

# NHI Bridge Safety Inspection Practice Exam (Midterm) for In-Service Bridges (Sample)

## Study Guide



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## **Questions**

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- 1. Why is historical data important in bridge inspections?**
  - A. For regulatory compliance**
  - B. To compare aesthetic changes over time**
  - C. It provides context for current conditions and helps track long-term changes**
  - D. It helps in planning future constructions**
- 2. What term describes a timber defect that involves a fracture or separation across the grain?**
  - A. Surface checking**
  - B. Blistering**
  - C. Checking**
  - D. Shake**
- 3. What primary method of inspection assesses the physical condition of bridge materials?**
  - A. Visual**
  - B. Physical**
  - C. Mechanical**
  - D. Auditory**
- 4. What types of materials are commonly evaluated during a bridge safety inspection?**
  - A. Wood only**
  - B. Steel, concrete, timber, and composite materials**
  - C. Only synthetic materials**
  - D. Glass and plastic**
- 5. Which inspection method uses chain drags to assess the soundness of concrete decks?**
  - A. Visual**
  - B. Physical**
  - C. Advanced**
  - D. Auditory**

- 6. Which inspection technique might be used to uncover defects not visible from the surface?**
- A. Visual inspection.**
  - B. FLIR thermography.**
  - C. Nondestructive testing (NDT).**
  - D. Weight testing.**
- 7. What is a major cause of deck failure in concrete bridges?**
- A. Water pooling**
  - B. Freeze-thaw cycles leading to spalling**
  - C. Inadequate drainage systems**
  - D. Increased traffic loads**
- 8. What does "condition rating" refer to in the context of bridge inspection?**
- A. A classification of repair needs**
  - B. A numerical representation of the bridge's overall health and safety**
  - C. An evaluation of aesthetic appearance**
  - D. A ranking of the bridge among others**
- 9. Which structural element supports the bridge deck and transfers loads to foundations?**
- A. Piers.**
  - B. Spans.**
  - C. Girders.**
  - D. Railings.**
- 10. What describes a defect parallel to the grain on the surface of timber?**
- A. Surface check**
  - B. Blistering**
  - C. Shake**
  - D. Split**

## **Answers**

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1. C
2. C
3. B
4. B
5. B
6. C
7. B
8. B
9. C
10. A

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## **Explanations**

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**1. Why is historical data important in bridge inspections?**

- A. For regulatory compliance**
- B. To compare aesthetic changes over time**
- C. It provides context for current conditions and helps track long-term changes**
- D. It helps in planning future constructions**

Historical data is crucial in bridge inspections because it provides context for current conditions and helps track long-term changes in the bridge's structural integrity and overall health. By analyzing historical data, inspectors can identify trends in deterioration, maintenance activities, and the impact of environmental factors on the bridge's performance over time. Understanding this context allows for more informed decision-making regarding necessary repairs, maintenance schedules, and prioritization of resources. This historical perspective is invaluable for identifying patterns that could indicate potential issues before they become critical, thereby enhancing the safety and longevity of the bridge. While regulatory compliance, aesthetic changes, and future construction planning are important considerations, they do not encompass the full range of insights that historical data provides regarding the ongoing monitoring and assessment needed for bridge safety.

**2. What term describes a timber defect that involves a fracture or separation across the grain?**

- A. Surface checking**
- B. Blistering**
- C. Checking**
- D. Shake**

The term that describes a timber defect involving a fracture or separation across the grain is referred to as "checking." This is a natural occurrence in wood, particularly when it dries or undergoes changes in moisture content. Checking typically appears as cracks or splits that run parallel to the grain, often beginning at the ends of the piece of timber and extending inward. Such structural fissures can affect the integrity and performance of the timber, which is especially important in the context of bridge safety and maintenance. In contrast, other timber defects mentioned in the options describe different issues. For example, "surface checking" generally pertains to smaller, superficial cracks that occur on the surface layer of the wood; "blistering" may indicate a separation of layers often seen in laminates; and "shake" refers to separations that are often larger and run along the growth rings of the wood rather than transverse to them. Understanding these differences is crucial for assessing wood quality and ensuring the structural soundness of timber components in bridge construction and maintenance.

