E-3
Kongres 2026
Congress 2026

doi: 10.67563/ASESCONF2026082P

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PERIODIC INSPECTIONS OF EXISTING STRUCTURES IN USA

Summary: This paper reviews the regulatory and technical framework for inspections of existing structures in the United States of America (USA), focusing on building facades, exterior steel structures, water-tank supports, fire escapes, and bridges. It examines the roles of the IEBC, IBC, ASCE/SEI 11, ACI 562, AISC standards, municipal ordinances, and the National Bridge Inspection Standards. Chicago and New York City facade programs are compared in terms of scope, inspection intervals, reporting, unsafe-condition classification, and required protective measures. Common deterioration mechanisms—corrosion, section loss, cracking, spalling, connection failure, and water damage—are summarized together with inspection methods and the consequences of delayed repairs. The paper emphasizes periodic, risk-based assessment by qualified professionals as essential for public safety, timely maintenance, and rehabilitation.

Keywords: existing structures, structural inspection, facade assessment, steel deterioration, bridge inspection, public safety

PERIODIČNE INSPEKCIJE POSTOJEĆIH OBJEKATA U SAD

Rezime: U radu je dat pregled regulatornog i tehničkog okvira za inspekcije postojećih objekata u Sjedinjenim Američkim Državama, sa fokusom na fasade zgrada, spoljašnje čelične konstrukcije, nosače rezervoara za vodu, evakuaciono stepenište i mostove. Analizirane su uloge propisa IEBC i IBC, standarda ASCE/SEI 11, ACI 562 i AISC, lokalnih uredbi i Nacionalnih standarda za inspekciju mostova. Programi inspekcije fasada u Čikagu i Njujorku upoređeni su prema opsegu, intervalima pregleda, izveštavanju, klasifikaciji nebezbednih stanja i obaveznim zaštitnim merama. Prikazani su najčešći oblici oštećenja, metode pregleda i posledice odlaganja sanacije. Naglašena je važnost periodičnih procena zasnovanih na riziku koje sprovode kvalifikovani stručnjaci radi zaštite javne bezbednosti i pravovremenog održavanja.

Ključne reči: postojeći objekti, inspekcija objekata, procena fasada, degradacija čelika, inspekcija mostova, javna bezbednost

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1. CODES THAT MANDATE INSPECTIONS OF EXISTING STRUCTURES

In the United States, there is no single national code that mandates inspection procedures for all existing structures. The applicable requirements depend on the building type, location, age, occupancy, and whether repairs, alterations, or a change of use are planned. Generally, engineers and inspectors rely on a combination of building codes, standards, and local regulations.

A typical code as a basis for inspecting an existing building in the U.S. is:

- 2024 IEBC (or adopted edition),
- 2024 IBC (or adopted edition),
- ASCE/SEI 11 - Structural Condition Assessment of Existing Buildings,
- ASCE 7 - Minimum Design Loads,
- ACI 562 - Assessment, Repair, and Rehabilitation of Existing Concrete Structures.

2. PRIMARY CODES AND STANDARDS

The following summary outlines the primary codes and standards that generally apply across USA states unless superseded by local municipal codes that are typically derived from amended primary codes.

2.1 INTERNATIONAL EXISTING BUILDING CODE (IEBC)

The IEBC is the primary model code used by many states and jurisdictions for existing buildings. It addresses repairs, alterations, additions, change of occupancy, historic buildings and unsafe structures. When an existing structure is modified, the IEBC often defines when a structural evaluation is required and what level of upgrade must be performed.

2.2 INTERNATIONAL BUILDING CODE (IBC)

The IBC is used in conjunction with the IEBC. Existing structures undergoing major renovation may need to demonstrate compliance with portions of the current IBC, especially for: structural lodes; wind resistance; seismic performance; fire and life safety.

2.3 ASCE/SEI 11 – STRUCTURAL CONDITION ASSESSMENT OF EXISTING BUILDINGS

The ASCE/SEI 11 provides guidelines for evaluating the structural condition of existing buildings. It covers preliminary assessments; detailed condition assessments; material testing; evaluation of structural systems; reporting requirements. This standard is widely used by structural engineers when inspecting existing buildings.

Typical structural inspection requirements generally include:

- Document Review - original drawings; previous inspection reports; renovation records; maintenance history.
- Visual Assessment - cracks; settlement; corrosion; water damage; deformations.
- Material Evaluation - concrete testing; steel corrosion assessment; masonry investigation; wood deterioration.
- Load capacity Evaluation - dead loads; live loads; wind loads; seismic loads.
- Structural Analysis - verify current code adequacy, assess safety margins; determine rehabilitation needs.

