"/>	003000800300071(Substructure Repair)		01/01/2026		09/13/2021
<input type="checkbox"/>	003000800300071(Bridge Replacement)		01/01/2029		09/13/2021

Total Projects: 320 Selected Projects: 1

Choose an Action



Step 3. Add Multi-year funding allocation to replacement projects

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WHAT'S NEXT

Projects > Create / Edit Project > Management

Project Details

Project ID: 4BAA07E1C916422486E988F33D6D466F Alternate ID: Create Time: 9/13/2021 2:57 AM Project URL:

Project Name: Project Type: Start Date: End Date:

Created By: (Pontis) User, Pontis

Project Description:

Project Costs

Additional Cost	Project Cost	User Cost
Estimation Method: <input type="text" value="Fixed Value"/>	Direct Cost: \$38,838,583	Enable Action User Costs: <input checked="" type="checkbox"/>
Value: <input type="text" value="0"/>	Additional Cost: \$0	Calculated Action User Costs: \$0
	Total Cost: \$38,838,583	Override Total User Costs: <input type="checkbox"/>
		Override Value: <input type="text" value="0"/>

Programs

Program Name	Program ID	Program's Start Date	Program's End Date	Description	Scenario Name	Target Year	Program Frozen	Year Frozen
<input checked="" type="checkbox"/> NHS - FY22 Bridge Program	E97F1B00AA0D4DE1B5FF8EFF271BF33F	01/01/2022	12/31/2031		\$50M per year	2025	<input type="checkbox"/>	<input type="checkbox"/>

[Add New](#)

Funding Sources

Funding Source	Target Date	Amount	Notes
<input checked="" type="checkbox"/> Multi-Year	<input type="text" value="01/01/2029"/>	<input type="text" value="38838583"/>	<input type="text"/>

[Add New](#)

Step 4. Freeze ALL remaining assigned projects to the Program

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WHAT'S NEXT

Programs > Assign Projects

Assign Projects

Projects List

Filter: Layout: Program: Scenario:

<input checked="" type="checkbox"/>	Name	Alt Id	Start Date	End Date	Create Date	Generation	First Name	Status	Project Category
<input checked="" type="checkbox"/>	003000990402075(Substructure Repair)		01/01/2030		09/13/2021	Automatic	Pontis	Proposed	Preservation Work
<input checked="" type="checkbox"/>	003000H10200865(Joint Replacement)		01/01/2027		09/13/2021	Automatic	Pontis	Proposed	Preservation Work
<input checked="" type="checkbox"/>	003000H10202514(Deck Repair)		01/01/2022		09/13/2021	Automatic	Pontis	Proposed	Preservation Work
<input checked="" type="checkbox"/>	003000990401802(Superstructure Repair, Substructure Repair)		01/01/2023		09/13/2021	Automatic	Pontis	Proposed	Preservation Work
<input checked="" type="checkbox"/>	003000H10202515(Deck Repair)		01/01/2023		09/13/2021	Automatic	Pontis	Proposed	Preservation Work
<input checked="" type="checkbox"/>	001002700500114(Deck Repair, Substructure Repair)		01/01/2028		09/13/2021	Automatic	Pontis	Proposed	Preservation Work
<input checked="" type="checkbox"/>	003000H21200527(Deck Repair)		01/01/2031		09/13/2021	Automatic	Pontis	Proposed	Preservation Work
<input checked="" type="checkbox"/>	003000780400001(Superstructure Repair)		01/01/2031		09/13/2021	Automatic	Pontis	Proposed	Preservation Work
<input checked="" type="checkbox"/>	003000720401504(Deck Repair, Superstructure Repair, Substructure Repair)		01/01/2025		09/13/2021	Automatic	Pontis	Proposed	Preservation Work
<input checked="" type="checkbox"/>	003000H10100635(Joint Replacement)		01/01/2023		09/13/2021	Automatic	Pontis	Proposed	Preservation Work
<input checked="" type="checkbox"/>	003000H30200661(Deck Repair, Superstructure Repair)		01/01/2022		09/13/2021	Automatic	Pontis	Proposed	Preservation Work
<input checked="" type="checkbox"/>	007000560400572(Substructure Repair)		01/01/2026		09/13/2021	Automatic	Pontis	Proposed	Preservation Work
<input checked="" type="checkbox"/>	003000H10201767(Deck Repair)		01/01/2022		09/13/2021	Automatic	Pontis	Proposed	Preservation Work
<input checked="" type="checkbox"/>	007000500302671(Deck Repair)		01/01/2023		09/13/2021	Automatic	Pontis	Proposed	Preservation Work
<input checked="" type="checkbox"/>	003000610401061(Deck Repair)		01/01/2028		09/13/2021	Automatic	Pontis	Proposed	Preservation Work

Total Projects: 320 Selected Projects: 320

Items per page: Projects Matching Search: 320

Choose an Action

Assign Selected Projects to program: , scenario(s): and with

Step 5. Re-run the Optimization

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LOOK AHEAD RULES

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WHAT'S NEXT

Programs > Program Planning

Optimize Program

Program:

Scenario:

Optimization Method:

Keep assigned projects:

Respect external frozen projects:

Recalc Structure Weight Annually:

Respect LCCA Plans:

[Add to Queue](#)

Optimization Queue:

NHS - FY22 Bridge Program, \$50M per year

[Abort Selected](#)

Program Information

Start Year: 2022 Subdivision Profile: Network-Wide

End Year: 2031 NBI Deterioration Method: ComponentLevelDeterioration

Utility Weight Profile: HDOT Optimizer Profile

Assigned Network Policies:

- Seismic Retrofit (HDOT)
- Bridge - Replace (HDOT)
- Superstructure - Rehab (HDOT)
- Substructure - Repair (HDOT)
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Optimization Progress

Optimizing Program...

