INTERNATIONAL CODE COUNCIL®

Ensuring the Safety of Existing Buildings:

Codes, Standards, and Periodic Inspections

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APPENDIX C – EXISTING BUILDING SAFETY INSPECTION GUIDE

Ensuring the Safety of Existing Buildings: Codes, Standards, and Periodic Inspections

INTRODUCTION

Florida's Building Code (FBC) is based on the model International Codes (I-Codes) developed by the International Code Council (ICC) through a national voluntary consensus process with input from leading experts from the private and public sectors. Florida maintains its building and safety codes through revisions and adaptations to the I-Codes on a three-year cycle.

According to the 2021 *Rating the States* report by the Insurance Institute for Business & Home Safety (IBHS), Florida ranks number one, leading the 18 Atlantic and Gulf coastal states in building code safety. The IBHS rating score is based 50% on statewide adoption and enforcement; 25% on state-adopted amendments for building official certification, training and continuing education; and 25% on state regulations for on-site implementation and proficiency based on contractor and subcontractor registration, licensing, and continuing education.

EXPERT PANEL DISCUSSION ON EXISTING BUILDINGS

In the wake of the collapse of the Champlain Towers South mid-rise condominium building in Surfside, Florida, the International Code Council (ICC), the Building Owners and Managers Association (BOMA), and the National Institute of Building Sciences (NIBS) convened a panel of subject matter experts from around the nation in West Palm Beach on August 17, 2021. The purpose was to share knowledge and recommendations on how communities monitor the safety of existing buildings, what guidance already exists, and how future catastrophic events may be avoided.

There were three panels, each focused on specific issues. The first panel was on "The Codes and Existing Buildings" and it was moderated by Dominic Sims, Chief Executive Officer of ICC. Panelists covered current building codes and standards that cover structural safety, existing buildings and property maintenance.

"Building Inspections" was the theme of the second panel moderated by Drew Rouland, Vice President of NIBS. These panelists discussed the current process for building inspections, including current guidelines for frequency, and what recommendations and practices of technologies will enhance building inspections in the future.

"Property Management and the Real Estate Industry" was the third topic. The panel was moderated by Ken Rosenfeld, Director of State and Local Affairs with BOMA International. Panelists discussed building safety from the perspective of property owners and managers, focusing on the overall systems of inspections, operations and maintenance.

Meeting participants generally agreed that the International Building Code's technical requirements, which have been incorporated in the Florida Building Code, currently provide the correct level of engineering guidance and safety for the construction of new buildings and alterations.

For context, ICC review of the property maintenance codes and regulations in 381 Florida jurisdictions found the following:

- Seventy-six jurisdictions (20%) have not adopted minimum building/property maintenance codes for existing buildings.
- Eighty-three jurisdictions (22%) reference model housing or existing building abatement codes/standards that were developed in the late 1970s.
- One hundred-thirty seven jurisdictions (36%) have implemented locally-developed property/building maintenance regulations or standards in lieu of a national model code or standard.

- Eighty-three jurisdictions (22%) have adopted the more modern *International Property Maintenance Code*.
- Less than 3% of jurisdictions have implemented a periodic recertification or inspection safety program for existing buildings.

TAKEAWAYS FROM THE PANELS DISCUSSIONS

- Communities are seeking better guidance for inspections of existing buildings, depending on local risk criteria.
- Owners need to keep building maintenance records available for inspection.
- More accountability is necessary; dangerous conditions must be reported to code (building) officials immediately.
- Timing and frequency of post CO inspections and recertification inspections must be considered.
- A uniform statewide property maintenance standard administered by local governments is critical for public safety and health of the real estate market.
- Continuous education and training for building managers, Code (Building) Officials and the building community is important.
- An analysis of existing and new technologies available to implement changes would provide great value to all stakeholders.
- Although building safety inspection programs are common, recertification programs are rare.

RECOMMENDATION

Adoption of a statewide property maintenance standard for existing buildings.

Maintaining the structural integrity of a building throughout its service life is of critical importance to the public's health and safety. The *International Property Maintenance Code* (IPMC) requires that both the building and the service/fire protection systems be maintained in good repair, and structurally sound. The IPMC with an appendix on inspection of existing buildings, would provide a ready-made solution for the State of Florida.

One inspection protocol for a state the size of Florida is not recommended. The geographic location of the building, local climate, risk of flooding, areas of high wind, soil conditions, the presence of salt air and other risk factors must be considered in order to focus on only the necessary existing buildings.

The purpose of the Existing Building Inspection Guide, Appendix C, is to recommend reasonable practices to ensure buildings are safe for continued use and occupancy.

The key criteria of Appendix C includes site specific inspection requirements based on the location of the building, including:

- The Use Classification of buildings and the required inspections based on the risk categories in the *International Building Code/FBC* in addition to and environmental risk exposures.
- Three phases of periodic inspections with specified frequency intervals over the service life of the building, performed by the following:
  - » **Maintenance inspection** performed by the Code (Building) Official, owner or owner’s authorized representative
  - » **Periodic inspection** performed by the Code (Building) Official or licensed design professional
  - » **Milestone special inspection** performed by a Special Inspector who is qualified and a registered engineer in the system discipline being inspected

- Details of each of the required inspections, including reference documents to be used for the inspections.
- Roles and responsibilities of all parties, including the Code (Building) Official.
- Criteria for assessing/identifying the existing design.
- Inspection of building construction materials and how environmental influences may affect their future performance.
- Inspection records, including sample inspection report forms.
- Resource materials providing additional information and guidance.

Appendix C
Existing Building Safety Inspection Guide
(Working Draft)

1. INTRODUCTION AND PURPOSE

Introduction

Maintaining the structural integrity of the building throughout its service life is of paramount importance. The ***International Property Maintenance Code*** **(IPMC)** requires both the interior and exterior of the building to be maintained in good repair and structurally sound so as to not pose a threat to public health, safety and welfare. Specifically, where the nominal strength of a structural member is exceeded by nominal loads, the load effects or the required strength, the building is determined to be unsafe and shall be required to be repaired or replaced to comply with the IBC/FBC. There are many such examples of unsafe conditions in the IPMC for both structural and non-structural considerations.

In order to assess whether an unsafe condition exists, this appendix provides guidance and evaluation criteria for the regular inspection of structural safety as well as the building envelope, electrical system, fire protection system and mechanical and plumbing systems.