**3. What primary method of inspection assesses the physical condition of bridge materials?**

- A. Visual
- B. Physical**
- C. Mechanical
- D. Auditory

The primary method of inspecting the physical condition of bridge materials is through physical inspection. This method involves a hands-on examination of the bridge components to assess their condition, including looking for signs of wear, corrosion, cracking, and other visible defects. Physical inspection is critical in identifying issues that may not be visible through other means. In contrast, while visual inspection plays a significant role in early assessments, it focuses on what can be seen from a distance and may not capture more severe underlying problems. Mechanical inspections typically involve the use of tools or devices to measure or test materials but do not encompass the overall physical evaluation of bridge components. Auditory inspections, which involve listening for sounds that indicate problems, are less reliable for assessing physical integrity compared to more direct methods. Therefore, the physical inspection is essential for accurately determining the state of bridge materials and ensuring functionality and safety.

**4. What types of materials are commonly evaluated during a bridge safety inspection?**

- A. Wood only
- B. Steel, concrete, timber, and composite materials**
- C. Only synthetic materials
- D. Glass and plastic

Bridge safety inspections require a thorough evaluation of various types of materials that form the structure of the bridge. The correct answer includes steel, concrete, timber, and composite materials, as these are the primary materials used in the construction and maintenance of most bridges. Steel is commonly used for structural elements due to its high strength-to-weight ratio, which allows for long spans and flexibility in design. Concrete is another critical material, often used for foundations, decks, and support elements, given its durability and ability to withstand compressive forces. Timber may be found in some older bridges or specific projects where aesthetics or historical significance is important. Composite materials, which combine different materials to achieve superior properties, are increasingly used for their lightweight and corrosion-resistant characteristics, enhancing the longevity of bridge elements. In contrast, focusing on just wood, synthetic, glass, or plastic does not encompass the full range of materials that structural engineers and inspectors encounter. Many bridges rely on a combination of materials, and an effective inspection must consider all of these components to assess the overall safety and integrity of the structure. Therefore, recognizing the significance of the variety of materials listed in the correct choice is crucial for understanding the complexities of bridge safety inspections.

**5. Which inspection method uses chain drags to assess the soundness of concrete decks?**

**A. Visual**

**B. Physical**

**C. Advanced**

**D. Auditory**

The method that employs chain drags to evaluate the soundness of concrete decks is classified as a physical inspection method. This technique involves applying a chain drag across the surface of the concrete deck, which helps identify delaminations and other issues beneath the surface. When the chain drags over areas of compromised integrity, it produces distinctive sounds or feels different in resistance, indicating potential problems such as voids or cracks within the concrete. This hands-on approach allows inspectors to gather tangible data about the condition of the deck, making it an effective means of assessing structural soundness. By physically engaging with the material, this method provides insights that may not be apparent through visual observation alone, highlighting its importance in comprehensive bridge inspections.

**6. Which inspection technique might be used to uncover defects not visible from the surface?**

**A. Visual inspection.**

**B. FLIR thermography.**

**C. Nondestructive testing (NDT).**

**D. Weight testing.**

Nondestructive testing (NDT) is a crucial inspection technique used to uncover defects that are not visible from the surface of a bridge. NDT methods allow for an in-depth examination of structures without causing any damage, which makes it especially valuable for assessing the integrity of critical components like welds, joints, and internal structures. Common NDT techniques include ultrasonic testing, magnetic particle testing, radiographic testing, and acoustic emission testing, all of which are designed to detect subsurface defects such as cracks, disbonds, or corrosion that may compromise the structural safety of a bridge. These methods provide quantitative data about the condition of the material and are essential for informed decision-making regarding maintenance and repair strategies. In contrast, visual inspection relies solely on what can be seen with the naked eye and is limited to surface conditions. FLIR thermography detects thermal patterns on surfaces, which can indicate certain issues but may not reveal deeper structural flaws. Weight testing assesses a bridge's performance under load but does not evaluate internal defects. Thus, NDT is the most suitable option for identifying hidden defects effectively.