43%

BACKGROUND

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PROS

1. PERFORMANCE MEASURE CHANGES WILL BE REFLECTED IN THE SCENARIO EXPLORER GRAPH
2. UNALLOCATED FUNDS FROM DELETED PROJECTS WILL BE SPENT ON ADDITIONAL WORK IF APPLICABLE

CONS

1. STILL A VERY MANUAL PROCESS – EVEN MORE TEDIOUS THAN WORKAROUND ONE, ESPECIALLY FOR STATES WITH LARGE BRIDGE INVENTORIES





BACKGROUND

**LOOK AHEAD
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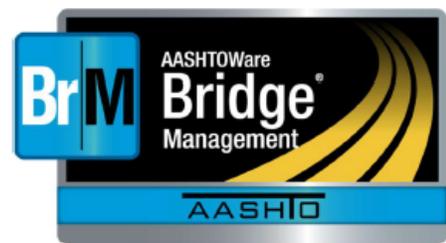
WHAT'S NEXT

DRAFT FDS



A Functional Design Specification (FDS) was drafted out of interest from previous BrM User Group Meetings

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- DRAFT FDS
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- WHAT'S NEXT



Suppression Rule Functional Design Specification (FDS)

Prepared for:
The AASHTOWare Bridge Management (BrM) Task Force
by



*Dated: January 4, 2021
Version 3*



BACKGROUND

LOOK AHEAD RULES

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WHAT'S NEXT

Draft FDS

1.1 OVERALL PAGE UI (SUBJECT TO CHANGE)

- Mayvue will enhance the existing Programs > Create/Edit Programs page in BrM to support the ability to assign a Suppression Rule for bridge replacement projects.
- The overall page UI is as shown in Figure 1, with default state of 'Enable Suppression Rule', unchecked. All sections on the page will remain unchanged except 'Network Policies'. Detailed requirements for enhancements to 'Network Policies' section are described in the following section.

Programs > Create/Edit Programs

Program Editor

Program: NHS Bridges Create New Copy >>

Program Details

Program Alternate ID: Program Status: Program Start Year:
 Program Name: Program URL: Program End Year:
 Program Objectives: Structure Weights Formula: Required Minimum Cost:
 Bridge Filter: (bridge.deck_area)*((2-(300000-(roadway.ADTTOTAL))/3000)

Program Description: [...\[edit\]](#)
 Program Notes: [...\[edit\]](#)

Configuration Data

NBI Deterioration Method: Residual Hix Approximation
 Long-Term Analysis Period: Discount Rate (%):
 Inflation Estimation Method: Inflation Rate (%): Indirect Cost (%):

Network Policies

Unassigned Network Policies:

Assigned Network Policies:

Optimize Work Candidates
 Enable Suppression Rule
 Suppress work prior to replacement Years

Assign All Unassign All

Figure 1: mockup of proposed 'Programs > Create/Edit Programs' page with 'Suppression Rule'

Draft FDS

- The Suppression Rule will only apply to the following:
 - Replacement actions selected by the optimizer for a selected scenario, with 'Bridge Replace' checkbox checked, on Admin > Modeling Config > Action Defs page, as shown in Figure 3.



Figure 3: Admin > Modeling Config > Action Defs page with 'Bridge Replace' checkbox checked

- Replacement projects assigned to a program with 'Keep assigned projects' set to 'YES'.
- Replacement projects frozen to a program with 'Keep assigned projects' set to 'YES' or 'NO'.
- Replacement projects frozen to an external program with 'Respect external frozen projects' set to 'Yes', on the Programs > Program Planning page, when an optimization is run on another program.



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Option 1 – The Optimizer Second Pass



Option 1 – The Optimizer Second Pass

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- **The Optimizer does an initial run and selects projects for each year starting from the first to last program year.**
- **The Optimizer starts from the last program year and unassigns selected projects on a bridge that fall within the specified number of years before a Bridge Replacement.**
- **The Optimizer freezes all bridges that have projects and does a second pass to see if it can find projects on remaining bridges with unallocated funds from the projects that were unassigned.**

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WHAT IS A "FROZEN" BRIDGE?





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Option 2 – Post Optimization Process



Option 2 – Post Optimization Process

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- **The Optimizer does an initial run and selects projects for each year starting from the first to last program year.**
- **In a separate Task, a “post optimization process” is run that removes selected projects on a bridge that fall within a specified number of years before a Bridge Replacement.**
- **An optional second optimization can be run on the program to look for additional projects on remaining bridges with unallocated funds from the projects that were removed.**



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WHAT'S NEXT?

- **Currently highest unfunded enhancement on the User Group priority list**

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2019 Vote Rank	Total Votes	State Rank	Count States	Priority Enhancement	JIRA Ticket	FDS Status (Not started, In Progress, Needs Finalized, or Complete)	Funding Status for FDS and Development	Estimated Level of Effort (T-shirt Size)	August 2021 Update
5	198	3	19	Optimizer look ahead rule (Suppression Rule)	BRMSD-1392	Needs Finalized	None	L	Also known as the Suppression Rule. A draft FDS is available (recently developed at the Task Force's direction). The next step is for the champion and interested agencies to confirm the requirements in the FDS draft or document additional needs or revise requirements. Funding will be needed to move the enhancement forward to development after requirements are finalized. At this time, there are no funding commitments from the user community. This enhancement will be considered by the Task Force for inclusion in a future work plan.

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THE CHOICE IS YOURS



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