

WisDOT Structure Inspection - Bridge Maintenance and Repair

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Welcome to the Wisconsin Department of Transportation's Structure Inspection Refresher Series.

This module details important information and reminders on bridge maintenance and repair activities. Identifying, recommending and documenting these activities are an essential part of completing a quality inspection.

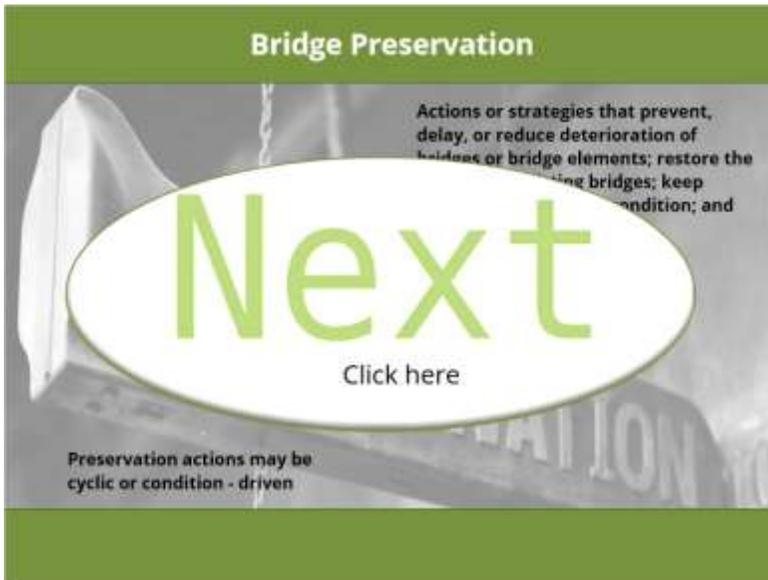
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At the end of this session, you will be able to:

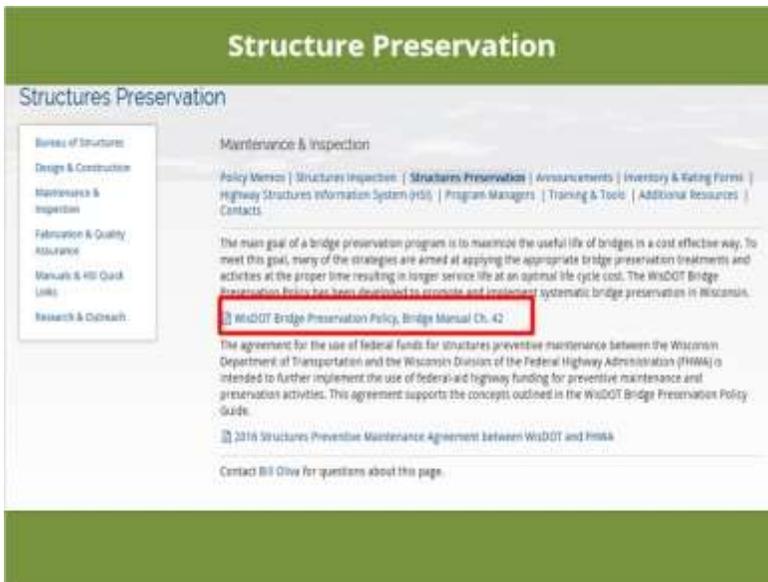
- Define bridge preservation
- Understand the responsibility and roles of the inspection team leader and Program manager relating to bridge maintenance and repair
- Define the general types of maintenance activities and list five primary preventative maintenance activities
- Review documentation requirements related to bridge work, and explain how that work gets documented in the Highway Structures Information System.

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Actions or strategies that prevent, delay, or reduce deterioration of bridges or bridge elements; restore the function of existing bridges; keep bridges in good or fair condition; and extend their service life.

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Bridge preservation is defined as the actions or strategies that

- prevent, delay, or reduce deterioration of bridges or bridge elements;
- restore the function of existing bridges;
- keep bridges in good or fair condition; and
- extend their service life.

