

Critical Findings: Recognition, Reporting and Follow-Up

A critical finding is the inspection result that cannot wait for the report. This course covers the NBIS definition, minimum triggers, FHWA notification, protective actions and closure documentation.

Learning objectives

- Define a critical finding under the NBIS
- Describe owner and FHWA notification expectations
- Outline immediate protective actions
- Document follow-up and closure

Definition and minimum triggers

The NBIS defines a critical finding as "a structural or safety related deficiency that requires immediate action to ensure public safety" (23 CFR 650.305). Owners must define critical findings in written procedures considering member location, redundancy, and the extent and consequence of the deficiency. At a minimum, procedures must include findings that warrant (650.313(q)(1)):

- Full or partial closure of any bridge;
- An NSTM rated 3 (serious) or less;
- A deck, superstructure, substructure or culvert rated 2 (critical) or less;
- Channel or scour condition rated 2 or less;
- Immediate load restriction or posting, or immediate repair (including shoring) to remain open.

Typical critical deficiencies

The rule lists deficiencies including scour, damage, corrosion, section loss, settlement, cracking, deflection, distortion, delamination and loss of bearing. Field examples:

- A through-thickness fatigue crack in a two-girder bridge web (NSTM).
- Exposed and undermined spread footing after a flood.
- Pile bent with a pile section-lost through at the waterline.
- Prestressed beam struck by an overheight load with multiple severed strands and displaced concrete.
- Concrete falling onto a roadway or rail line below (a public safety hazard even when the structure is adequate).

Immediate actions in the field

The BIRM directs the team leader to recognize conditions that pose an imminent threat and notify the owner immediately, following agency procedures. Typical sequence:

1. Make the site safe: request traffic control, lane closure or full closure per agency authority.
2. Call the program manager or designated responsible engineer immediately — do not wait for the report.
3. Document: photos with scale, measurements, location sketch, time of discovery.

4. Support the engineer's decision on load restriction, shoring or closure.

The inspector rarely has authority to close a road, but must know who does and how to reach them at any hour.

FHWA notification and status reporting

Owners must notify FHWA within **24 hours of discovery** of each critical finding on the **National Highway System** that warrants full or partial closure or results in an NSTM rated 3 or less (650.313(q)(2)(i)). For all critical findings, owners provide monthly (or as requested) written status reports until resolved, containing owner, NBI structure number, date, description and photos, corrective actions, status, and estimated or actual completion date.

Engineering follow-up and closure

The engineer evaluates whether the bridge can remain open, needs posting or shoring, or must close. Load rating per the MBE may be needed promptly (NBIS rating clock: no later than 3 months after a change warranting re-rating; posting within 30 days of the determination). Repairs are designed and tracked to completion. Close out the finding only with documentation: what was done, by whom, verification inspection, and updated ratings and inventory data.

Common failures: a critical finding buried on page 14 of a report; a phone call with no written record; a temporary shoring that becomes permanent without evaluation.

Part A — What makes a finding critical

The NBIS (23 CFR 650.305) defines a critical finding as a structural or safety-related deficiency that requires immediate action to ensure public safety. Three words in that definition do the work:

- **Structural or safety-related.** The deficiency can be in a load-carrying member (a cracked girder, an undermined footing) or it can be a safety hazard that is not strictly structural (a missing section of bridge rail at a drop-off, a large deck hole, loose concrete over a travel lane or sidewalk).
- **Immediate action.** The deficiency cannot wait for the next maintenance cycle or the next inspection. Something has to happen now — a closure, a restriction, a barricade, removal of loose material, shoring, or an emergency repair.
- **Public safety.** The test is risk to people: motorists, pedestrians, people below the bridge, vessels in the channel, rail traffic.

Owners must have written procedures that define how critical findings are identified, communicated, acted upon and tracked to resolution (650.313). Many States supplement the federal definition with lists of typical critical findings so field teams apply it consistently. Because the procedure is owner-specific, every team leader should carry and know the procedure for the owner they are working for.

Critical finding versus poor condition

Not every bad condition is a critical finding. A bridge can be in poor condition — a superstructure rated 4 for widespread section loss — and still be safe to carry traffic at its current posting, with deterioration progressing slowly and already accounted for in the load rating. A critical finding is about a change or a newly recognized deficiency that requires *immediate* action. Conversely, a bridge in otherwise good condition can have a critical finding — a new vehicle strike that severs strands, or a newly exposed scour hole under a footing.