An important criterion for the establishment of the necessary inspection frequency is the location where the building is sited. All buildings are not considered the same even where their occupancy, size, and height are similar. Each building must be considered unique based on its site location due to concerns in response to the following:

- Occupancy and Use Classification
- Risk Categories
- Environmental influences such as humidity, temperature, presence of salt air and chlorides
- Areas which are subject to frequent flooding
- Areas of high seismic and very high wind
- Site soil conditions such as questionable soils, expansive soils, ground water table, compacted fill, and rock strata

Purpose

The fundamental purpose of an Existing Building Inspection program is to confirm that the building or structure under consideration is safe for continued use under the present occupancy. As implied by the title of this document, this is a recommended program, and under no circumstances are these minimum recommendations intended to supplant proper professional judgment.

Such inspection shall be for the purpose of determining the general condition of the building or structure to the extent reasonably possible of any part, material or assembly of a building or structure which affects the safety of such building or structure and/or which supports any dead or designed live load, and the general condition of its electrical, mechanical, plumbing and fire protection systems.

The effects of time with respect to deterioration of the original construction materials must also be evaluated.

Visual examination will, in most cases, be considered adequate when executed systematically. The visual examination must be conducted throughout all habitable and non-habitable areas of the building, as deemed necessary by the inspecting professional to establish compliance. Surface imperfections such as cracks, distortion, sagging, excessive deflections, significant misalignment, signs of leakage, and peeling of finishes should be viewed critically as indications of possible concern.

Testing procedures and quantitative analysis will not generally be required except for such cases where visual examination has revealed such need, or where apparent loading conditions may be critical.

Manual procedures such as chipping small areas of concrete and surface finishes for closer examinations are encouraged in preference to sampling and/or testing where visual examination alone is deemed insufficient.

Generally, unfinished areas of buildings such as utility spaces, maintenance areas, stairwells and elevator shafts should be utilized for such purposes. In some cases, to be held to a minimum, ceilings or other construction finishes may have to be opened for selective examination of critical structural elements. A sufficient number of structural members must be examined to afford reasonable assurance that such are representative of the total structure.

When evaluating an existing structure for the effect of time, two basic elements must be considered:

1. Movement of structural components with respect to each other
2. Deterioration of materials

With respect to the former, volume change considerations, principally from ambient temperature changes, and possible long-time deflections, are likely to be most significant. Foundation movements will frequently be of importance (usually settlement) although upward movement due to expansive soils may occur.

Older buildings on spread footings may exhibit continual settlements if constructed on deep, unconsolidated, fine-grained or cohesive soils or from subterraneous losses or movements.

Structural deterioration will always require repair. The type of repair, however, will depend on the importance of the member in the structural system and degree of deterioration. Cosmetic repairs may suffice in certain non-sensitive members such as tie beams and columns, provided that the remaining sound material is sufficient for the required function. For members carrying assigned gravity or other loads, cosmetic repairs will only be permitted if it can be demonstrated by rational analysis that the remaining material, if protected from further deterioration, can still perform its assigned function at acceptable stress levels. Failing that, adequate repairs or reinforcement will be considered mandatory.

Structural problems in existing buildings may have catastrophic consequences. Just as important are potential hazards to building occupants caused by electrical deficiencies. These are often qualified under the following three headings:

1. Electric service
2. Branch circuits and raceways
3. Emergency lighting, essential power and fire alarm systems.

As such, they warrant special attention in terms of maintenance and periodic inspections.

For additional information on structural, electrical, mechanical and plumbing evaluations, see the “Resource Material” at the end of this appendix.

2. SCOPE/RESPONSIBILITIES

The owner or owner’s authorized representative of the building bears the responsibility for the maintenance of the building and for maintaining public safety.

Design professionals and special inspectors shall be used when required by Table 4.1 or when required by the Code (Building) Official.

The owner or owner's authorized representative is responsible for the orderly maintenance of buildings. Maintenance for the purpose of this appendix refers to all measures for maintenance of the planned condition or the assurance of unrestricted usability of a building. Servicing and regular inspections are essential elements of maintenance.

The Code (Building) Official shall ensure all existing buildings are maintained by the owner or owner's authorized representative in accordance with the *International Property Maintenance Code* and this appendix.

The inspections required by Table 4.1 are in addition to those required by the fire department, for active fire and life safety systems and equipment, commercial cooking systems, and elevators, as specified Sections 604, 606.3 and 901 of the *International Fire Code/FFC* (IFC).

3. TERMS

APPROVED AGENCY. An established and recognized agency that is regularly engaged in conducting tests, furnishing inspection services or furnishing product certification where such agency has been approved by the Code (Building) Official.

CODE (BUILDING) OFFICIAL. The officer or other designated authority charged with the administration and enforcement of this code, or a duly authorized representative.

DURABILITY. The condition of building elements or individual construction components that ensure the load-bearing capacity and the usability during the whole service life when subjected to reasonable maintenance.

EXTREME RAINFALL AREAS. (under development)

EXTREME SEISMIC AREAS. (under development)

EXTREME WIND AREA. Include areas where the ultimate design wind speed is 140 mph or greater and in Exposure Category D.

LIFETIME. The actual time during which a building or bearing element is structurally safe.

OWNER. Any person, agent, operator, entity, firm or corporation having any legal or equitable interest in the property; or recorded in the official records of the state, county or municipality as holding an interest or title to the property; or otherwise having possession or control of the property, including the guardian of the estate of any such person, and the executor or administrator of the estate of such person if ordered to take possession of real property by a court.

REGISTERED DESIGN PROFESSIONAL. An individual who is registered or licensed to practice their respective design profession as defined by the statutory requirements of the professional registration laws of the state or jurisdiction in which the project is to be constructed. This includes any registered design professional so long as they are practicing within the scope of their license, which includes those licensed under Chapters 471 and 481, Florida Statutes.

REGISTERED DESIGN PROFESSIONAL IN RESPONSIBLE CHARGE. A registered design professional engaged by the owner or the owner's authorized agent to review and coordinate certain aspects of the project, as determined by the building official, for compatibility with the design of the building or structure, including submittal documents prepared by others, deferred submittal documents and phased submittal documents.

RISK CATEGORY. A categorization of buildings and other structures for determination of flood, wind, and earthquake loads based on the risk associated with unacceptable performance.