Preservation actions may be cyclic (i.e. on a set schedule) or condition-driven.

An example of cyclic preservation would be washing the bridge deck every year. Likewise, an example of a condition-driven preservation action would be spot painting a steel beam where the original paint system has started to fail.

In the last few years the national trend has been to allocate more money for preservation activities. A number of studies across the country have shown investing in preservation activities is generally more cost effective than deferring actions until the structure needs much larger rehabilitation or bridge replacement project.

In 2016, the Wisconsin Department of Transportation implemented a Bridge Preservation Policy that can be found in Chapter 42 of the Wisconsin Bridge Manual.

This chapter outlines the Department's approved preservation activities. It emphasizes applying the appropriate bridge preservation treatments and activities at the proper time resulting in longer service life at optimal life cycle cost.

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Bridge Maintenance and Repair Work Categories

Preventive Maintenance (Proactive)	Repairs (Reactive)
Common types: <ul style="list-style-type: none">• Bridge washing• Drain System cleaning• Expansion joint cleaning• Sealing (crack and deck)• Flood debris removal• Brush removal	Common types: <ul style="list-style-type: none">• Concrete patching• Spot painting• Resetting bearings• Replacing joint seals• Strengthening

Over time, there could be a whole host of maintenance actions which may be needed at a given bridge. Generally, they can be grouped into 2 categories.

The first set of actions are proactive measures referred to as preventative maintenance. These are activities which help to keep a bridge in good condition.

The 2nd set of actions are considered reactive. These are repair activities that fix issues that have already occurred on the structure.

Let's look at a few of these actions a bit closer, starting with some common preventative maintenance activities.

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Preventative Maintenance Bridge Washing



One of the most common preventative maintenance actions used by WisDOT is bridge washing. Washing is important due to the quick build-up of debris, bird droppings, and chlorides on critical components of the bridge. In a short period of time, those items can accelerate the deterioration of both concrete, steel, and timber bridge members.

Most commonly the deck is washed using a high pressure washer.

With proper access equipment, other areas of the bridge can be cleaned as well.

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Another common preventative maintenance is crack sealing, particularly in concrete decks.

An unsealed crack allows penetration of water and chlorides into the deck, causing deterioration of the reinforcing steel. When steel corrodes, it expands. That expansion is what typically causes delaminations and eventually spalls of the deck.

To prevent that intrusion, WisDOT policy recommends sealing cracks every 4 years. One caveat is the deck condition; if the NBI value is 5 (fair condition) or less, the agency should suspend cracking sealing due to ineffectiveness in an already compromised deck.

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In addition to crack sealing, an important activity to maintain a bridge structure involves deck sealing. Deck sealing involves flooding the deck with an approved sealing product that works to significantly slow the ingress of chloride ions into bridge-deck concrete, thus slowing deterioration of the structure.

WisDOT recommends deck sealing on a 4~5 year cycle, and similar to crack sealing, only if the bridge deck is in good condition.

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Not all preventative maintenance actions are cyclical. Some are based on external conditions that occasionally pop up on structures. One common action is removal of debris after significant flooding of a waterway. Often bridge abutments and piers can “catch” floating debris.

As that debris piles up on the upstream side of a substructure unit, it can cause extreme lateral forces on the bridge. It can also act to scour the streambed around the substructure unit which can destabilize the bridge in extreme instances.

For these reasons, debris should be removed shortly after discovery and underwater profiles should be taken to determine that the streambed and bridge were not significantly affected by the debris build-up.

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Preventative Maintenance Brush/Vegetation Removal

WHY? Vegetation touching or close to the structure can impede drying of the elements after rain events and accelerate corrosion.

HOW OFTEN

- As needed
- Up to 5' around ends of structure

Another important, and yet simple bridge preventative maintenance item is removal of brush and vegetation around the vicinity of the structure.

Brush can cause many issues both related to safety (sight distances for drivers) and condition (prolonged dampness of elements that accelerate corrosion).

