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# Ensuring the Safety of Existing Buildings in Florida:

Codes, Standards, and  
Inspections (Draft 3.0)



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# Ensuring the Safety of Existing Buildings in Florida: Codes, Standards, and Inspections (Draft 3.0)

## BACKGROUND

In addition to Florida specific provisions, the *Florida Building Code* (FBC) is based on national consensus standards and 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 of updated construction standards on a three-year cycle.

Since the collapse of Champlain Towers South 12-story condominium, in Surfside, Florida; the International Code Council has been working with Building Safety Professionals, and other leaders to support efforts to assure that older existing buildings remain safe. Together with the Building Owners and Managers Association (BOMA), and the National Institute of Building Sciences (NIBS) a panel of subject matter experts from throughout the nation was convened 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.

Takeaways and recommendations from the meeting listed below were shared with the Florida Building Commissions, Hurricane Research Advisory Committee on August 27, in order to gain additional feedback.

- 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 Certificate of Occupancy (CO) 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.

## RECOMMENDATION

### **Adoption of a 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 systems be maintained in good repair, and structurally sound. Currently the Code Council with input from stakeholders, is developing an appendix guide on the best practices for inspection of existing buildings. The IPMC is a ready-made solution for Florida or individual jurisdictions that are considering the adoption of procedures to assess the safety of existing buildings.

Since a one size inspection protocol would not be the right solution for Florida, this guide is being developed based on Florida specific risks. The geographic location of the building, regional climate, risk of flooding, areas of very high wind, poor soil conditions, the presence of salt air and other risk factors are factors being considered to focus on only the right existing buildings. The purpose of the Existing Building Inspection Guide, Appendix C, is to give communities

an option to adopt an existing building monitoring program that takes a reasonable approach to ensure buildings are safe for continued use and occupancy. It also provides jurisdictions the choice and flexibility of how to administer the program with support from design professionals.

The key criteria of attached Working Draft 3.0 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 Florida Building Code 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 owner or owner’s authorized representative
  - » **Periodic inspection** performed by a Registered Design Professional
  - » **Milestone special inspection** performed by a Registered Design Professional who is qualified and a registered engineer in the system discipline being inspected in accordance with the professional registration laws in the state of Florida
- 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 and building owners.
- Inspection records, including sample inspection report forms.
- Resource materials providing additional information and guidance.

## COMMENTS

The Code Council received comments on Draft 2.1 from the following individuals. All comments have been reviewed and considered. Changes based on most of the comments are reflected in this Draft 3.0. A few comments warrant further review and input from the Hurricane Research Advisory Committee.

Written comments have been received from:

- Jim Schock, Chair
- Dan Lavrich, P.E.
- Angela Schedel, Ph.D.,P.E.
- Lawrence Murphy, CBO
- Rick De La Guardia, B.S.A.E., E.I., M. ASCE
- Florida Building Codes and Standards staff
- Timothy Trewyn, PE
- Larry Felker
- Andrew Schrader, PE
- James Guinan
- Bryan Holland, MCP
- Florida Engineering Society
- Jeff Schnellmann
- Kumar Allady
- Mike Silvers
- Anne Cope, PE
- Chris LaForte, PE
- Tom Goldsbury, PE
- Joe Belcher
- Steve Szoke, PE
- Troy Bishop, PE
- Bonnie Manley, PE

## Appendix C

# Existing Building Safety Inspection Guide

(Working Draft 3.0)

### 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 (including the roof) and the electrical system.

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 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.

#### Structural

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 systems.

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

Visual examination will only provide a qualitative assessment of structural conditions when executed systematically. At a minimum, 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, spalling, signs of corrosion or rot, distortion, sagging, excessive deflections, significant misalignment, signs of leakage, and peeling of finishes should be viewed critically as indications of possible concern. Adequate roof anchorage of mechanical system components and other roof top components such as solar panels are included in this visual examination.

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 create a critical situation.

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 subterranean 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. Such repairs require the notification of the Code (Building) Official and the issuance of a permit to perform the repairs.

### ***Electrical***

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

1. Electric service and other power production sources;
2. Feeders, branch circuits, wiring methods and materials; and
3. Utilization equipment for life and property safety.

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

Electrical service and other power production sources can include the utility supply, onsite renewable energy sources, energy storage systems, and standby generators.

Utilization equipment for life and property safety includes all the devices, equipment, and systems that keep the building and people safe from the above-mentioned electrical hazards.