Condition	Poor condition?	Critical finding?	Why
Long-standing section loss on stringers, already rated and posted, no change since last inspection	Yes	No	Known, evaluated, no new immediate risk
New 4 ft hole through a deck in a travel lane	Maybe	Yes	Immediate hazard to vehicles
Concrete spall hanging loose over a sidewalk below the bridge	No	Yes	Falling-debris hazard
Crack through a fracture-critical (NSTM) tension flange	Yes	Yes	Possible sudden collapse
Fair-condition deck with scattered small spalls	No	No	Routine maintenance

Part B — Typical critical findings by component

The list below is not a regulatory list — it is a field reference drawn from typical State procedures and the BIRM. When any of these is found, the team leader should treat it as a potential critical finding and follow the owner's procedure.

Component	Typical potential critical findings
Deck	Full-depth holes or punch-throughs; loose concrete over traffic or pedestrians; failed expansion joints creating a vehicle hazard; missing or displaced deck panels or grating
Railing / barrier	Missing, broken or detached rail sections at a drop-off; damaged barrier that no longer provides containment
Steel superstructure	Cracks in tension members or welds, particularly NSTMs; severe section loss reducing capacity below the posted level; impact damage with buckled flanges or webs; failed pin, hanger or eyebar; missing or failed connection bolts or rivets in primary members; distorted gusset plates
Concrete superstructure	Severed or heavily corroded prestressing strands; shear cracking at girder ends; loss of bearing area; large impact damage
Timber	Crushed or broken stringers or caps; advanced decay reducing section in primary members; broken piles
Bearings	Girder off bearing or near loss of seat; failed rocker or roller beyond its limits
Substructure	Undermining or exposed footings; scour exposing piles; settlement or tilting; cracked pier caps with displacement; broken or buckled piles
Culvert	Barrel deformation or collapse; invert loss with piping; headwall failure; roadway sinkholes over the culvert
Channel	Major scour, channel migration toward a foundation, debris accumulation threatening a pier

Judgment remains

Lists help, but the team leader's judgment governs. A 1/16 in. crack in a cross-frame connection plate on a multi-girder bridge may not require immediate action; the same crack in the web of a two-girder bridge near the bottom flange very well may. The questions to ask are: What happens if this gets worse before the next visit? How fast could it get worse? Who could be hurt?

Part C — Immediate actions in the field

The team leader's first obligation is public safety. Owner procedures generally empower the team leader to take or request immediate action — and require immediate notification of the program manager or the designated bridge engineer.

The escalation ladder

Severity	Typical immediate action
Imminent collapse or failure	Close the bridge to all traffic immediately (and any traffic below it); call the program manager and law enforcement or maintenance for barricades
Local failure affecting part of the structure	Close lanes over the affected members; restrict loads; prohibit heavy vehicles
Falling debris hazard	Remove loose concrete (if safe and allowed by procedure) or close the area below
Rail or barrier hazard	Temporary barrier, barricades, warning signs
Scour or undermining	Close per scour plan of action; arrange engineering evaluation and countermeasures

Worked example 1 — In the field

During a routine inspection of a 1970s steel two-girder bridge, the team finds a 6 in. crack in the web of the north girder extending from a weld at a lateral bracing gusset toward the bottom flange. The bottom flange is not yet cracked.

1. **Recognize:** the girder is an NSTM (two-girder system); a web crack at a welded attachment heading toward the tension flange can lead to fracture of the girder.
2. **Protect:** the team leader calls the program manager immediately. Based on the owner's procedure, the bridge is closed to traffic pending engineering evaluation.
3. **Document:** photographs with scale, crack length and location measured from a fixed reference, crack tip marked with paint and date, sketch.
4. **Notify:** the NSTM is now rated 3 or less and the bridge is closed. Is the bridge on the NHS? If so, either trigger requires FHWA notification within 24 hours. Even if not on the NHS, the NSTM rated 3 or less triggers notification.
5. **Follow up:** engineering evaluation, crack-arrest holes, bolted retrofit, in-depth inspection of all similar details, updated load rating, decision on reopening.