3. SPECIAL INSPECTION PROGRAMS

Some jurisdictions impose mandatory periodic inspections. Those are typically governed by Municipal codes, and typically exist in large, densely populated cities. Some of them are:

- Florida: Milestone inspections for certain aging condominium and multifamily buildings;
- New York City: Facade Inspection & Safety Program (FISP, formerly Local Law 11);
- Chicago: Periodic inspections may be required for specific building occupancies, parking structures, or high-rise buildings;
- Many cities as Boston, Philadelphia, Washington D.C., San Francisco, Cincinnati, Cleveland have similar ordinances. The trigger height, inspection frequency, and reporting requirements vary by jurisdiction;
- Local requirements always govern over primary codes and standards.

3.1 FACADE ORDINANCES

Central goal for facade ordinances was to reduce the risk of injuries and fatalities from falling building materials through mandatory periodic inspections and repairs. Large densely populated cities like New York or Chicago have large inventory of older high-rise buildings clad with: brick masonry; limestone; terra cotta; precast concrete; metal and glass curtain walls (Figures 1 and 2).

Over time, weathering, corrosion, freeze-thaw cycles, water infiltration, and aging anchors can cause facade components to loosen or deteriorate. Several incidents involving falling facade materials highlighted the need for a formal inspection program to identify unsafe conditions before failures occurred.

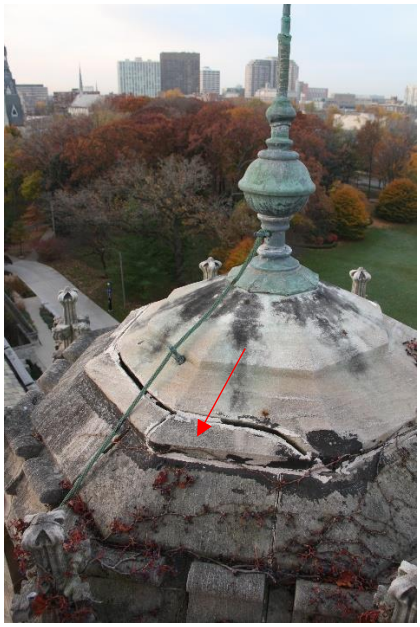

Figure 1: Spalled limestone at the cupola cap (red arrow)

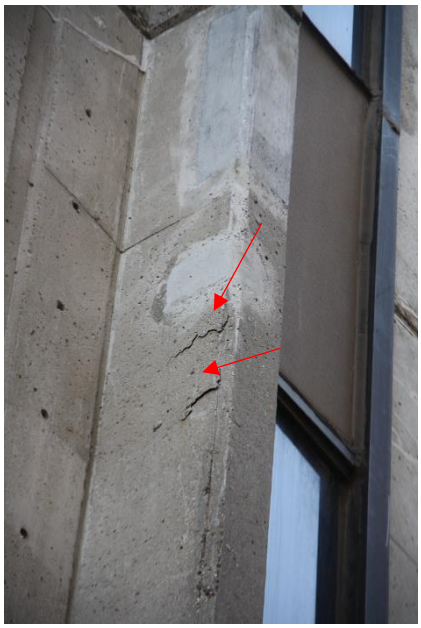

Figure 2: Spalled concrete on the facade mullion (red arrow)

The ordinance was therefore designed to: protect pedestrians and occupants; identify deteriorated facade conditions before they become hazardous. It requires systematic inspection by licensed architects or structural engineers. It also establishes repair and maintenance responsibilities for building owners.

The Chicago Facade Ordinance was enacted in 1996 as a public-safety measure after multiple incidents of facade materials detaching from high-rise buildings and falling onto sidewalks and

streets, creating hazards for pedestrians and property. For reference, the ordinance is currently implemented through Chicago Municipal Code §14A-6-603.2 (Exterior Walls of High-Rise Buildings) and the City's Rules Regarding the Maintenance of High-Rise Exterior Walls and Enclosures.

Chicago's ordinance became one of the earliest and most comprehensive facade inspection programs in the USA, similar in intent to New York City's facade laws. These ordinances were evolving over time with significant updates to the program rules as refining inspection procedures, reporting requirements, and compliance pathways.

Many high-rises constructed in the early and mid-20th century were reaching ages where concealed deterioration of anchors, shelf angles, and facade attachments became a growing concern. The updated rules placed greater emphasis on: building classification by facade system; critical examinations; exploratory openings for certain older masonry/stone/terra cotta facades with concealed anchors.