For those reasons, agencies should remove brush as needed around the structure.

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Equally important to preventative maintenance are repair activities.

These are reactive activities based on specific conditions affecting the bridge. Common examples of these activities are:

- Full or partial depth patching of concrete
- Repairing washouts
- Spot painting
- Cleaning and re-setting bearings, etc..
- Strengthening of deteriorated or damaged materials

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The inspection team leader is expected to properly assess and document the condition of the bridge using inspection elements and defects.

As important, the inspector must recommend activities to maintain the safety and protect the public investment by identifying maintenance items and/or remedial repairs needed for the bridge, including documenting what repairs have been completed since the last inspection report. As such, identifying maintenance activities is a fundamental duty of the inspection team leader.

In the same token, the bridge Program Manager's responsibility is to review maintenance recommendations and act on them accordingly. This action may be to order the repairs to be complete. It may also be that the PM rejects or defers the recommendations due to budgetary issues, future planned work on the structure, etc.

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Documentation - HSI

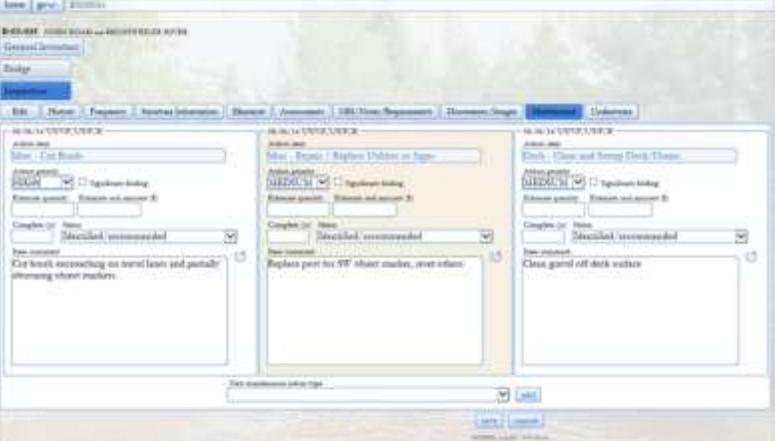


- All maintenance and repair activities should be documented in HSI
- Close-out maintenance items when completed (PM responsibility)
- Follow-up inspections will catch things that fall through cracks.

Documentation of maintenance on bridge structures is key to a successful bridge program.

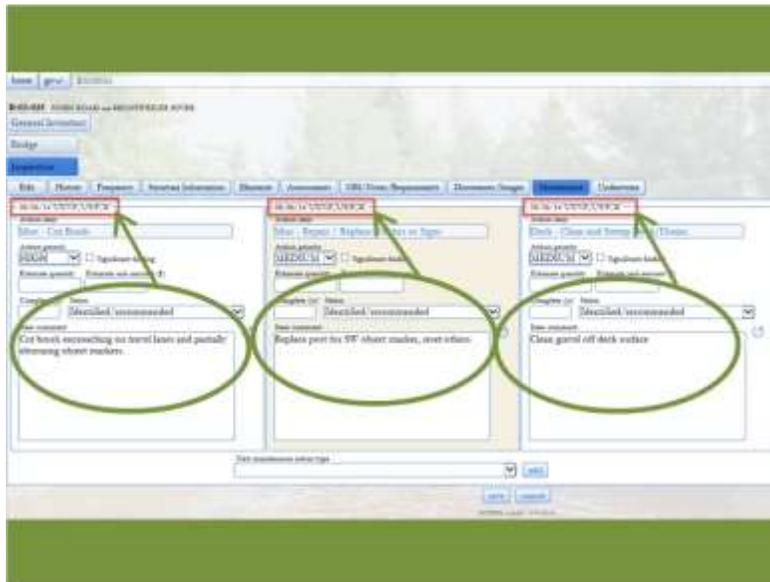
The Highway structures information system (or HSI) has a “Maintenance tab” on the inspection entry screen in which the inspector documents the proposed maintenance activities.