Safety of the inspection team

Immediate actions should never put the team at unreasonable risk. If the bridge is in danger of imminent collapse, the team should get off and away from it before making calls. Removing loose concrete is a common action, but only where the procedure allows it and the team can do it safely with traffic control.

Part D — Notification

Notification has two layers: within the owner organization, and to FHWA.

Within the owner organization

Owner procedures typically require the team leader to notify the program manager or a designated engineer immediately — by phone, not just in the report. Many procedures specify a time (for example, within hours) and a written follow-up. For consultants, the contract and the owner's procedure govern who gets the call; keep that list in the field folder.

FHWA notification

Under 650.313, owners must notify FHWA within 24 hours of the discovery of a critical finding that results in either of these:

- full or partial closure of a bridge on the National Highway System (NHS); or
- an NSTM rated in condition 3 or less (serious or worse).

Other critical findings are reported to FHWA through periodic summaries per the rule and the State's procedures. The program manager or designee normally handles FHWA notification; the field team's job is to get accurate information to them fast.

Worked example 2 — Notification decision table

Finding	NHS?	Closure?	NSTM ≤3?	24-hr FHWA?
Deck hole on an Interstate, one lane closed	Yes	Partial	No	Yes
Off-system timber bridge closed for broken stringer	No	Full	No	No (State procedure applies)
Rural two-girder bridge, non-NHS, cracked flange, posted not closed	No	No	Yes	Yes
NHS bridge with loose concrete over a road below, area beneath closed briefly	Yes	Lane below closed, bridge open	No	Per owner/FHWA division interpretation — escalate

The last row is deliberately ambiguous. When a situation does not clearly fit, the field team should notify the program manager and let the owner, who knows its agreement with the FHWA division office, decide.

Part E — Documentation that holds up

A critical finding usually starts a chain of decisions — closures, emergency contracts, load ratings, repairs — that may later be reviewed by managers, FHWA, the public or the courts. The field documentation must make the deficiency understandable to someone who was not there.

The minimum record

- **Who, when, where:** team leader, team, date and time of discovery, bridge ID, span and member, and a location measured from a fixed reference (e.g., "north girder G1, span 2, 34 ft 6 in. east of pier 1 bearing centerline, web 4 in. above the bottom flange").
- **What:** the deficiency described in measurable terms — crack length and orientation, section loss with remaining thickness, displacement in inches, scour depth relative to footing bottom.
- **Photographs:** an overview photo locating the member, a medium photo showing the detail, and a close-up with a scale or tape. Mark crack tips with paint and date before photographing.
- **Sketch:** plan or elevation with dimensions; for scour, a channel cross-section with soundings.
- **Actions:** what was done immediately, who was notified, when, and by what means.
- **Recommendations:** what engineering evaluation, repair or monitoring is needed.

Worked example 3 — Two versions of the same record

Weak: "Big crack in girder near pier. Called office."

Strong: "Critical finding. 10:42 a.m., Oct 3. G2 (interior), span 1, bottom flange at end of cover plate, 18 ft 2 in. west of pier 1 CL bearing. Through-thickness crack in bottom flange from the cover plate end weld toe, 3-1/4 in. long, extending transversely toward the north flange edge (flange width 12 in.). Crack tips marked (yellow paint, 10/3). Photos 41–48. Called J. Smith, PE (program manager) 10:51 a.m.; on PM direction, lanes over G2 closed by district maintenance at 12:20 p.m.

Recommend: immediate engineering evaluation; MT of all cover plate ends; load rating update with G2 flange cracked; retrofit design."

Part F — Engineering follow-up

After immediate action, an engineer must evaluate the deficiency and decide how the bridge can be operated until it is repaired. The follow-up typically includes:

1. **Verification.** An engineer visits or reviews the documentation; additional NDE may define extent (for example, ultrasonic testing to find crack depth, or GPR/sounding to map delamination).
2. **Load rating.** The load rating engineer updates the rating to reflect the deficiency. If the bridge cannot safely carry legal loads, it must be posted within 30 days of that determination; if the gross live load capacity is below 3 tons, it must be closed.
3. **Temporary measures.** Shoring, crack-arrest holes, temporary supports, lane restrictions, speed restrictions, or load restrictions while the repair is designed.
4. **Repair or replacement.** An emergency repair contract or maintenance forces carry out the permanent fix.
5. **Verification inspection.** After repair, an inspection confirms the fix and records updated condition, element quantities and ratings.
6. **Closure.** The finding is closed in the tracking system with dates and documentation.