The ordinance applies primarily to buildings 24 meters or taller and requires periodic inspection and reporting by a licensed Illinois architect or structural engineer of:

- exterior walls,
- cladding systems,
- balconies,
- canopies,
- fire escapes,
- appurtenances attached to the building envelope.

Frequency and type of reporting vary for each municipality. As an example, in Chicago there are two types of reporting; Short Form Program and Critical Examination. Short Form Program (also called the Ongoing Inspection and Repair Program or "Short Form Only" Program) is a compliance option within Chicago's Exterior Wall Program that allows certain qualifying high-rise buildings to undergo periodic visual inspections instead of full hands-on Critical Examinations. It was formalized as part of the 2016 rule revisions. The program is intended for buildings with a demonstrated history of safe facade performance. Rather than requiring costly scaffold access and close-up inspections at every cycle, qualifying buildings may submit a visual inspection report every two years.

The comparison between two Chicago Facade Ordinance Programs

Table 1: The comparison between two Chicago Facade Ordinance Programs

Feature	Short Form Program	Critical Examination
Inspection method	Visual, at-distance	Close-up, hands-on
Scaffold required	Usually no	Yes
Probe openings	Generally no	May be required
Cost	Lower	Higher
Intended for	Buildings with good condition history	Higher-risk or non-qualifying buildings
Frequency	Typically every 2 years	Every 4, 8, or 12 years depending on category

Engineering Consideration – Even when a building is in the Short Form Program, the inspecting architect or structural engineer is expected to recommend a Critical Examination if visible conditions suggest potential hidden deterioration, movement, corrosion, or facade instability. The program reduces regulatory burden but does not eliminate the professional responsibility to investigate potentially unsafe conditions. In practice, many condominium and commercial high-rises with consistently good inspection histories use the Short Form Program to reduce inspection costs while maintaining compliance with Chicago's facade ordinance.

Facade regulations in New York City apply to buildings greater than six stories and requires a hands-on facade inspection every 5 years by a Qualified Exterior Wall Inspector (QEWI). The facade codes in New York City (NYC) are:

- NYC Construction Code §28-302.1,
- Facade Inspection & Safety Program (FISP), formerly Local Law 11.

Examples of typical critical/unsafe conditions include: loose or displaced masonry; cracked or unstable stone panels; corroded anchors or shelf angles; bulging walls; falling concrete or terra cotta; deteriorated balconies or appurtenances; and any other condition that could result in falling material and endanger pedestrians or occupants.

Immediate Actions Required - When an unsafe condition is identified, the inspecting architect or structural engineer generally must:

- Notify the building owner immediately;
- Recommend public protection measures, such as sidewalk canopies/sheds; barricades; fencing; street or sidewalk closures where necessary;
- Submit an inspection report to the building department identifying the unsafe condition.

In such circumstances the owner is typically required to:

- Retain qualified contractors and design professionals;
- Perform repairs in accordance with approved plans and permits where required;
- Maintain temporary protection until repairs are completed and verified.

Under Chicago's Exterior Wall Program, the engineer or architect's report may classify the building as: safe; safe with repair and maintenance program (SWARMP); unsafe. If classified unsafe, immediate stabilization and public-safety measures are generally required, followed by corrective repairs and reinspection.

In New York City's FISP program, unsafe conditions must be repaired, and owners are required to file an amended report after the repairs are completed. The city also requires public protection measures while hazards remain.

From a professional practice perspective, if architect or structural engineer discovers a condition that presents an imminent life-safety hazard, they generally have an ethical and legal obligation to notify the owner promptly and document the unsafe condition. Depending on local law, notification to the authority having jurisdiction may also be required.

3.2 EXTERIOR STEEL STRUCTURES

In the U.S., inspection of exterior steel structures is usually governed by local municipal building codes and maintenance ordinances, not a single national code. The applicable code depends on whether the steel is part of: building facade or enclosure; exposed structural frame; canopy, marquee, sign support, or tower; exterior fire escape; parking structure; steel lintels supporting masonry; shelf angles; steel framing associated with facades; balcony supports; fire escapes; exterior stairs; metal railings; water tower; other steel appurtenances attached to the building envelope.

Municipalities often supplement ordinances with engineering national standards such as:

- AISC 360 - Specification for Structural Steel Buildings,
- AISC 303 - Code of Standard Practice,
- ASCE/SEI 11 - Structural Condition Assessment of Existing Buildings,
- International Existing Building Code (IEBC),
- International Building Code (IBC).

These documents provide evaluation criteria for corrosion, section loss, connection deterioration, fatigue cracking, and structural adequacy of existing steel members.