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

## 2. SCOPE/RESPONSIBILITIES

The owner or owner’s authorized representative of the building bears the responsibility for the maintenance of the building, retention and filing of all maintenance and inspection records and for maintaining public safety.

Registered Design Professionals shall be used when required by Table 4.1 and Section 5.

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.

A maintenance/inspection summary shall be submitted to the Code (Building) Official at the conclusion of each inspection required by Table 4.1

The Code (Building) Official is authorized to require that 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 applicable laws, ordinances and statutes.

## 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 located. 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. See *Florida Building Code Table 1604.5* in this guide.

**FLORIDA BUILDING CODE 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: <ul style="list-style-type: none"> <li>▪ Agricultural facilities.</li> <li>▪ Certain temporary facilities.</li> <li>▪ Minor storage facilities.</li> <li>▪ Screen enclosures</li> </ul>   |
| 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: <ul style="list-style-type: none"> <li>▪ Buildings and other structures whose primary occupancy is public assembly with an occupant load greater than 300.</li> <li>▪ 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.</li> <li>▪ Buildings and other structures containing Group E or Group I-4 occupancies or combination thereof, with an occupant load greater than 250.</li> <li>▪ Buildings and other structures containing educational occupancies for students above the 12th grade with an occupant load greater than 500.</li> <li>▪ Group I-2, Condition 1 occupancies with 50 or more care recipients.</li> <li>▪ Group I-2, Condition 2 occupancies not having emergency surgery or emergency treatment facilities.</li> <li>▪ Group I-3 occupancies.</li> <li>▪ Any other occupancy with an occupant load greater than 5,000.<sup>a</sup></li> <li>▪ Power-generating stations, water treatment facilities for potable water, wastewater treatment facilities and other public utility facilities not included in Risk Category 4.</li> <li>▪ Buildings and other structures not included in Risk Category 4 containing quantities of toxic or explosive materials that:               <ul style="list-style-type: none"> <li>» 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 <i>Florida Fire Prevention Code</i>; and</li> <li>» Are sufficient to pose a threat to the public if released.<sup>b</sup></li> </ul> </li> </ul> |



**FLORIDA BUILDING CODE TABLE 1604.5**  
**RISK CATEGORY OF BUILDINGS AND OTHER STRUCTURES**

| RISK CATEGORY | NATURE OF OCCUPANCY  |
|---------------|--|
| 4             | <p>Buildings and other structures designated as essential facilities, including but not limited to:</p> <ul style="list-style-type: none"> <li>▪ Group I-2, Condition 2 occupancies having emergency surgery or emergency treatment facilities.</li> <li>▪ Ambulatory care facilities having emergency surgery or emergency treatment facilities.</li> <li>▪ Fire, rescue, ambulance and police stations and emergency vehicle garages</li> <li>▪ Designated earthquake, hurricane or other emergency shelters.</li> <li>▪ Designated emergency preparedness, communications and operations centers and other facilities required for emergency response.</li> <li>▪ Power-generating stations and other public utility facilities required as emergency backup facilities for Risk Category 4 structures.</li> <li>▪ Buildings and other structures containing quantities of highly toxic materials that: <ul style="list-style-type: none"> <li>▪ Exceed maximum allowable quantities per control area as given in Table 307.1(2) or per outdoor control area in accordance with the <i>Florida Fire Prevention Code</i>; and</li> <li>▪ Are sufficient to pose a threat to the public if released.<sup>b</sup></li> </ul> </li> <li>▪ Aviation control towers, air traffic control centers and emergency aircraft hangars.</li> <li>▪ Buildings and other structures having critical national defense functions.</li> <li>▪ Water storage facilities and pump structures required to maintain water pressure for fire suppression.</li> </ul> |

<sup>a</sup> 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.

<sup>b</sup> 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 (Florida specific risk data under development, see below):

**WIND-BORNE DEBRIS REGION.** Areas within hurricane-prone regions located:

1. Within 1 mile (1.61 km) of the coastal mean high water line where the ultimate design wind speed,  $V_{ult}$ , is 130 mph (58 m/s) or greater; or
2. In areas where the ultimate design wind speed is 140 mph (63.6 m/s) or greater.

For *Risk Category* II buildings and structures and *Risk Category* III buildings and structures, except health care facilities, the wind-borne debris region shall be based on Florida Building Code Figure 1609.3.(1). For *Risk Category* IV buildings and structures and *Risk Category* III health care facilities, the wind-borne debris region shall be based on Florida Building Code Figure 1609.3(2).