Worked example 4 — Load rating after strand damage

A prestressed AASHTO Type III girder bridge is struck by a dump truck with its bed raised. The fascia girder loses 4 of 30 bottom strands (severed) with concrete spalling exposing 3 more. The load rating engineer:

- removes the 4 severed strands from the girder section;
- considers the exposed strands with reduced effectiveness per the owner's guidance;
- checks flexural strength at midspan and the effect on stress limits;
- evaluates whether the damage affects load distribution to adjacent girders.

Result (illustrative): the fascia girder rating factor for the State legal truck drops below 1.0 at operating level. Options: post the bridge, or close the lane over the fascia girder so traffic does not load it significantly, and re-rate with that restriction. The owner chooses a lane restriction and schedules a strand splice repair or girder replacement. NCHRP Report 226 and later research on damaged prestressed girders provide guidance on repair options.

Part G — Tracking to resolution

The NBIS requires owners to track critical findings until they are resolved. In practice, that means a log — usually in the bridge management system — with at least the following fields:

Field	Example
Bridge ID and location	12345, SR 9 over Mill Creek
Date/time discovered	2026-10-03 10:42
Description	Cracked bottom flange, G2 span 1
Immediate action and date	Lanes over G2 closed 2026-10-03

Field	Example
FHWA notification required? Date	No (non-NHS, not NSTM) / n.a.
Responsible engineer	Name
Follow-up actions with target dates	Rating update by 2026-11-15; retrofit by 2027-03
Status	Open – temporary measures in place
Closure date and evidence	Post-repair inspection report ref.

Why tracking fails

- The finding is closed when temporary measures go in, rather than when the permanent repair is done.
- Responsibility passes between offices (inspection → design → construction → maintenance) and no one owns the whole chain.
- The next routine inspection team does not see the open finding before going to the bridge.

Good programs review open findings regularly at the management level and make open findings visible on the bridge's inspection schedule page so every team that visits knows what to look at.

Part H — Case studies from public investigations

Public investigations show how missed or mishandled findings can escalate. These summaries are drawn from widely published accounts; consult the investigation reports for details.

Mianus River Bridge, Connecticut (1983)

A section of the I-95 bridge fell when a pin-and-hanger assembly failed, killing three people. The investigation found corrosion-induced forces had pushed the hanger off the pin. Drainage problems contributed to the corrosion. Lessons: pin-and-hanger assemblies on non-redundant structures warrant close, hands-on inspection; drainage defects can drive structural failures; signs such as displacement at a hanger must be acted on promptly.

Schoharie Creek Bridge, New York (1987)

A pier on the New York State Thruway bridge failed during a flood after scour undermined its footing; ten people died. The investigation cited, among other factors, inadequate maintenance of riprap protection around the pier and the absence of an effective inspection of the foundation below water. Lessons: scour can undermine a foundation without visible distress above water; underwater inspection and scour evaluation programs matter; flood monitoring and closure plans can save lives. This collapse drove national scour programs and HEC-18.

I-35W Bridge, Minneapolis (2007)

The deck truss collapsed, killing 13 people. The NTSB concluded that undersized gusset plates — a design error — combined with added dead load and construction loads on the day of collapse caused the failure. Bowing of gusset plates had been photographed in earlier inspections. Lessons: distortion of connection elements is a potential critical finding; inspectors and raters should evaluate connections, not just members; FHWA issued gusset plate load rating guidance (FHWA-IF-09-014).

Common threads

- Early signs were observable but not recognized as urgent.

- The deficiency was in a detail that was not systematically evaluated.
- Immediate action, had it been triggered, could have reduced the consequence.

Part I — Scour-related critical findings

Scour is a leading cause of bridge failures in the United States, and scour-related critical findings are often time-sensitive because they arise during or after floods, when access is hardest.

Signs to recognize

- Exposed footing bottoms or undermining beneath spread footings.
- Exposed piles below the pile cap, especially if exposed length exceeds what the design anticipated.
- Settlement or tilting of a pier or abutment; sag or kink in the deck or rail line over a support.
- Loss of riprap or other countermeasures around a foundation.
- Debris rafts against piers, increasing local scour and lateral load.
- Channel migration toward an abutment or pier.

