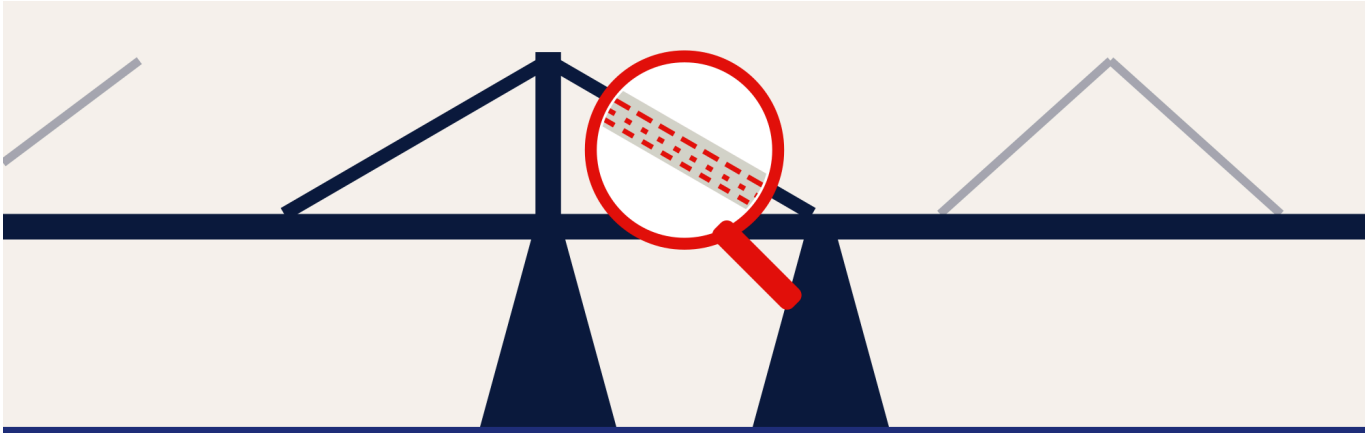


CORRODED STEEL INSIDE CONCRETE

# Ponte Morandi, 2018: the steel nobody could see

*A reliability and asset management reading of the Genoa bridge collapse, with five practical checks for owners of ageing structures*

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**ABSTRACT**

On 14 August 2018 about 200 m of the Polcevera viaduct in Genoa, Italy, collapsed during a rainstorm, killing 43 people [1]. In the 2020 report summarised by Italian court-appointed experts, corrosion at the upper part of the Genoa-side south stay of pier 9, hidden inside concrete, was identified as the triggering failure mechanism; the broader collapse sequence and responsibility findings remained subject to evidence, judgment and appeal [2][3]. A project to strengthen the stays had been designed but never built [1]. In the July 2026 first-instance judgment, the Tribunal of Genoa reportedly found the collapse foreseeable and preventable and convicted 32 defendants; the written reasoning and all convictions remained subject to appeal [1][4][14]. We review the case with a bow-tie view, a contributing-factor map, RCM and an ISO 55001:2024 lens, and turn it into five checks.

**KEY FINDINGS**

1. Court experts identified corrosion at the top of the Genoa-side south stay of pier 9 as the triggering mechanism [2][3].
2. Inspections were judged insufficient and unreliable for the stay steel; no direct examination was made at the critical point [1].
3. A stay retrofit for piers 9 and 10 was designed from 2015 but never started [1].
4. Available monitoring was described as substantially qualitative and limited in coverage [1][11].

This brief describes findings of court-appointed experts and a first-instance verdict. The verdict is subject to appeal; nothing here assigns individual responsibility [1][4].

## 01 Context and purpose

The Polcevera viaduct, known as Ponte Morandi after its designer Riccardo Morandi, was a 1,182-m motorway bridge opened in 1967 [5]. Its main piers carried the deck through a small number of stays: steel cables encased in prestressed concrete, unlike modern cable-stayed bridges with many exposed cables [1]. It was operated under concession by Autostrade per l'Italia, with inspection and engineering by its subsidiary SPEA [1].

**About this brief.** A practitioner interpretation from public sources by AFDARA & Co.; not legal or engineering advice, not peer-reviewed. The expert report and verdict are cited through published reporting; the full court reasoning was not yet published when sources were checked.

## 02 The sequence

**An early warning from the designer.** The court experts wrote that indications given over the years by Morandi himself, especially on the degradation of the steel, had been neglected [2][3]. The bridge received major reinforcement work in the 1990s [5]. On pier 9, however, the experts found that since 1993 no work had been done that could stop the degradation or repair the defects at

the ends of the stays, which at the top of the south stay were particularly serious [3].

**A fix designed, not built.** Design of a project to strengthen the stays of piers 9 and 10 began in 2015 and went through preliminary, final and executive phases. Autostrade sought bids for the work, worth about US$23 million, but construction never began [1].

**The failure.** On 14 August 2018, during heavy rain, about 200 m of the viaduct fell [1][5]. The court-appointed experts identified corrosion of the upper part of the Genoa-side south stay of pier 9 as the triggering mechanism [2][3]. Other analyses and defence arguments considered original design or construction defects, including a hidden void, while academic models have examined corrosion-fatigue and alternative stay-release scenarios; these studies use assumptions and do not by themselves establish the judicially accepted sequence [1][12][13].