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This is an example of the maintenance tab in HSI for a recent bridge inspection. The tab shows 3 items that are carry-overs from the previous inspection.

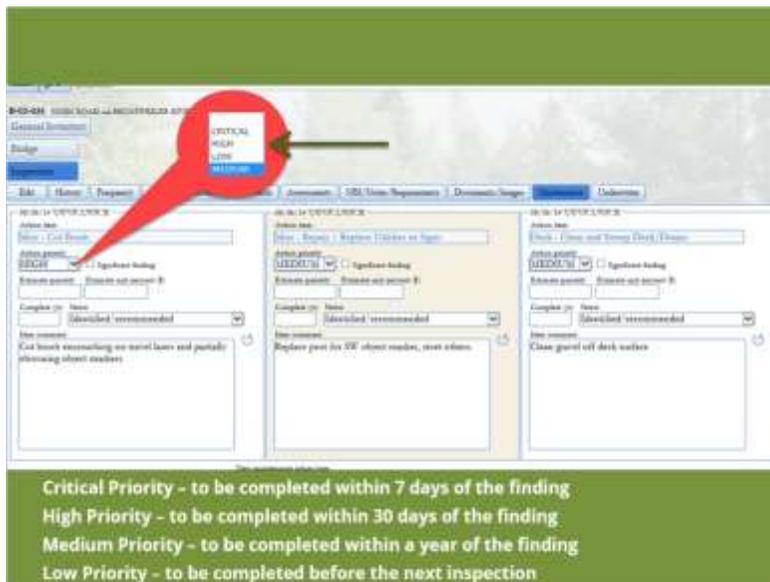
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The upper left hand corner indicates the date of the inspection when the items were first recommended. In this case, the 2014 inspector recommended the following:

- 1) To cut brush around the structure that is encroaching on the traveling lanes and obscuring site vision.
- 2) To replace the post for the SW object marker (that had been damaged) and to reset the other object markers to their proper orientation.
- 3) To clean excess gravel off of the deck surface.

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Once activities are chosen and documented, each specific activity must be assigned a priority by the inspector. This alerts the program manager to the severity of the request for maintenance and repair actions. In general, priorities can be thought in the following sense:

Critical Priority - To be completed within 7 days of the finding.

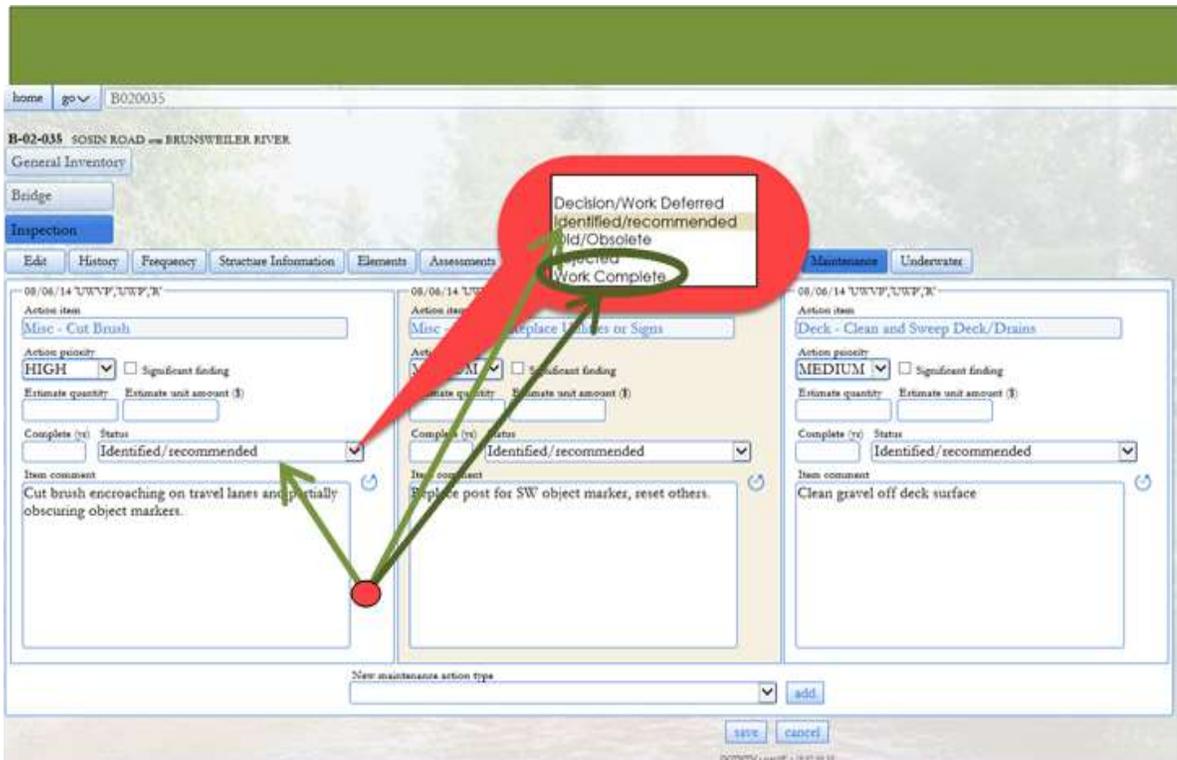
High Priority - To be completed within 30 days of the finding.