The scour plan of action

Scour-critical bridges and bridges with unknown foundations must have a plan of action (POA). The POA usually defines monitoring (fixed instruments, portable devices, or visual monitoring at defined flood stages), closure criteria, detour routes, and countermeasure plans. When a POA trigger is reached — for example, a river stage — the POA governs: close the bridge per the plan, then perform a post-flood inspection before reopening. A finding during that post-flood inspection that shows foundation distress is a critical finding.

Worked example 5 — Post-flood decision

After a 50-year flood, the team uses a sounding pole and a portable sonar from the deck at a two-span bridge with a center pier on a spread footing. Plans show the footing bottom at elevation 92.0; the soundings show the streambed at 91.5 on the upstream nose. The scour hole has reached below the footing bottom — the footing is undermined at the nose.

- Immediate action: close the bridge (the POA's closure criterion is any exposure of the footing bottom).
- Notify the program manager immediately; if the bridge is on the NHS, the closure triggers 24-hour FHWA notification.
- Follow-up: underwater inspection to map undermining; geotechnical and structural evaluation; emergency countermeasure (e.g., riprap, grout bags, or underpinning per HEC-23 guidance) before reopening.

Part J — Building a good critical findings procedure

Whether you work for an owner or advise one, these are the elements of a procedure that works in practice.

Element	What it should say
Definition and examples	The federal definition plus a list of typical critical findings with photos
Authority	What the team leader may do without waiting (close a lane, close a bridge, remove loose concrete)
Contacts	Primary and backup contacts by phone, 24/7, by district

Element	What it should say
Time limits	Verbal notification immediately; written notification within a set time; FHWA notification within 24 hours where required
Documentation template	Fields for location, description, measurements, photos, actions, notifications
Engineering response	Who evaluates, by when; load rating update; posting/closure decisions
Tracking	Log fields, review frequency, closure criteria
Communication	Public information and law enforcement coordination for closures
Training	Annual review with field staff and consultants

Consultant contract tips

Inspection contracts should state how critical findings are handled: who the consultant calls, what the consultant may do on site, whether the consultant must provide on-call engineering, and how extra work (such as an immediate in-depth inspection) is authorized. Ambiguity costs time when it matters most.

Part K — Field exercise

For each scenario, decide (a) whether it is a critical finding, (b) the immediate action, and (c) whether 24-hour FHWA notification is required. Answers follow.

1. An Interstate overpass (NHS) has a 2 ft × 3 ft piece of concrete hanging loose from the deck overhang over the road below; the overpass itself carries traffic normally.
2. A non-NHS county road bridge has a timber cap that is crushed at one pile, with the stringer bearing dropped 1 in.
3. A non-NHS truss has a bottom chord eyebar with a visible crack at the eye; the inspector rates the NSTM 2.
4. A State route bridge (non-NHS) has an expansion joint armor plate loose and lifting under traffic, creating a tire hazard.
5. A prestressed girder has longitudinal cracking along the bottom flange with rust staining, unchanged since the last two inspections, already in the load rating.

Answers

1. (a) Yes — falling debris hazard. (b) Close the lane(s) below and remove the loose concrete under traffic control, per procedure. (c) Owner decision; a lane closure beneath an NHS bridge may or may not be treated as a partial closure of the NHS bridge — escalate to the program manager.
2. (a) Yes — local failure of a primary member. (b) Close or restrict the bridge per the engineer's direction; consider shoring. (c) Non-NHS, not NSTM — State procedure; no 24-hour FHWA notice under the NHS/NSTM triggers.
3. (a) Yes. (b) Close the bridge pending evaluation (an eyebar crack on a two-bar panel can lead to collapse). (c) Yes — NSTM rated 3 or less.
4. (a) Yes — safety hazard. (b) Lane restriction, emergency maintenance to secure or remove the plate. (c) No.
5. (a) No — known, unchanged, evaluated. (b) Continue monitoring; consider special inspection or in-depth inspection if progression is suspected. (c) No.