TABLE 1604.5
RISK CATEGORY OF BUILDINGS AND OTHER STRUCTURES

RISK CATEGORY	NATURE OF OCCUPANCY
1	Buildings and other structures that represent a low hazard to human life in the event of failure, including but not limited to: ▪ Agricultural facilities. ▪ Certain temporary facilities. ▪ Minor storage facilities.
2	Buildings and other structures except those listed in Risk Categories 1, 3 and 4.
3	Buildings and other structures that represent a substantial hazard to human life in the event of failure, including but not limited to: ▪ Buildings and other structures whose primary occupancy is public assembly with an occupant load greater than 300. ▪ Buildings and other structures containing one or more public assembly spaces, each having an occupant load greater than 300 and a cumulative occupant load of the public assembly spaces of greater than 2,500. ▪ Buildings and other structures containing Group E or Group I-4 occupancies or combination thereof, with an occupant load greater than 250. ▪ Buildings and other structures containing educational occupancies for students above the 12th grade with an occupant load greater than 500. ▪ Group I-2, Condition 1 occupancies with 50 or more care recipients. ▪ Group I-2, Condition 2 occupancies not having emergency surgery or emergency treatment facilities. ▪ Group I-3 occupancies. ▪ Any other occupancy with an occupant load greater than 5,000.[a] ▪ Power-generating stations, water treatment facilities for potable water, wastewater treatment facilities and other public utility facilities not included in Risk Category 4. ▪ Buildings and other structures not included in Risk Category 4 containing quantities of toxic or explosive materials that: » Exceed maximum allowable quantities per control area as given in Table 307.1(1) or 307.1(2) or per outdoor control area in accordance with the *International Fire Code*; and » Are sufficient to pose a threat to the public if released.[b]

TABLE 1604.5
RISK CATEGORY OF BUILDINGS AND OTHER STRUCTURES

RISK CATEGORY	NATURE OF OCCUPANCY
4	Buildings and other structures designated as essential facilities, including but not limited to: ▪ Group I-2, Condition 2 occupancies having emergency surgery or emergency treatment facilities. ▪ Ambulatory care facilities having emergency surgery or emergency treatment facilities. ▪ Fire, rescue, ambulance and police stations and emergency vehicle garages ▪ Designated earthquake, hurricane or other emergency shelters. ▪ Designated emergency preparedness, communications and operations centers and other facilities required for emergency response. ▪ Power-generating stations and other public utility facilities required as emergency backup facilities for Risk Category 4 structures. ▪ Buildings and other structures containing quantities of highly toxic materials that: ▪ Exceed maximum allowable quantities per control area as given in Table 307.1(2) or per outdoor control area in accordance with the *International Fire Code*; and ▪ Are sufficient to pose a threat to the public if released.b ▪ Aviation control towers, air traffic control centers and emergency aircraft hangars. ▪ Buildings and other structures having critical national defense functions. ▪ Water storage facilities and pump structures required to maintain water pressure for fire suppression.

[a] For purposes of occupant load calculation, occupancies required by Table 1004.5 to use gross floor area calculations shall be permitted to use net floor areas to determine the total occupant load.

[b] Where approved by the building official, the classification of buildings and other structures as Risk Category 3 or 4 based on their quantities of toxic, highly toxic or explosive materials is permitted to be reduced to Risk Category 2, provided that it can be demonstrated by a hazard assessment in accordance with Section 1.5.3 of ASCE 7 that a release of the toxic, highly toxic or explosive materials is not sufficient to pose a threat to the public.

SERVICEABILITY. The property of a building or individual construction elements of being useable as planned and according to the specified conditions.

SERVICE LIFE. The planned period for which a building or individual construction elements can be used with regular maintenance, but without any significant restoration.

SPECIAL BUILDING ENVIRONMENTAL FACTORS (SBEF). Special building environmental factors are areas where natural conditions can impact a buildings performance or safety. Special attention must be paid to proper building maintenance and regular inspection, as specified in Table 4.1. SBEF areas include the following:

> **MARINE.** This includes areas that are regularly subject to marine spray, fog or mist, etc. where a building is exposed to brine or chlorides. This includes the area two miles landward of the Florida CCCL which is based on coastal engineering models, survey and bathymetric data and scientific principles that determine the upland or landward extent of the damaging effects of a 100-year storm event. For simplicity of application and enforcement, the Code (Building) Official may designate the local limits of marine risk environments using recognizable local landmarks.

FLOOD COASTAL A ZONE. Area within a special flood hazard area, landward of a V zone or landward of an open coast without mapped coastal high hazard areas. In a coastal A zone, the principal source of flooding must be astronomical tides, storm surges, seiches or tsunamis, not riverine flooding. During the base flood conditions, the potential for breaking wave height shall be greater than or equal to 1½ feet (457 mm). The inland limit of the coastal A zone is (a) the Limit of Moderate Wave Action if delineated on a FIRM, or (b) designated by the authority having jurisdiction.

COASTAL HIGH HAZARD AREA. Area within the special flood hazard area extending from offshore to the inland limit of a primary dune along an open coast and any other area that is subject to high-velocity wave action from storms or seismic sources, and shown on a Flood Insurance Rate Map (FIRM) or other flood hazard map as velocity Zone V, VO, VE or V1-30.

SPECIAL SOIL CONDITIONS. (under development)

For other terms not defined in this appendix, refer to the definitions in the *International Building Code/FBC* and *International Property Maintenance Code*.

4. BUILDING OCCUPANCIES/RISK CATEGORY ASSESSMENTS/INSPECTION FREQUENCY

Each building or structure shall be assigned a minimum frequency of required inspections based upon its structural design risk category as specified in the *International Building Code*, Table 1604.5, and its exposure to environmental factors in accordance with Table 4.1. The frequency intervals for existing building inspections shall be maintained for the service life of the building.

Exception: Detached one- and two-family dwellings and townhouses not more than three stories above grade plane in height with a separate means of egress, and their accessory structures not more than three stories above grade plane are exempt from the periodic inspection requirements.

Table 4.1 Use, Occupancy and Special Building Environmental Factors Frequency Intervals for Existing Building Inspections

IBC/IFC Use Risk Category	Special Environmental Factors	Maintenance Inspection	Periodic Inspection (in years)	Milestone Special Inspection (in years)
1 (e.g. Ag buildings)	No	Recommended	N/A	N/A
	Yes	Recommended	N/A	N/A
2 (e.g. commercial/ residential high-rise)	No	Annually	15 (N/A for buildings <4 stories or 3,500 sq.ft.)	30 (N/A for buildings <4 stories or 3,500 sq.ft.)
	Yes	Annually	10 (N/A for buildings <4 stories or 3,500 sq.ft.)	20 (N/A for buildings <4 stories or 3,500 sq.ft.)
3 (e.g. large assembly)	No	Annually	15	30
	Yes	Annually	10	20
4 (e.g. Hospitals)	No	Annually	5	20
	Yes	Annually	5	20

5. TYPES OF INSPECTIONS

A. Maintenance Inspection

Maintenance inspections required by Table 4.1 shall be a visual surveillance by the owner or owner's authorized representative and include the inspection of the building for obvious defects or damages and the documentation thereof.