Municipal codes commonly require inspection when: visible corrosion or section loss is observed (Figures 3 and 4); structural members are exposed to weather; falling hazards could affect the public way; major alteration or change of occupancy occurs; periodic facade inspections are mandated; A complaint, incident, or unsafe condition is reported.

Figure 3: Overall view of the steel fire escape

Figure 4: Corrosion built up between fire escape steel stringer and stair tread

In New York City, exterior steel inspections are handled primarily through the Facade Inspection & Safety Program (FISP), formerly known as Local Law 11. The focus is not on steel structures in general, but on any exterior element whose deterioration could create a public safety hazard. Buildings taller than six stories must undergo inspection every five years by QEWI. If the steel structure is not part of a building facade but standalone —for example: communication towers, sign structures, industrial steel frames and pedestrian bridges, those structures are typically regulated under other NYC Building Code provisions, owner maintenance requirements, and applicable engineering standards rather than the facade ordinance.

For comparison, NYC's approach is generally more stringent than Chicago's because it requires a citywide inspection cycle for virtually all buildings over six stories every five years, regardless of facade type.

Chicago has a specific ordinance for water tanks and their supporting structures, separate from the high-rise facade ordinance.

The relevant provisions are:

- Chicago Municipal Code §14A-6-603.4 – Tanks and Supporting Structures;
- Chicago Municipal Code §14A-6-603.3 – Exposed Metal Structures .

The ordinance applies to: water tanks with a capacity greater than 250 gallons that are exposed to the weather; freestanding tanks greater than 250 gallons (Figures 5 and 6); tank support structures (steel towers, steel frames, roof-top tank supports), whether or not a tank is currently installed or contains water.

Chicago requires periodic inspections by a licensed design professional (architect or structural engineer) for: water tank supports; steel tower structures; exposed steel members connections; bracing systems; corroded or deteriorated components.

Figure 5: Overall view of the water tower

Figure 6: Corrosion at steel connection plates

For a steel rooftop water tank or elevated steel water-tower support in Chicago, the inspection frequency is generally every 5 years, with additional inspections triggered by deterioration, damage, or unsafe conditions.

Typical steel-related deficiencies include: corrosion and rust; section loss; failed protective coatings; loose or failed connections; cracked welds; distorted members; water-induced deterioration; movement affecting attached facade materials.

The inspection evaluates whether such deterioration constitutes a safe, potentially unsafe, or unsafe condition. Typically, a close-up inspection of representative portions of the exterior wall system using: suspended scaffolds; rope access; lifts and other hands-on access methods. Ground-level visual observations alone are generally insufficient for the required examination.

If repairs are not completed on time, the owner may face: civil penalties and fines from the Department of Buildings (DOB); continued requirements for sidewalk canopies or other public protection measures, often for extended periods. DOB enforcement actions and violations; increased liability exposure if falling debris or structural failure causes injury or property damage.

Once deterioration reaches a point where debris could fall or structural capacity is compromised, engineers typically classify the condition as Unsafe and recommend immediate protection measures.

For owners, the most significant practical consequence of delaying facade or steel repairs is often the long-term cost of maintaining sidewalk canopies and the accumulation of DOB penalties, which can eventually exceed the cost of the repairs themselves. From an owner's perspective, the largest financial risk is often not the fine itself but: emergency stabilization work; long-term sidewalk protection; escalating repair costs due to continued deterioration and liability exposure if an incident occurs.

4. BRIDGES

The primary federal regulation for bridge inspections in the United States is the:

- National Bridge Inspection Standards (NBIS); 23 CFR Part 650, Subpart C - National Bridge Inspection Standards (NBIS).

The NBIS establishes the minimum national requirements for the inspection, evaluation, and inventory of highway bridges on public roads throughout the United States. It is administered by the Federal Highway Administration (FHWA). NBIS applies to:

- Highway bridges on all public roads,
- Federal-aid highways,
- State and local roads,
- Tribal bridges,
- Federally owned bridges,
- Certain private bridges connected to public roads on both ends,
- Temporary bridges and bridges under construction that are open to traffic.

4.1 INSPECTION

Under NBIS, bridge owners must: maintain an inventory of bridges; conduct regular safety inspections; use qualified bridge inspectors; document bridge condition ratings; report inspection data to FHWA; implement follow-up actions for critical findings.

Most highway bridges require routine inspection every 24 months (2 years) unless a different interval is justified by risk assessment and approved under NBIS procedures. Additional inspection types may include: fracture-critical inspections; underwater inspections; damage inspections after impacts, floods, fires, or earthquakes; special inspections for identified deficiencies.