Part L — Communicating with the public

Closures and restrictions affect people immediately. While public information is usually handled by the owner's communications staff, field teams and engineers support it with accurate facts. A short, factual statement is better than speculation: what was found (in plain language), what action has been taken, whether the bridge is safe as restricted, and when more information will be available. Engineers should avoid giving repair timelines or cost estimates in the field before an evaluation is done.

Worked example 6 — A plain-language summary

"During a scheduled inspection this morning, our inspectors found damage to one of the main steel beams supporting the Mill Creek bridge on SR 9. As a precaution, the bridge is closed to all traffic while engineers evaluate the damage. A detour is posted via SR 12 and County Road 4. We expect to provide an update within 48 hours."

This statement states the facts, explains the action as precautionary, gives the detour and sets an update time without promising a reopening date.

Part M — Recognizing severity: steel and concrete details

Steel cracks

Not every crack in steel is equally urgent. Severity depends on where the crack is, which way it is going, and what it could cut through next.

Factor	Lower concern	Higher concern
Member	Secondary member (lateral bracing, diaphragm) on a redundant bridge	Primary tension member, especially an NSTM
Orientation	Parallel to the primary stress (e.g., longitudinal web crack at a stiffener gap)	Perpendicular to primary tension stress
Location	Compression zone	Tension flange or web near tension flange
Origin	Distortion-induced in a web gap, short and stable	At a weld toe of a Category E or E' detail, growing
Rate	No change across inspections (crack tips marked)	Growth beyond previous paint marks

Distortion-induced cracking at connection plates (web gaps) is common and often addressed by drilling crack-arrest holes and modifying the connection, as described in FHWA's *Manual for Repair and Retrofit of Fatigue Cracks in Steel Bridges* (FHWA-IF-13-020). A crack that has entered or is approaching a tension flange is a different matter and normally requires immediate action.

Concrete distress

Observation	Why it might be critical
Diagonal cracks near girder ends, widening toward the bearing	Possible shear distress; brittle failure mode
Severed prestressing strands	Direct loss of flexural capacity; possible loss of prestress in adjacent strands
Spalling at bearing seat with loss of bearing area	Risk of girder dropping off seat
Loose concrete over traffic or people	Falling-debris hazard

Observation	Why it might be critical
Map cracking with no displacement	Usually not critical alone; may indicate ASR — evaluate

Part N — Roles and responsibilities

Role	Responsibilities for critical findings
Team leader	Recognize, take or request immediate action, notify immediately, document thoroughly
Team members	Help identify and document; keep the site safe; support the team leader
Program manager	Receive notification, direct immediate actions, notify FHWA when required, assign engineering follow-up, ensure tracking
Load rating engineer	Evaluate capacity with the deficiency; recommend posting, restriction or closure; re-rate after repair
Maintenance forces	Implement closures, barricades, signing, temporary repairs
Design/repair engineers	Design temporary and permanent repairs
Communications staff	Inform the public, coordinate with emergency services

When the team leader is a consultant

A consultant team leader may not have authority to close a road on their own, depending on the owner's procedure; in that case the obligation is to contact the owner immediately and, where safety demands it, take protective steps such as stopping traffic until the owner's staff arrive, if the procedure and law allow. Agree on this before field work starts.

Part O — Frequently asked questions

Is every NSTM rated 3 a critical finding?

An NSTM rated 3 or less triggers the 24-hour FHWA notification, and a deficiency that has driven an NSTM to that rating generally requires immediate action. Owners treat it as a critical finding under their procedures.

If we close a bridge as a precaution and engineers reopen it the same day, do we still notify FHWA?

If it is an NHS bridge and the closure resulted from a critical finding, the 24-hour notification requirement is triggered by the closure. The program manager should make the call based on the rule and the division office's guidance.

Can the team leader remove loose concrete?

Often yes, if the owner's procedure allows it and it can be done safely with traffic control. Document the area removed and what was exposed.

Does a critical finding automatically lower the condition rating?

Not automatically, but the deficiency that caused it usually affects the component rating. Rate the component per the SNBI and owner guidance considering the deficiency and any temporary measures.

Who closes the finding in the log?

The responsible engineer or program manager, after the permanent corrective action is complete and verified.