This includes all load-bearing construction elements such as supports, walls, ceilings, joists, trusses, with a focus on deformations, misalignments, cracks, humidity, efflorescence, and corrosion.

In addition to the structural considerations noted above, the building envelope components (including balconies and roof), electrical system, fire protection system, and the mechanical and plumbing systems shall be inspected at the noted frequency interval to maintain public safety.

Written reports shall be required for all inspections and shall note the description of the type and manner of the inspection, noting problem areas and recommended repairs. All repairs requiring a building permit shall be submitted and approved by the Code (Building) Official.

B. Periodic Inspection

Inspections required by Table 4.1 may be performed by the Code (Building) Official or by a licensed design professional, as determined by the Code (Building) Official. The registered design professional shall be an architect or engineer.

ASCE 11 – 99, Guideline for Structural Condition Assessment of Existing Buildings, should be used when performing any structural inspection.

ASCE/SEI 30 – 14, Guideline for Condition Assessment of the Building Envelope, should be used when performing any building envelope inspection.

All inspection results, as well as any corrective measures necessary, must be documented and shall be provided to the Code (Building) Official.

C. Milestone Special Inspection

Inspections required by Table 4.1 at long-term milestones shall be performed by a Special Inspector. A special inspector shall be a registered engineer qualified and registered in the discipline for the system being evaluated (structural, electrical, mechanical). Such agency shall provide all information as necessary for the Code (Building) Official to determine that the agency meets the applicable requirements specified in the *International Building Code*, Sections 1703.1.1 through 1703.1.3.

The owner or owner's authorized representative, other than the contractor, shall employ one or more approved special inspectors to provide milestone inspections and tests on the types of work specified by the registered design professional in responsible charge of the periodic inspection as specified in Table 4.1.

The special inspector shall keep records of special inspections and tests, as required by the *International Building Code*, Section 1704, and shall submit reports of special inspections and tests to the Code (Building) Official, the registered design professional in responsible charge and the owner or the owner's authorized agent.

A final report documenting required special inspections and tests, and correction of any discrepancies noted in the inspections or tests, shall be submitted at a point in time agreed upon prior to the start of work by the owner or the owner's authorized agent to the Code (Building) Official.

The Code (Building) Official may perform additional inspections as necessary to approve the corrective action(s) necessary. The Code (Building) Official shall issue an updated CO (recertification) when the building is deemed safe by the special inspector, in accordance with local rules and procedures.

6. EXISTING DESIGN CONSIDERATIONS

A. Code of Record

The code of record used for the initial building design shall be the minimum building design. Certified copies of all building permits and approved construction documents, including as-built drawings, shall be maintained by the property owner and available on site.

B. Design Strength of Materials and Referenced Standards at time of construction

- Concrete and masonry grout mix designs for all structural components
- Prestressing tendons design strength/post tensioning pressures
- Structural Steel design strengths of primary and secondary members
- Cold-formed steel framing/cladding design strengths
- The design pressure rating of exterior windows and doors in the buildings

C. Subsequent Additions/Alterations/Repairs

The adopted edition of the *International Existing Building Code* (IEBC) used for any subsequent additions, alterations or repairs shall be the minimum building design for those elements.

Certified copies of all building permits and approved construction documents shall be maintained by the property owner and available on site.

7. BUILDING MATERIALS INSPECTIONS

Building materials are subject to aging over the course of their useful life. How quickly this progresses during the planned service life and to what extent properties of the building materials are altered depends on the building material, but also to a substantial degree on the type and intensity of the environmental influences.

Deterioration of building materials can only occur in the presence of moisture, mostly to metals because of their natural tendency to return to the oxide state in the corrosive process.

In a marine climate, highly aggressive conditions exist year-round. For most of the year, outside relative humidity may frequently be about 90 or 95%, while within air-conditioned buildings, relative humidity will normally be about 35 to 60%. Under these conditions moisture vapor pressures ranging from about ⅓ to ½ pounds per square inch will exist much of the time. Moisture vapor will migrate to lower pressure areas. Common building materials such as stucco, masonry and even concrete, are permeable even with these slight pressures. Where vapor barriers were not used for the existing building, condensation will take place within the enclosed walls of the building. As a result, deterioration is most likely adjacent to exterior walls, or wherever else moisture or direct leakage has been permitted to penetrate the building envelope.

The changes in the building material properties can be essential for the structural safety of a building. For this reason, it is important that these are examined in the regular inspections and evaluated.

A. Critical building material properties/potential impairments

Changes which can occur in building materials due to environmental influences are listed in Table 7.1.

Characteristics of a building material with reference to the structural safety of a building are its strength, rigidity, ductility, and its time- and load-related behavior.

For building materials mainly subject to compression, compressive strength is the decisive value, for building materials subject to tension or bending, tensile strength, as applicable in conjunction with shear strength, is of primary importance.

Changes in strength, generally the microstructure of the material reduction, are usually the result of changes in material structure. This is associated with a more or less pronounced reduction of the elasticity module so that even larger deformations can occur. This must be taken into account in the prognosis for the future behavior of the building structure.

Embrittlement of the materials micro-structure generally leads to a significant reduction in failure strain. This means that comparatively little deformation occurs which would indicate an imminent failure.

In addition to changes caused by environmental influences, strength and rigidity losses may also be caused by external loads, such as overloading or cyclical loads at an unplanned high level.

Table 7.1. Changes in Building Material Characteristics due to Environmental Influences

Material	Environmental Influence	Primary Consequence	Secondary Consequence
Steel	humidity	corrosion	reduction of cross section
	oxygen, hydrogen, nitrogen, phosphorous	embrittlement	reduction in ductility
	heat	hardening, softening	cracks
Aluminum	alkalis (mortar, building lime)	corrosion	reduction of cross section
Concrete	humidity, frost, chemicals	crumbling, cracks	loss of strength & stiffness
Masonry	humidity, frost, chemicals	weathering	reduction of cross section
Reinforced Concrete	carbonization, chlorides	corrosion of the reinforcement, cracks	reduction of cross section loss of strength & stiffness
Pre/post-stressed concrete	carbonization, chlorides	corrosion of the reinforcement, cracks	reduction of cross section loss of strength & stiffness
Wood	humidity, mold, insects	rotting	loss of strength & stiffness
Plastics	UV radiation	embrittlement, cracks	reduction in elongation

B. Identification of changes in the building

Some changes in the building material characteristics can be deduced from visible changes in the appearance of the construction element surface (weathering, corrosion, crack, etc.). This is why a vigorous visual inspection of buildings for these parameters is particularly important.