**MARINE.** This includes areas that are regularly subject to marine spray, fog or mist, etc. where a building is exposed to brine or chlorides.

**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.

**COASTAL BUILDING ZONE.** The land area from the seasonal high-water line landward to a line 1,500 feet landward from the coastal construction control line as established pursuant to s. 161.053, and, for those coastal areas fronting on the Gulf of Mexico, Atlantic Ocean, Florida Bay, or Straits of Florida and not included under s. 161.053, the land area seaward of the most landward velocity zone (V-zone) line as established by the Federal Emergency Management Agency and shown on flood insurance rate maps.

Link to Florida specific data similar to the ASCE 7 Hazard tool  
and the FDEP SLIP tool under development

**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.

**Exceptions** – The following are exempted from the required inspections of Table 4.1:

1. 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.
2. Hospital and hospital related facilities covered by the Joint Commission and AHCA accreditation surveys.
3. Educational facilities covered by the Florida State Requirements for Educational Facilities (SREF).

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

| <b>FBC Use Risk Category</b>                       | <b>Special Environmental Factors Applicable (Yes/No)</b> | <b>Maintenance Inspection</b> | <b>Periodic Inspection (in years)</b>                   | <b>Milestone Special Inspection (in years)</b>          | <b>Follow-Up Milestone Special Inspection (in years)</b> |
|--|--|-------------------------------|---|---|--|
| 1<br>(e.g. Ag buildings)                           | No   | Recommended                   | N/A   | N/A   | N/A  |
|  | Yes  | Recommended                   | N/A   | N/A   | N/A  |
| 2<br>(e.g. commercial/<br>multifamily residential) | No   | Annually                      | 15<br>(N/A for buildings<br><4 stories or 3,500 sq.ft.) | 30<br>(N/A for buildings<br><4 stories or 3,500 sq.ft.) | 10<br>(N/A for buildings<br><4 stories or 3,500 sq.ft.)  |
|  | Yes  | Annually                      | 10<br>(N/A for buildings<br><4 stories or 3,500 sq.ft.) | 20<br>(N/A for buildings<br><4 stories or 3,500 sq.ft.) | 10<br>(N/A for buildings<br><4 stories or 3,500 sq.ft.)  |
| 3<br>(e.g. large assembly)                         | No   | Annually                      | 15  | 30  | 10   |
|  | Yes  | Annually                      | 10  | 20  | 10   |
| 4<br>(e.g. Hospitals)                              | No   | Annually                      | 5   | 20  | 10   |
|  | Yes  | Annually                      | 5   | 20  | 10   |

## 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.

Knowledge of building science, exterior enclosure design, and construction principles and practice is required for this process. Alternatively, services of knowledgeable building design, restoration and/or maintenance professionals will be required.

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

In addition to the structural considerations noted above, the building envelope components (including balconies and roof), electrical 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

Periodic inspections required by Table 4.1 shall be a visual surveillance performed by a Registered Design Professional.

The owner or owner's authorized representative, other than the contractor, shall employ one or more approved Registered Design Professionals to provide periodic visual inspections.

The following guidelines are recommended for use:

- *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.
- *NFPA 70B – 19, Recommended Practice for Electrical Equipment Maintenance*

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

If additional special inspections or tests are recommended by the design professional, such special inspection or testing shall be performed by a qualified agency that meet the requirements of ASTM E329 and accredited by an accrediting body. The agency 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.

The Registered Design Professional shall notify the Code (Building) Official immediately of any imminent life-safety hazard which requires temporary shoring or occupant evacuation during repairs. Such repairs shall not commence until the shoring or occupant evacuation has been completed.

### C. Milestone Special Inspection

Milestone inspections required by Table 4.1 at long-term milestones shall be performed by a Registered Design Professional. The Registered Design Professional shall be qualified and registered in the discipline for the system being evaluated (structural and electrical) in accordance with the professional registration laws in the state of Florida. 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 and the *Florida Building Code*.

The owner or owner's authorized representative, other than the contractor, shall employ one or more approved Registered Design Professionals 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 Registered Design Professional shall keep records of special inspections and tests, as required by the *Florida Building Code*, 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.

The Registered Design Professional shall notify the Code (Building) Official immediately of any imminent life-safety hazard which requires temporary shoring or occupant evacuation during repairs. Such repairs shall not commence until the shoring or occupant evacuation has been completed.