Part P — Self-check and summary

Question	Answer
Definition of critical finding?	Structural or safety-related deficiency requiring immediate action to ensure public safety
Two triggers for 24-hour FHWA notification?	Full/partial closure of an NHS bridge; NSTM rated 3 or less
Posting deadline after determination?	30 days
Closure threshold?	Gross live load capacity less than 3 tons
When is a finding closed?	When the permanent corrective action is complete and verified
Three photos for each finding?	Overview, medium (detail in context), close-up with scale

Key points

- Recognize: ask what happens if it gets worse, how fast, and who could be hurt.
- Protect: take or request immediate action; the team's own safety comes first.
- Notify: call immediately; let the program manager handle FHWA notification.
- Document: measurable, located, photographed, sketched.
- Follow up: evaluate, rate, restrict, repair, verify.
- Track: keep the finding open until permanently resolved.

Part Q — Bearing seat loss: a quick calculation

Girders can lose support when bearings walk, seats spall, or substructures move. A quick seat-length check helps a team leader decide how urgent a seat problem is.

Worked example 7 — Remaining seat

A simply supported steel girder rests on a rocker bearing on a concrete pier cap. Plans show 14 in. from the bearing centerline to the cap edge. The inspection finds:

- the rocker tilted toward the cap edge, displacing the bearing centerline 2 in. toward the edge;
- the cap edge spalled back 7 in. under the bearing area.

Remaining distance from bearing centerline to sound concrete edge: $14 - 2 - 7 = 5$ in. The masonry plate is 12 in. long, so half its length (6 in.) should be on sound concrete; with 5 in. remaining, part of the masonry plate is already over spalled concrete.

Decision: this is a potential critical finding — loss of bearing support is a sudden failure mode. Immediate actions might include lane restriction over the girder and emergency shoring or a temporary support under the girder end, with engineering evaluation the same day. Compare: had the remaining distance been 12 in. with the plate fully on sound concrete, the finding would be a priority maintenance item, not critical.

Part R — Culvert and timber findings

Culverts

Culvert failures often show up at the road surface first: sinkholes, pavement cracking or dips over the barrel. Inside, look for deformation of flexible pipes (flattening, reverse curvature at the crown), invert deterioration in corrugated metal with soil loss through holes, joint separations with infiltration, and headwall rotation. A sinkhole in the roadway over a culvert is an immediate hazard to vehicles even if the culvert has not collapsed. The FHWA *Culvert Inspection Manual* (FHWA-IP-86-2) describes these modes.

Worked example 8 — CMP crown deflection

A 10 ft diameter corrugated metal pipe under a county road shows the crown flattened, with a measured vertical diameter of 8.2 ft and horizontal diameter of 11.3 ft. Vertical deflection: $(10 - 8.2) / 10 = 18\%$. Many owners treat flexible pipe deflection beyond a moderate percentage, combined with reverse curvature or cracked seams, as severe. With 18% and visible flattening, the team leader escalates immediately; the road may be restricted pending evaluation. Check the owner's specific deflection thresholds.

Timber

Timber members can lose capacity rapidly to decay, especially at bearing areas and at pile tops where water collects. Signs of critical timber deficiencies include crushed caps, broken stringers, piles with heavy decay or marine borer damage reducing section significantly, and split members with displacement. Sounding with a hammer and probing or boring help estimate sound section. Ritter's *Timber Bridges: Design, Construction, Inspection, and Maintenance* (EM 7700-8) is a practical reference.

Part S — Case study: a finding handled well

The following hypothetical case brings the steps together.

Discovery. At 9:15 a.m., during a routine inspection of an NHS bridge (four-span continuous steel plate girder, eight girders), the team finds that a cross-frame connection plate on G4 near pier 2 has a 2 in. crack in the web gap that has turned and is now growing down the girder web, perpendicular to the flange, 3 in. above the bottom flange. The team leader notes the bottom flange is in compression under negative moment at the pier and that the crack is in a multi-girder (redundant) system.

Judgment. The crack has turned perpendicular to primary bending stress in the web, but it is in the compression region near the pier and the system is redundant. The team leader classifies it as a priority repair rather than a critical finding but calls the program manager immediately to discuss — the procedure encourages calls when in doubt. The program manager agrees, directs drilling crack-arrest holes within a week and an in-depth MT inspection of similar details across the bridge.