**What happened**

Ponte Morandi, Genoa (simplified)

| | |
|---|---|
| **1967** | The Polcevera viaduct on the A10 opens. Each main pier carries the deck on a few concrete-encased stays. |
| **1990s** | Major reinforcement work on the bridge. On pier 9, no work after 1993 stops the degradation of the stay ends. |
| **2015** | Design starts for a project to strengthen the stays of piers 9 and 10. |
| **Before 2018** | Autostrade seeks bids for the retrofit, about US$23 million. Construction never begins. |
| **14 Aug 2018** | During a rainstorm about 200 m of the viaduct collapses. 43 people die. |
| **Dec 2020** | Court experts identify corrosion at the top of the Genoa-side south stay of pier 9 as the trigger. |
| **16 Jul 2026** | First-instance judgment: 32 convictions. The court reportedly finds the collapse foreseeable and preventable. |

**43 killed**

First-instance judgment; all convictions subject to appeal.

Sources: [1][2][3][4] AFDARA & Co.

**Figure 1.** A simplified chronology from published reporting; not a full log [1][2][3][4].

## 03 Reliability and barrier analysis

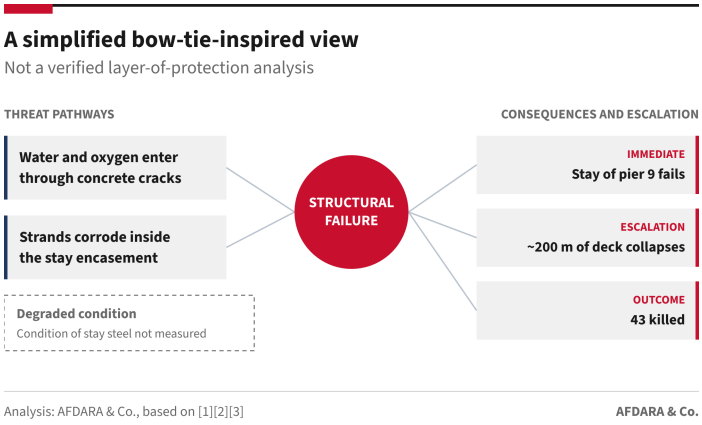



**Figure 2.** A qualitative cause–consequence sketch, not a structural assessment [10]. Controls that failed or were unavailable: *prevention* — protection of the stay steel from water and oxygen, inspection able to show the steel condition, timely strengthening; *mitigation* — traffic or load restrictions while the condition was uncertain [1][2][3].

**The critical steel was out of sight.** The stay cables sat inside concrete. Court experts said non-destructive testing alone could not establish their condition, and that coring and endoscopic inspection should have been done. No direct examination was ever made at the top of the Genoa-side south stay of pier 9, even though defects had been found at piers 10 and 11 [1].

**Monitoring that could not answer the question.** The ministry commission described the available reflectometric monitoring as substantially qualitative and limited in coverage, leaving major uncertainty about the internal steel condition; later court-expert reporting said indirect testing alone could not establish the critical cable condition [1][11]. Experts rejected a defence theory of a hidden construction void and pointed instead to long-term water and oxygen intrusion through concrete cracks [1].

**Closely connected roles.** The operating concessionaire and its affiliated inspection and engineering subsidiary occupied closely connected roles; this brief presents that as a governance question, not a finding of individual wrongdoing. Those convicted at first instance included staff of the concessionaire and of its inspection subsidiary, and officials responsible for ministry oversight of the concession [1]. The victims' committee said that "no controller stopped the operator" [1].

## 04 Contributing causes and organisational learning

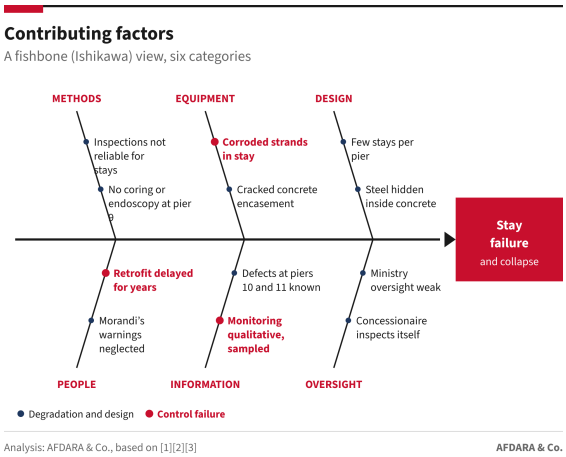



**Figure 3.** A workshop aid by AFDARA & Co.: a contributing-factor map for structuring discussion. It is a practitioner interpretation, not the experts' or the court's causal analysis [1][2][3].

**One selected branch (workshop aid).** Why did the stay fail? Its strands had corroded. Why was it not found? Inspections could not show the steel condition, and the critical point was never examined directly. Why was it not strengthened anyway? The retrofit stayed in design and tender for years [1][3]. Real causation had several branches.