Medium Priority - To be completed within a year of the finding.

Low Priority - To be completed before the next inspection.

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Decision/Work Deferred
Identified/recommended
Old/Obsolete
Rejected
Work Complete

- Identified/recommended. This is the default status when the maintenance item is entered.
- Work complete. This is what the status of the item is changed to after the work has been completed.
- Rejected. This can only be entered by the Program Manager, and is used when the work action will not be completed due to budget constraints or other reasons.

In this example, the status of the 3 maintenance items is still unknown, so they are being carried forward to the 2019 inspection.

Recall that when an inspector first enters a maintenance action, the status is set to “Identified/Recommended”. That status does not change until either the bridge program manager or the next inspector updates it.

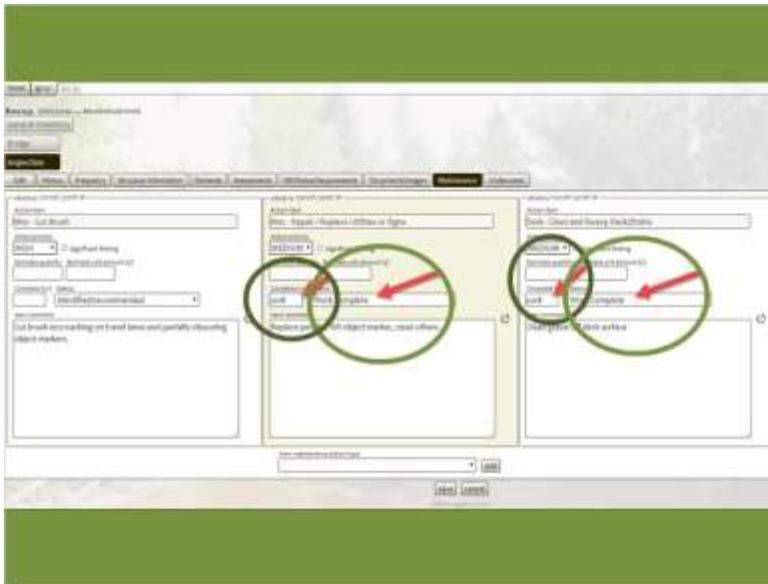
The three primary status items are as follows:

- 1) Identified/recommended. This is the default status when the maintenance item is entered.
- 2) Work Complete. This is what the status of the item is changed to after the work has been completed.
- 3) Rejected. This can only be entered by the Program manager, and is used when the work action will not be completed due to budget constraints or other reasons.

Now, back to the example.

The inspector in this case needs to decide if the work that was requested in 2014 has been accomplished. If so, then the inspector needs to change the status to “Work Complete”.