The environmental conditions can be important for the long-term behavior of the building materials (humidity, temperature, alternation of frost and thawing). Effects on the building physics (heat conductivity, condensation, etc.) must also be taken into account.

For a quantitative identification of the current building material and construction element characteristics (contamination profiles, corrosion, etc.) destructive and non-destructive test methods can be used. In the case of destructive test methods, the relevant characteristic data is generally gained directly. Samples are taken for this purpose without causing significant damage to the building, such as:

- Core drill sampling with direct strength test or direct determination of moisture content
- Sampling of core drills with direct determination of contaminants (chloride, sulphate content)
- Direct determination of the carbonization depth on fresh fracture surfaces
- Visual inspection of the state of corrosion of exposed reinforcement
- Determination of the depth of rot damage in wood by shaving off or drill/puncture resistance measurements
- Assessment of the type and condition of adhesives
- Taking samples from metallic construction elements for an analysis of chemical properties (spectral analysis), mechanical characteristics, susceptibility to brittle fracture (notched bar impact bending test) and the microstructural composition (microsection, structural characteristics, grain size)

Non-destructive test methods generally use indirect characteristics which make it possible to deduce the primary characteristics on the basis of more or less reliable correlations (often on an empirical basis). Non-destructive testing and the subsequent interpretation of the measurements requires experience and may only be performed by the approved special inspection agency. Examples of non-destructive testing include:

- Strength test on mineral building materials with a rebound hammer (primary tested characteristic: elastic behavior in the boundary zone)
- Tensile strength of metallic materials by hardness test
- Determination of microstructural dispersal by ultrasound (primary tested characteristic: ultrasonic transit time; comparative values from different test times are essential for this purpose)
- Moisture content determination by electrical resistance measurement or carbide method (CM)
- Determination of surface cracks using magnetic powder or pigment penetration methods
- Localization and determination of weak points (e.g. weld seams)
- Thickness measurement of the corrosion protection coating or metal coatings
- Wall thickness measurement (vernier)
- Measurement of the concrete cover

C. Evaluation of the examination results and assessment of the service life

The results gained during building inspections provide information about the building material characteristics at the time of testing. For a prognosis regarding further changes to the materials over time, the particular location (indoors, outdoors) and the environmental conditions to which the material in the respective construction element is exposed must be taken into consideration.

8. BUILDING DESIGN LOADS

An existing building may be exposed to the following loads:

- Dead loads and imposed loads
- Soil and water pressure
- Wind loads
- Seismic Loads
- Extraordinary actions, such as impact, explosion and wildfires
- Restraint from settlement and deformation
- Temperature and humidity
- Shrinkage and swelling
- Actions during construction, i.e., pre-tensioning, etc.
- Mechanical and chemical actions

For the assessment of the load-bearing capacity and the serviceability of an existing building, it is essential to consider the applicable loads based on the code of record for the original construction, particularly taking into account any design changes and change in use.

Models as well as the corresponding values (characteristics, measurements) of the loads must be determined in line with the safety concept. The actual values of the loads are often greater than the values applicable at the time when the building was constructed. It is also essential to correctly assess the nature of the loads (constant, pulsating, alternating).

9. INSPECTION RECORDS

A. Original Construction Design and Construction Documents

Figure 1 indicates the minimum type of construction documents that the owner must have readily available on site.

B. Existing Building Safety Inspection Log

The Existing Building Safety Inspection Log should provide an overview of the building, the basic data of the structural analysis and the permit documents and serve as a reliable source of information for the regular inspections by the licensed design professionals required by Tables 3.1 and 3.2 and the Code (Building) Official. Each report shall include a statement to the effect that the building is structurally safe, unsafe, or safe with qualifications.

Figure 2 is a sample the layout and the content of a typical Building Safety Inspection Log. The Building Safety Inspection Log shall be referenced while performing all periodic inspections and should also be maintained as an electronic document in PDF format.

If there are no copies of the approved construction documents available for an existing building, the Code (Building) Official must approve all documents, or measures that are necessary for the assessment of type of inspection(s) required. In such instances, it is imperative that the documentation is representative of the actual construction of the building.

C. Inspection Report Forms

See Figures 3 and 4 for sample inspection report forms for structural and electrical inspections, respectively.

FIGURE 1

EXISTING BUILDING SAFETY INSPECTION
(Structural Documents)

A. Approved Geotechnical/Soils Investigation Reports

B. Approved construction documents, as necessary

C. Structural design analysis and assumptions

D. Approved fabrication drawings for pre-cast or prefabricated structural elements

E. Approved erection plans for the load-bearing structure

F. Reports by the registered design professional of record

G. Monitoring reports by the registered design professional of record

H. Material test reports and inspection records

I. Final special inspection reports

J. Construction documents for any subsequent additions, alterations and repairs

FIGURE 2

EXISTING BUILDING SAFETY INSPECTION LOG
(Layout and content)

1. **Title sheet**
2. **Contents**
3. **Overview drawings**
   - 3.1 Views, cross sections of the building
   - 3.2 Copies of all approved architectural, structural, electrical, mechanical, plumbing and fire protection plans, and details
4. **Documents for structural analysis**
   - 4.1 Structural design analysis with construction description and data on building materials, site, applicable regulations and all assumed loads
   - 4.2 Construction/Erection/Fabrication drawings/details
5. **Copies of all building permits**
6. **Copies of all property owner inspection results**
7. **Copies of all registered design professional inspection results**
8. **Copies of all special inspection agency reports and test results**

FIGURE 3

(Figure 3 pdf)

Please download the form to your computer before filling out and submitting.