**Recorded signals.** The experts also listed design shortcomings, a lack of adequate technical specifications for the cable sheaths and grouting, construction defects, and inadequate checks [8]. Defects at the other piers were known [1].

**Uncertainty is a condition.** When an owner cannot measure the state of a critical, hard-to-inspect element, the honest answer is "unknown". The case shows the cost of treating unknown as acceptable.

| RCM QUESTION | APPLIED TO A STAY OF PIER 9 |
|---|---|
| **1 Function** | Carry the deck load from the antenna to the deck. |
| **2 Functional failure** | Loses load capacity and fails. |
| **3 Failure mode** | Corrosion of strands inside the concrete encasement, from water and oxygen entering through cracks [1]. |
| **4 Effect** | Little or nothing visible from outside; condition shows only on failure or invasive inspection. |
| **5 Consequence** | Hidden failure with catastrophic safety consequences. |
| **6 Proactive task** | On-condition inspection that can actually see the steel: coring, endoscopy or other validated methods at critical points [1]. |
| **7 If no proactive task** | Redesign may be required: strengthening or replacing the stays. Until then, consider load or traffic restrictions. |
| **Operational rule** | Separately: where the condition of a critical element cannot be established, treat it as degraded until shown otherwise. |

**Table 1.** RCM questions (after SAE JA1011 [9]; not a quotation), applied by AFDARA & Co. to the failed stay.

> **TAKEAWAY**
> If your inspection method cannot see the failure mode, you do not have an inspection. You have a ritual.

## 05 A retrospective ISO 55001 lens

Viewed retrospectively through ISO 55001:2024, the case raises questions about risk, decision-making, outsourced or affiliated inspection, and performance evaluation. These are illustrative questions, not an audit or a finding of nonconformity, and they do not anticipate the outcome of any appeal. ISO 55001 complements rather than replaces structural codes and concession law [7].

| HISTORICAL CONTROL ISSUE IN THIS BRIEF | ILLUSTRATIVE ISO 55001:2024 QUESTION TODAY |
|---|---|
| **Critical element with unknown condition** | 6.1 Actions to address risks |
| **Retrofit designed but not built for years** | 6.2 Asset management objectives and planning to achieve them |
| **Inspection by an affiliated company** | 8.1 Operational planning and control (externally provided processes) |
| **Monitoring could not show steel condition** | 9.1 Monitoring, measurement, analysis and evaluation |
| **Grantor oversight did not stop operation** | 5.1 Leadership and commitment · 9.3 Management review |

**Table 2.** Selected illustrative mappings [7]. The clauses do not prescribe a specific inspection technique or structural assessment method.

## 06 An ageing-structure screen

| CONDITION | POSSIBLE EFFECT | SAFER ACTION |
|---|---|---|
| **Critical element not inspectable by current method** | Hidden deterioration | Invasive or validated testing at critical points |
| **Known defects on sister elements** | Same mechanism elsewhere | Inspect all similar elements to the same depth |
| **Strengthening approved but delayed** | Risk accepted by default | Dated decision with interim restriction |
| **Monitoring gives qualitative results only** | False comfort | Define what result would trigger action |
| **Few load paths (low redundancy)** | Single failure leads to collapse | Higher inspection depth and lower tolerance for uncertainty |

**Table 3.** Illustrative condition–effect–action screen; not a structural assessment or code requirement.

**Evidence check (AFDARA heuristic).** For each critical control, look for evidence that it *exists*, is *understood*, is *implemented* (sampled records and observations) and *performs* under defined conditions. Ponte Morandi had inspections, monitoring and a retrofit design [1]; the gaps lay in whether they could see the steel, and in action.

## 07 Five practical checks and risk-linked monitoring

1. **Can your inspection see the failure mode?** For each critical element, state the failure mechanism and show that the inspection method can detect it [1].
2. **Treat unknown as degraded.** Where condition cannot be established, apply interim measures until it can [1].
3. **Learn from sister assets.** A defect on one element is evidence about all similar elements [1].
4. **Put dates on deferred strengthening.** Every approved but unbuilt repair needs an owner, a date and an interim restriction [1].
5. **Independent challenge.** Make sure someone outside the operating chain reviews the condition of critical structures and can stop operation [1].

### Illustrative indicators

| INDICATOR | DEFINITION TO SET | RESPONSE RULE |
|---|---|---|
| **Critical elements with unknown condition** | Elements where inspection cannot confirm the state of the load path | Invasive test or restriction |
| **Overdue strengthening** | Approved repairs past their planned start | Escalate to the board and grantor |
| **Inspection depth coverage** | Share of critical points examined by a method able to detect the mechanism | Plan to close gaps |
| **Sister-element follow-up** | Defects found with no check of similar elements | Extend the inspection |
| **Independent reviews** | Critical structures with a recent independent review | Schedule missed reviews |

Thresholds and monitoring frequencies are AFDARA heuristics and must be set by risk assessment and structural codes, not read as ISO 55001 or statutory limits. Indicators give early warning, not prediction.

**QUESTION FOR YOUR TEAM**

Which critical part of your asset can you not see inside, and how do you know it is sound?

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