## 7. What is a major cause of deck failure in concrete bridges?

- A. Water pooling
- B. Freeze-thaw cycles leading to spalling**
- C. Inadequate drainage systems
- D. Increased traffic loads

A major cause of deck failure in concrete bridges is indeed the freeze-thaw cycles leading to spalling. This phenomenon occurs when moisture that has infiltrated the concrete structure freezes during cold weather. As the water freezes, it expands, exerting pressure on the surrounding concrete. When it thaws, the water contracts, leading to repeated cycles of expansion and contraction that can break down the concrete material over time. These freeze-thaw cycles are particularly damaging when the concrete is not properly designed or when proper maintenance is neglected. Despite efforts to mitigate such conditions through the use of air-entrained concrete or effective sealants, the natural environment can still impose significant stress on the bridge deck. The result is spalling, which manifests as flaking or chipping of the concrete surface, ultimately compromising the structural integrity of the deck and leading to more significant failures if not addressed promptly. Although other factors, such as inadequate drainage systems and increased traffic loads, can contribute to deck deterioration, freeze-thaw cycles specifically target the concrete's physical properties, making them a critical concern in regions subject to fluctuating temperatures. Proper design considerations and maintenance practices are thus essential to minimize the impact of these environmental effects on concrete bridge decks.

## 8. What does "condition rating" refer to in the context of bridge inspection?

- A. A classification of repair needs
- B. A numerical representation of the bridge's overall health and safety**
- C. An evaluation of aesthetic appearance
- D. A ranking of the bridge among others

In the context of bridge inspection, "condition rating" specifically refers to a numerical representation of the bridge's overall health and safety. This rating is derived from the assessment of various structural components and their respective conditions. It encompasses factors such as structural integrity, serviceability, and load-carrying capacity. By quantifying the bridge's condition, inspectors can communicate important safety information to stakeholders, facilitate maintenance planning, and prioritize repair or replacement needs effectively. This numerical value serves as an essential tool for decision-making regarding the management of the infrastructure. The other options, while related to bridge inspection, do not encapsulate the primary definition of "condition rating." Repair needs are part of the inspection process but do not reflect the overall numerical assessment of health. Aesthetic evaluations focus on appearance rather than safety and functionality, and ranking may involve comparative assessments among multiple bridges but does not provide an inherent measure of an individual bridge's condition.

**9. Which structural element supports the bridge deck and transfers loads to foundations?**

- A. Piers.**
- B. Spans.**
- C. Girders.**
- D. Railings.**

The structural element that supports the bridge deck and transfers loads to the foundations is indeed the girders. Girders are the main horizontal supports in a bridge structure that bear the weight of the bridge deck, along with any additional loads (such as vehicles, pedestrians, and environmental factors). They function by distributing these loads down to the vertical elements like columns or piers, which then transfer the weight to the foundations. Girders are designed to handle bending, shear, and axial loads, making them a crucial part of the bridge's structural integrity. They typically span the distance between supports (like piers) and provide the necessary strength and stability for the bridge deck above. In contrast, piers are vertical supports that elevate and stabilize the bridge, but they do not directly support the bridge deck. Spans refer to the distance between two supports but do not identify a specific component that carries load. Railings, while essential for safety, are not structural elements that support the bridge deck or transfer loads; they simply provide a barrier along the edge of the bridge.

**10. What describes a defect parallel to the grain on the surface of timber?**

- A. Surface check**
- B. Blistering**
- C. Shake**
- D. Split**

The choice of surface check as the correct answer is based on its specific definition in the context of timber defects. A surface check refers to additional separations or splits that occur in the surface layer of timber, running parallel to the grain direction. These checks are typically the result of natural drying processes or stress within the wood and can compromise the timber's structural integrity if they are significant. In contrast, the other options represent different types of defects: blistering can occur when moisture builds up under the surface, shake is a defect that occurs inside the wood, often parallel to the growth rings, and split refers to a more severe and complete fracture through the timber, which typically goes across the grain rather than following it. Understanding these distinctions helps in correctly identifying and assessing defects in timber materials.