The 2022 NBIS update requires bridge owners to identify and address critical findings, defined as structural or safety-related deficiencies requiring immediate action or follow-up inspection. Examples include: significant steel section loss; cracked fracture-critical members; scour threatening foundations; severe deck or girder deterioration; impact damage affecting load-carrying capacity

Inspections are typically performed in accordance with:

- NBIS (23 CFR Part 650 Subpart C),
- FHWA Bridge Inspector's Reference Manual (BIRM),
- AASHTO Manual for Bridge Evaluation .

BIRM is the primary guidance document used by bridge inspectors in the USA to perform inspections in accordance with the NBIS. The BIRM is guidance, not a law or regulation. It is published by the Federal Highway Administration FHWA and serves as the industry's foundational training and reference document. The manual provides procedures and guidance for: conducting bridge inspections; identifying and documenting defects; evaluating bridge condition; assigning condition ratings; recognizing critical findings; performing fracture-critical inspections; conducting underwater inspections; reporting inspection data under NBIS requirements

Inspectors learn how to evaluate: decks; superstructures; substructures; steel girders and trusses; bearings; connections and welds; timber members; concrete structures; masonry structure; culverts and short-span bridges.

For steel bridge inspection the manual discusses: corrosion assessment; section loss measurement; fatigue cracking; weld defects; riveted and bolted connections; gusset plate inspections; fracture-critical members (Figure 7); coating deterioration.

Common defects include: steel corrosion; pack rust; distortion and misalignment; concrete cracking and spalling; reinforcement corrosion; scour around foundations; impact damage; fatigue-related cracking.

The BIRM is commonly used by: State Departments of Transportation (DOT); county highway departments; municipal bridge owners; consulting structural engineers; FHWA inspectors; bridge inspection trainees.

For engineers involved in existing steel bridge inspections, the BIRM is often considered the equivalent of a "field handbook." It provides accepted methods for: visual inspection; defect recognition; documentation; condition rating; inspection planning; safety procedures.

Figure 7: Cracked steel girder

The standard training course is: National Highway Institute (NHI) Bridge Inspection Training Course. This FHWA-sponsored course is the foundational training for bridge inspectors and is widely required by State DOTs for NBIS-qualified inspectors. The NBIS also recognizes refresher training to maintain inspection quality and consistency. A bridge inspection Team Leader generally must have a combination of:

- Bridge inspection training.
- Bridge inspection experience.
- Additional education, professional licensure, or certifications as specified by NBIS and the bridge owner. Examples commonly accepted include: Professional Engineer (PE) license plus bridge inspection experience; engineering degree plus bridge inspection training and experience; extensive bridge inspection experience combined with approved training.

Specialized Training - Additional training may be required for certain bridge types or inspection activities:

- Fracture-Critical / Nonredundant Steel Tension Member inspections
- Underwater bridge inspections
- Movable bridge inspections
- Complex steel bridge inspections
- Damage inspections following collisions, floods, fires, or earthquakes.

Refresher Training - the 2022 NBIS includes provisions for bridge inspection refresher training to maintain competency and keep inspectors current with new procedures, technologies, and standards.

5. CONCLUSIONS

The inspection of existing structures in the United States is governed by a combination of national model codes, engineering standards, federal regulations, and locally adopted ordinances rather than by a single uniform framework. The reviewed examples demonstrate that inspection requirements depend on the structure’s type, age, location, exposure, occupancy, and potential risk to the public. Programs established in Chicago and New York City illustrate how periodic facade and exterior-steel inspections, condition classifications, hands-on examinations, and

mandatory protective measures can identify deterioration before it develops into an imminent hazard. Similarly, the National Bridge Inspection Standards provide a consistent federal framework for routine, special, and critical inspections of highway bridges.

Effective inspection programs depend on qualified professionals, appropriate access and testing methods, accurate documentation, and timely corrective action. Corrosion, section loss, cracking, spalling, connection deterioration, water infiltration, and fatigue can progressively reduce structural reliability and significantly increase repair costs when left unaddressed. Therefore, periodic risk-based assessment, prompt stabilization of unsafe conditions, and planned maintenance are essential not only for extending service life, but also for protecting occupants, pedestrians, infrastructure users, and building owners from avoidable safety, legal, and financial consequences.

REFERENCES

[1] International Existing Building Code (IEBC).

[2] International Building Code (IBC).

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[4] Chicago Municipal Code §14A-6-603.2 (Exterior Walls of High-Rise Buildings) and the City's Rules Regarding the Maintenance of High-Rise Exterior Walls and Enclosures.

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[6] NYC Construction Code §28-302.1.

[7] National Bridge Inspection Standards (NBIS): 23 CFR Part 650, Subpart C – National Bridge Inspection Standards (NBIS).