EXISTING BUILDING SAFETY INSPECTION REPORT FORM (STRUCTURAL)

INSPECTION COMMENCED

Date:

INSPECTION COMPLETED

Date:

INSPECTION MADE BY:

SIGNATURE:

PRINT NAME:

TITLE:

ADDRESS:

1. DESCRIPTION OF STRUCTURE

a. **Name on Title:**

b. **Street Address:**

c. **Legal Description:**

d. **Owner's Name:**

e. **Owner's Mailing Address:**

f. **Folio Number of Property on which Building is Located:**

g. **Building Code Occupancy Classification:**

h. **Present Use:**

i. **General Description:**

Addition Comments:

j. **Additions/Alterations/Repairs to original structure:**

FIGURE 3 (continued)
(Figure 3 pdf)

2. PRESENT CONDITION OF STRUCTURE

a. General alignment (Note: good, fair, poor, explain if significant)

1. Bulging
2. Settlement
3. Deflections
4. Expansion
5. Contraction

b. Portion showing distress (Note, beams, columns, structural walls, floor, roofs, other)

c. Surface conditions – describe general conditions of finishes, noting cracking, spalling, peeling, signs of moisture penetration and stains.

d. Cracks – note location in significant members. Identify crack size as HAIRLINE if barely discernible; FINE if less than 1 mm in width; MEDIUM if between 1 and 2 mm width; WIDE if over 2 mm.

e. General extent of deterioration – cracking or spalling of concrete or masonry, oxidation of metals; rot or borer attack in wood.

f. Previous patching or repairs

g. Nature of present loading indicate residential, commercial, other estimate magnitude.

FIGURE 3 (continued)
(Figure 3 pdf)

3. INSPECTIONS

a. Date of notice of required inspection ______

b. Date(s) of actual inspection ______

c. Name and qualifications of individual submitting report:

______

d. Description of laboratory or other formal testing, if required, rather than manual or visual procedures

______

e. Structural repair – note appropriate line:

1. ☐ None required
2. ☐ Required (describe and indicate acceptance)

______

4. SUPPORTING DATA

a. ______ **sheet written data**

b. ______ **photographs**

c. ______ **drawings or sketches**

5. MASONRY BEARING WALL = Indicate good, fair, poor on appropriate lines:

a. Concrete masonry units ______

b. Clay tile or terra cota units ______

c. Reinforced concrete tie columns ______

d. Reinforced concrete tie beams ______

e. Lintel ______

f. Other type bond beams ______

g. Masonry finishes – exterior

1. Stucco ______
2. Veneer ______
3. Paint only ______
4. Other (describe)

______

EXISTING BUILDING SAFETY INSPECTION REPORT FORM – STRUCTURAL www.iccsafe.org | page 3

FIGURE 3 (continued)
(Figure 3 pdf)

h. Masonry finishes – interior

1. Vapor barrier
2. Furring and plaster
3. Paneling
4. Paint only
5. Other (describe)

i. Cracks

1. Location – note beams, columns, other
2. Description

j. Spalling

1. Location – note beams, columns, other
2. Description

k. Rebar corrosion – check appropriate line

1. ☐ None visible
2. ☐ Minor – patching will suffice
3. ☐ Significant – but patching will suffice
4. ☐ Significant – structural repairs required

l. Samples chipped out for examination in spall areas:

1. ☐ No
2. ☐ Yes – describe color, texture, aggregate, general quality

FIGURE 3 (continued)
(Figure 3 pdf)

6. FLOOR AND ROOF SYSTEM

a. Roof

1. Describe (flat, slope, type roofing, type roof deck, condition)

2. Note water tanks, cooling towers, air conditioning equipment, signs, other heavy equipment and condition of support:

3. Note types of drains and scuppers and condition:

b. Floor system(s)

1. Describe (type of system framing, material, spans, condition)

c. Inspection – note exposed areas available for inspection, and where it was found necessary to open ceilings, etc. for inspection of typical framing members.

7. STEEL FRAMING SYSTEM

a. Description

b. Exposed Steel – describe condition of paint and degree of corrosion

c. Concrete or other fireproofing – note any cracking or spalling and note where any covering was removed for inspection

d. Elevator sheave beams and connections, and machine floor beams – note condition:

FIGURE 3 (continued)
(Figure 3 pdf)

8. CONCRETE FRAMING SYSTEM

a. Full description of structural system

b. Cracking

1. ☐ Not significant
2. ☐ Location and description of members affected and type cracking

c. General condition

d. Rebar corrosion – check appropriate line

1. ☐ None visible
2. ☐ Location and description of members affected and type cracking
3. ☐ Significant but patching will suffice
4. ☐ Significant – structural repairs required (describe)

e. Samples chipped out in spall areas:

1. ☐ No
2. ☐ Yes, describe color, texture, aggregate, general quality:

FIGURE 3 (continued)
(Figure 3 pdf)

9. WINDOWS AND DOORS

a. Type (Wood, steel, aluminum, jalousie, single hung, double hung, casement, awning, pivoted, fixed, other)

b. Anchorage – type and condition of fasteners and latches

c. Sealant – type of condition of perimeter sealant and at mullions:

d. Interiors seals – type and condition at operable vents

e. General condition:

10. WOOD FRAMING

a. Type – fully describe if mill construction, light construction, major spans, trusses:

b. Note metal fitting i.e., angles, plates, bolts, split pintles, other, and note condition:

c. Joints – note if well fitted and still closed:

d. Drainage – note accumulations of moisture

e. Ventilation – note any concealed spaces not ventilated:

f. Note any concealed spaces opened for inspection:

FIGURE 4

(Figure 4 pdf)

Please download the form to your computer before filling out and submitting.

EXISTING BUILDING SAFETY INSPECTION REPORT FORM (ELECTRICAL)

INSPECTION COMMENCED

Date: ____________

INSPECTION COMPLETED

Date: ____________

INSPECTION MADE BY: ____________

SIGNATURE: ____________

PRINT NAME: ____________

TITLE: ____________

ADDRESS: ____________

DESCRIPTION OF STRUCTURE

a. **Name on Title:** ____________

b. **Street Address:** ____________

c. **Legal Description:** ____________

d. **Owner's Name:** ____________

e. **Owner's Mailing Address:** ____________

f. **Folio Number of Property on which Building is Located:** ____________

g. **Building Code Occupancy Classification:** ____________

h. **Present Use:** ____________

i. **General Description, Type of Construction, Size, Number of Stories and Special Features:**

Additional Comments:

FIGURE 4 (continued)
(Figure 4 pdf)

1. ELECTRIC SERVICE

1. Size:	Amperage	( )	Fuses	( )	Breakers	( )
2. Phase:	Three Phase	( )	Single Phase	( )		
3. Condition:	Good	( )	Fair	( )	Needs Repair	( )

Comments:

2. METER AND ELECTRIC ROOM

1. Clearances:	Good	( )	Fair	( )	Requires Correction	( )

Comments:

3. GUTTERS

1. Location:	Good	( )	Requires Repair	( )
2. Taps and Fill:	Good	( )	Requires Repair	( )

Comments:

FIGURE 4 (continued)
(Figure 4 pdf)

4. ELECTRICAL PANELS

Location:

1. Panel #	( )	Good	( )	Requires Repair	( )
2. Panel #	( )	Good	( )	Requires Repair	( )
3. Panel #	( )	Good	( )	Requires Repair	( )
4. Panel #	( )	Good	( )	Requires Repair	( )
5. Panel #	( )	Good	( )	Requires Repair	( )

Comments:

5. BRANCH CIRCUITS

1. Identified:	Yes	( )	Must be identified	( )		
2. Conductors:	Good	( )	Deteriorated	( )	Must be replaced	( )

Comments:

6. GROUNDING SERVICE

Good ( ) Repairs Required ( )

Comments:

7. GROUNDING OF EQUIPMENT

Good ( ) Repairs Required ( )

Comments:

FIGURE 4 (continued)
(Figure 4 pdf)

8. SERVICE CONDUITS/RACEWAYS

Good ( ) Repairs Required ( )

Comments:

9. SERVICE CONDUCTORS AND CABLES

Good ( ) Repairs Required ( )

Comments:

10. SERVICE CONDUCTORS AND CABLES

Conduit Raceways:	Good	( )	Repairs Required	( )
Conduit PVC:	Good	( )	Repairs Required	( )
NM Cable:	Good	( )	Repairs Required	( )
BX Cable:	Good	( )	Repairs Required	( )

Comments:

11. FEEDER CONDUCTORS

Good ( ) Repairs Required ( )

Comments:

FIGURE 4 (continued)
(Figure 4 pdf)

12. EMERGENCY LIGHTING

Good (☐) Repairs Required (☐)

Comments:

13. BUILDING EGRESS ILLUMINATION

Good (☐) Repairs Required (☐)

Comments:

14. FIRE ALARM SYSTEM

Good (☐) Repairs Required (☐)

Comments:

15. SMOKE DETECTORS

Good (☐) Repairs Required (☐)

Comments:

FIGURE 4 (continued)
(Figure 4 pdf)

16. EXIT LIGHTS

Good ( ) Repairs Required ( )

Comments:

17. EMERGENCY GENERATOR

Good ( ) Repairs Required ( )

Comments:

18. WIRING IN OPEN OR UNDER COVER PARKING GARAGE AREAS

Require Additional

Good ( ) Repairs Required ( )

Comments:

19. OPEN OR UNDERCOVER PARKING GARAGE AREAS AND EGRESS ILLUMINATION

Require Additional

Good ( ) Repairs Required ( )

Comments:

EXISTING BUILDING SAFETY INSPECTION REPORT FORM – ELECTRICAL www.iccsafe.org | page 6

FIGURE 4 (continued)
(Figure 4 pdf)

20. SWIMMING POOL WIRING

Good (☐) Repairs Required (☐)

Comments:

21. WIRING TO MECHANICAL EQUIPMENT

Good (☐) Repairs Required (☐)

Comments:

22. ADDITIONAL COMMENTS

RESOURCE MATERIAL

I. STRUCTURAL EVALUATION – BACKGROUND

A. Foundations

If all the supporting subterranean materials were completely uniform beneath a structure, with no significant variations in grain size, density, moisture content or other mechanical properties; and if dead load pressures were completely uniform, settlements would likely appear uniform and of little practical consequence. Unfortunately, that is typically not the case. Significant deviations are likely to result in unequal vertical movements.

Monolithic masonry, generally incapable of accepting such movements, will crack. Such cracks are most likely to occur at corners, and large openings. Since, in most cases, differential shears are involved, cracks will typically be diagonal.

Small movements are most likely to be structurally important only if long term leakage through fine cracks may have resulted in deterioration. In the event of large movements, continuous structural elements such as floor and roof systems must be evaluated for possible fracture or loss of bearing.

Pile foundations are, in general, less likely to exhibit such difficulties. Where such does occur, special investigation will be required.

B. Roof Coverings

Sloping roofs, constructed of clay or cement tiles, are of concern in the event that the covered membrane may have deteriorated, or the tiles may have become loose. Large deflections, if merely resulting from deteriorated rafters or joists are of greater importance. Valley flashing, and base flashing at roof penetrations need to similarly be investigated.

Flat roofs with built up membrane roofs require investigation with respect to deflection considerations. Additionally, since roofing materials may be approaching expected life limits at the age when building special inspections are required, careful examination is important. Blisters, wrinkling, and loss of gravel are usually an indication of possible roof problems.

Punctures or loss of adhesion of base flashing, coupled with loose counterflashing will also signify possible problems. Windblown gravel, if excessive, and the possibility of other debris, may result in pounding, which if permitted, may impact the performance of the roof.

Gypsum roof decks will usually perform satisfactorily except in the presence of moisture. Disintegration of the material and the foam-board may result from sustained leakage. Anchorage of the supporting bulb tees against uplift may also be of importance if there is significant deterioration.

C. Floor Assemblies

Sagging floors will most often indicate problem areas. Floor and roof systems of cast-in-place concrete with self-centering reinforcing, such as paper backed mesh and rib-lath, may be critical with respect to corrosion of the unprotected reinforcing. Loss of uplift anchorage on roof decks will also be important if significant deterioration has taken place, in the event that dead loads are otherwise inadequate to resist uplift.

D. Masonry Bearing Walls

Random cracking, or if discernible, definitive patterns of cracking, as well as bulging, sagging, or other signs of misalignment may also indicate related problems in other structural elements. Masonry walls constructed of either concrete masonry remits or scored clay tile, may adversely impact adjacent reinforced concrete columns tie beams, or lintels.

E. Structural Steel/ Cold-Formed Steel Framing/Welding

Corrosion will be the determining factor in the deterioration of structural steel. Most likely suspect areas will be fasteners, welds, and the interface area where bearings are embedded in masonry. Column bases may often be suspect in areas where flooding has been experienced, especially if salt water has been involved.

Thin cracks usually indicate only minor corrosion, requiring minor patching. Extensive spalling may indicate a much more serious condition requiring further investigation.

Vertical and horizontal cracks where masonry units abut tie columns, or other frame elements such as floor slabs may be an indication of volume change resulting from moisture content, and variations in ambient thermal conditions versus the adjacent frame elements.