If the work still needs to be done, the inspector should leave it as-is and update the note(s) as required to properly identify the maintenance needs. When the inspector signs the inspection with an maintenance items still set to Identified/recommended, the recommendation date will be updated to the current inspection and it will be assumed the current inspector recommended the action.



For instance, let's say that in 2019 the inspector noted that the actions for the object markers and the deck had both been previously completed, but that the brush cutting still needed to be done.

In this instance, the inspector would set the status to "work complete" and choose the year the work was completed.

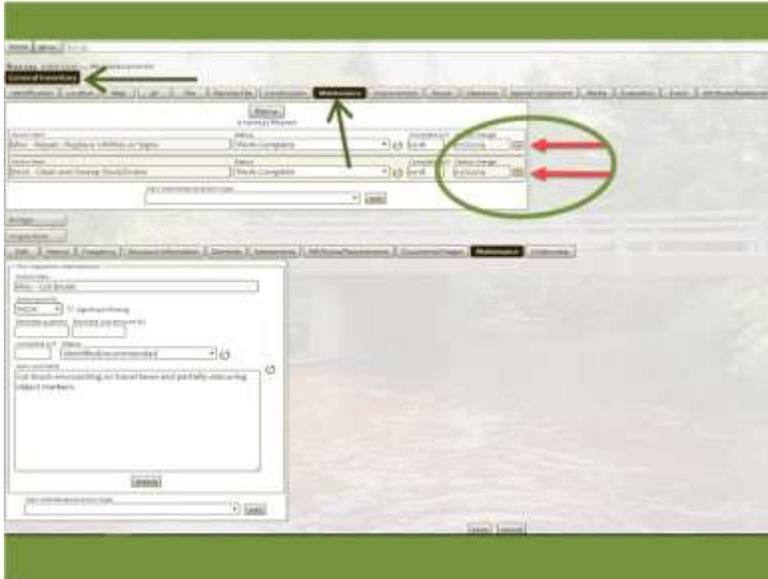
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Once the inspector saves the data, the refreshed HSI maintenance screen will only show one maintenance item that is needed: Brush Cutting.

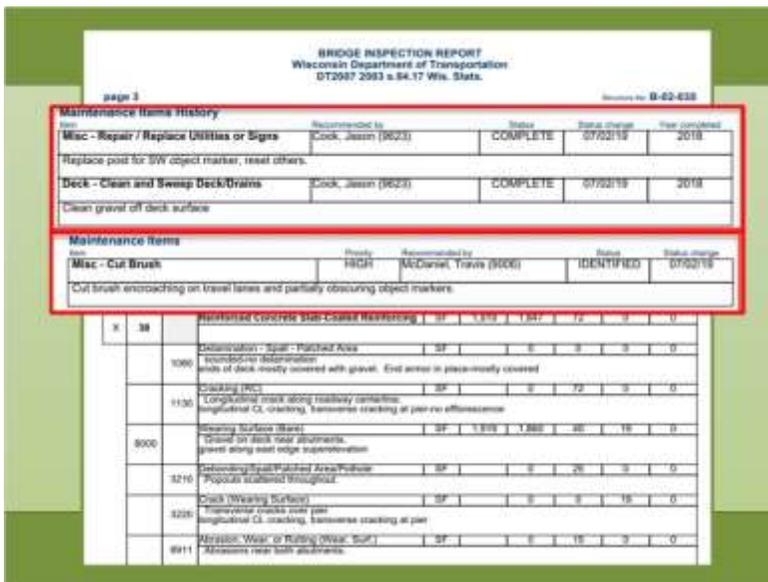
Also note the date changed from 2014 to "This Inspection" indicating that this maintenance item is now part of the current inspection recommendations.

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The completed items do not show up in the inspection “Maintenance” tab, but users can see completed items in the Maintenance tab under the General Inventory information for the bridge as shown by the red arrows.

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In addition, the inspection PDF will show both the historical maintenance items, as well as the items identified in the current inspection.

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