Contrast. Had the same crack been at midspan of a positive-moment region of a two-girder bridge, heading for a tension flange, it would have been a critical finding requiring immediate closure or restriction and a 24-hour FHWA notification (NSTM rated 3 or less, and NHS closure).

Lesson. Location and stress state matter as much as crack size. When in doubt, call — the procedure exists so that the decision can be made with more than one set of eyes.

Part T — Event-driven findings and lessons for designers

Events that commonly produce critical findings

Event	What to check first
Over-height vehicle strike	Fascia girders and diaphragms: severed strands, buckled flanges, cracked welds, bearing displacement
Vessel impact	Pier protection, piers and pile groups, bearings above, alignment of superstructure
Flood	Scour at foundations, debris, approach embankment washouts, settlement
Fire under or on a bridge	Steel distortion, concrete spalling and heat damage, damaged bearings and utilities
Earthquake	Bearing and seat displacement, column cracking and spalling, abutment movement

Owner procedures should name the event thresholds that trigger a damage inspection and who responds. Pre-arranged on-call inspection contracts make response faster.

What designers can learn

Many critical findings trace to details that designers can avoid or make easier to inspect:

- Avoid Category E and E' fatigue details in tension regions; use bolted rather than welded attachments where practical.
- Provide redundancy so a single member failure does not cause collapse.
- Keep drainage away from bearings and steel; joint leakage drives corrosion of the members below.
- Provide adequate seat widths and restrainers.
- Design scour countermeasures and foundations to the HEC-18 design and check floods, and record foundation details on the plans so future inspectors know what they are looking at.
- Provide access — inspection walkways, hand-holds, inspection ports in boxes — so hands-on inspection is practical.

Every detail that cannot be inspected easily is a detail where a critical finding is more likely to be found late.

Wrap-up

Critical findings are where inspection most directly protects lives. The rule's requirements — a procedure, immediate action, notification, and tracking — exist so that observations in the field reliably turn into protective action. Recognize, protect, notify, document, follow up and track: those six verbs are the whole process.

Part U — Readiness checklist for the field team

Critical findings are rare on any given day, which is exactly why teams are sometimes unprepared when one happens. Before each inspection trip, confirm the following.

#	Item
1	Current copy of the owner's critical findings procedure (printed or offline on a tablet)
2	Contact list with primary and backup phone numbers for the program manager, district engineer and maintenance, valid outside office hours
3	Knowledge of which bridges on the trip are on the NHS and which have NSTMs
4	Open critical findings and special inspection items for each bridge, reviewed before arrival

#	Item
5	Paint markers for crack tips, tape measures, calipers, ultrasonic thickness gauge, sounding hammer, scale cards
6	Camera with location/time stamps; spare batteries
7	Cones, signs and barricades, or a confirmed way to get maintenance forces quickly
8	Critical finding documentation template
9	Scour plan of action for scour-critical bridges on the route
10	Knowledge of what the team leader is authorized to do on site under the contract

Practice drill

Some owners run an annual tabletop drill: a facilitator presents a photo of a deficiency, and the team walks through recognition, immediate actions, calls, documentation and FHWA notification decision in real time. Drills expose gaps — outdated phone lists, unclear authority, missing templates — before a real event does. Consultant firms can run the same drill internally at the start of each inspection season.

A team that has practiced the sequence handles a real critical finding calmly, accurately and quickly, which is exactly what the public depends on.

After each drill or real event, hold a short debrief: what worked, what was slow, which contact did not answer, and what the procedure should say differently. Feed those lessons into the next version of the procedure and the next training session so the program keeps improving.

Key takeaways

- Critical finding = deficiency requiring immediate action for public safety.
- Minimum triggers include closure, $NSTM \leq 3$, components ≤ 2 , channel/scour ≤ 2 , and immediate posting or repair.
- NHS closures and $NSTM \leq 3$ findings: notify FHWA within 24 hours.
- Track every finding with monthly status reports until resolved.

References

1. 23 CFR Part 650, Subpart C — National Bridge Inspection Standards (final rule published May 6, 2022)
2. FHWA, Bridge Inspector's Reference Manual (BIRM), FHWA-NHI-12-049, 2012 (as revised)
3. AASHTO, The Manual for Bridge Evaluation, 3rd Edition, 2018 (with interim revisions)

Study text only; the final quiz is taken online. Verify all references against the edition your agency has adopted.