Moisture vapor penetration, sometimes abetted by salt laden aggregate and corroding rebars, will usually be the most common cause of deterioration. Tie columns are rarely structurally sensitive, and a fair amount of deterioration may be tolerated before structural impairment becomes important. Usually, if rebar loss is such that the remaining steel area is still about 0.0075 of the concrete area, structural repair will not be necessary. Cosmetic type repair involving cleaning and patching to effectively seal the member may often suffice. A similar approach may not be unreasonable for tie beams, provided they are not also serving as lintels. In that event, a rudimentary analysis of load capability using the remaining actual rebar area, may be required.

Steel bar joists are sensitive to corrosion. Most critical locations will be web member welds, especially near supports, where shear stresses are high, possible failure may be sudden and without warning.

Cold formed steel joists, usually of relatively light gage steel, are similarly sensitive to corrosion, and are highly dependent upon at least normal lateral support to carry designed loads. Bridging and the floor or roof system itself, if in good condition, will serve the purpose.

F. Concrete Framing Systems

Cast in place reinforced concrete slabs and/or beams and joists may often show deterioration due to corroding rebars resulting from cracks or merely inadequate protecting cover of concrete. Patching procedures will usually suffice where such damage has not been extensive. Where corrosion and spalling has been extensive in structurally critical areas, competent analysis with respect to remaining structural capacity, relative to actual supported loads, will be necessary. The type and extent or repair will be dependent upon the results of such investigation.

Precast members may present similar deterioration conditions. End support conditions including adequacy of bearing, indications of end shear problems, and restraint conditions should be evaluated in at least a few typical locations.

Concrete deterioration can occur due to the presence of salt-water aggregate or in excessively permeable concrete. In this respect, honeycomb areas may contribute adversely to the rate of deterioration. Columns are frequently most suspect. Extensive honeycomb is most prevalent at the base of columns, where fresh concrete was permitted to segregate during placement into the form boxes. This type of problem has been known to be compounded in areas where flooding has occurred, especially involving salt water.

In spall areas, chipping away a few small loose samples of concrete may be very revealing. Fairly reliable quantitative conclusions may be drawn with respect to the quality of the concrete. Even though the cement and local aggregate may be derived from the same sources, cement will have a characteristically dark grayish brown color in contrast to the almost white aggregate. A typically white, almost alabaster like coloration will usually indicate reasonably good overall strength. The original gradation of aggregate can be seen through a magnifying glass. Depending upon the structural importance of the specific location, this type of examination may obviate the need for further testing if a value of 2000 psi to 2500 psi is sufficient for required strength, in the event that visual inspection indicates good quality for the factors mentioned.

G. Wood Construction

Wood joists, rafters and wall framing are most often deteriorated due to “dry rot”, or the presence of termites. The former is most often prevalent in the presence of sustained moisture or lack of adequate ventilation. A member may usually be deemed in acceptable condition if a sharp pointed tool will penetrate no more than about ⅛" under moderate hand pressure.

Older wood framed structures, especially of the industrial type, are of concern in that long term deflections may have opened important joints, even in the absence of deterioration. Corrosion of ferrous fasteners will in most cases be obvious. Dry rot must be considered suspect in all sealed areas where ventilation has been inhibited, and at bearings and at fasteners. Penetration with a pointed tool greater than about ⅛" with moderate hand pressure, will indicate the possibility of further concern.

H. Windows and Doors

Window condition is of considerable importance with respect to two considerations: Leakage and anchorage. Deteriorating anchorage may result in loss of the entire unit in the event of severe windstorms. Perimeter sealant, glazing, seals, and latches should be examined with a view toward deterioration of materials and anchorage of units for inward as well as outward (section) pressures, most importantly in high-rise buildings.

II ELECTRICAL/FIRE ALARM SYSTEMS EVALUATION – BACKGROUND

A. Electrical Service

A description of the type of service supplying the building or structure must be provided, stating the size of amperage, if three (3) phase or single (1) phase, and if the system is protected by fuses or breakers. Proper grounding of the service should also be in good standing. The meter and electric rooms should have sufficient clearance for equipment and for the serviceman to perform both work and inspections. Gutters and electrical panels should all be in good condition throughout the entire building or structure.

B. Branch Circuit and Raceways

Branch circuits in the building must all be identified, and an evaluation of the conductors must be performed. There should also exist proper grounding for equipment used in the building, such as an emergency generator, or elevator motor.

All types of wiring methods present in the building must be detailed and individually inspected. The evaluation of each type of conduit and cable, if applicable, must be done individually. The conduits in the building should be free from erosion and checked for considerable dents in the conduits that may be prone to cause a short. The conductors and cables in these conduits should be chafe free, and their currents not over the rated amount.

C. Emergency Lighting/Essential Power/Fire Alarm Systems

Exit signs lighting and emergency lighting, along with voice annunciation systems and a functional fire alarm must tested to confirm they are in good working condition.

III MECHANICAL SYSTEMS – BACKGROUND

HVAC systems should be inspected to ensure energy efficiency and indoor air quality. If the building is located in a region prone to condensation, hire a commercial HVAC technician to periodically inspect the ductwork for excessive condensation and mold. The following should be considered during the inspections:

- Air filters cleaned and replaced as necessary
- Check for excessive noise or vibration when the blower motors or fans are running.
- Condensate drains/pans draining properly
- Motors and ductwork clean, no evidence of mold/moisture.
- Flexible duct connectors not cracked or leaking.
- Check for screws, latches, and gaskets that are in need of repair or replacement.
- Inspect the condition of all electrical hardware and connections.
- Make sure that the safety controls and equipment are working properly.
- Make sure that all guards and access panels remain secure.
- Check the operation of the interior and exterior mechanical equipment.
- Clean damper operators.
- Make sure that the mineral buildup inside water heater/boiler is kept at a minimum to ensure efficiency.
- Drain water heaters and boilers when necessary to remove any sediment that has accumulated.
- Clean/replace the boiler's oil filter once a month.
- Make sure thermostats are calibrated correctly.

IV PLUMBING SYSTEMS – BACKGROUND

The plumbing system for a building is vital for access to clean water and the removal of wastewater. The plumbing systems are inspected for general function and leaks and the water supply and drainage, waste and venting installations are inspected visually where accessible. Water heaters are inspected for leaks and probable life expectancy. The following should be considered during the inspections:

- Investigate any signs of leaks
- Verify free and fast flow of water in bathroom facilities, sinks, and drinking fountains
- Inspect all appliances with water connections
- Test water heaters and boilers
- Inspect and service water boosters and pump systems
- Inspect and service condensers (internal and external) for water fountains/dispensers
- Inspect sump pumps and sewage ejection systems