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 require additional inspections as necessary to approve the corrective action(s) necessary.

## 6. INSPECTION RECORDS

### A. Design and Construction Documents

Figure 1 indicates the minimum type of original construction documents that the owner must have readily available on site. 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. This figure also includes construction documents for subsequent additions, alterations and repairs.

### 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 Table 4.1 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.

### **C. Inspection Report Forms**

See Figures 3 and 4 for sample inspection report forms for structural and electrical inspections, respectively. These forms are intended to be sample forms which can be customized as needed or replaced in their entirety. It is important to note that some type of equivalent record keeping report forms is imperative.

## FIGURE 1

### EXISTING BUILDING SAFETY INSPECTION (Structural Documents)

- A. Approved Geotechnical/Soils Investigation Reports
- B. Approved construction documents, as necessary
- C. Threshold buildings approved inspection plan/signed and sealed statement of inspection in accordance with the rules and regulations of the state of Florida
- E. Structural design analysis and assumptions
- E. Approved fabrication drawings for pre-cast or prefabricated structural elements
- F. Approved erection plans for the load-bearing structure
- G. Reports by the registered design professional of record
- H. Monitoring reports by the registered design professional of record
- I. Material test reports and inspection records
- J. Final special inspection reports
- K. Construction documents for any subsequent additions, alterations and repairs
- L. Maintenance records

## 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**
9. **Copies of all maintenance logs**



**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 MADE BY:

SIGNATURE:

**INSPECTION COMPLETED**

Date:

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)**

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

**c. 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.**

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

**e. Previous patching or repairs**

**f. 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:
- None required
  - 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 cotta units
- c. Reinforced concrete tie columns
- d. Reinforced concrete tie beams
- e. Lintel
- f. Other type bond beams
- g. Masonry finishes – exterior
- Stucco
  - Veneer
  - Paint only
  - Other (describe)

**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, scuppers and flashing and respective 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 MADE BY:

SIGNATURE:

**INSPECTION COMPLETED**

Date:

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 # | ( <input type="text"/> ) | Good | ( <input type="text"/> ) | Requires Repair | ( <input type="text"/> ) |
| 2. Panel # | ( <input type="text"/> ) | Good | ( <input type="text"/> ) | Requires Repair | ( <input type="text"/> ) |
| 3. Panel # | ( <input type="text"/> ) | Good | ( <input type="text"/> ) | Requires Repair | ( <input type="text"/> ) |
| 4. Panel # | ( <input type="text"/> ) | Good | ( <input type="text"/> ) | Requires Repair | ( <input type="text"/> ) |
| 5. Panel # | ( <input type="text"/> ) | Good | ( <input type="text"/> ) | Requires Repair | ( <input type="text"/> ) |

Comments:

**5. BRANCH CIRCUITS**

- |                |      |                          |                    |                          |   |
|----------------|------|--------------------------|--------------------|--------------------------|---|
| 1. Identified: | Yes  | ( <input type="text"/> ) | Must be identified | ( <input type="text"/> ) |   |
| 2. Conductors: | Good | ( <input type="text"/> ) | Deteriorated       | ( <input type="text"/> ) | Must be replaced ( <input type="text"/> ) |

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 | ( <input type="text"/> ) | Repairs Required | ( <input type="text"/> ) |
| Conduit PVC:      | Good | ( <input type="text"/> ) | Repairs Required | ( <input type="text"/> ) |
| NM Cable:         | Good | ( <input type="text"/> ) | Repairs Required | ( <input type="text"/> ) |
| BX Cable:         | Good | ( <input type="text"/> ) | Repairs Required | ( <input type="text"/> ) |

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:

**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

*This resource section is intended to provide additional information to aid in both the maintenance and inspection of existing buildings. The determination of how this information will be used is subject to review by the owner or the owners authorized representative and approval by the Code (Building) Official.*

### I STRUCTURAL EVALUATION

#### 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.

Structures near the shoreline which are not protected from beach erosion or other locations adjacent to altered ground levels and a high water table require investigation.

Where visual examination indicates a need for further evaluation and assessment of concrete foundation elements, such evaluation and assessment shall be performed in accordance with Chapter 4 of ACI 562 Code Requirements for Assessment, Repair and Rehabilitation of Existing Concrete Structures.

#### B. Roof Construction and Roof Coverings

The construction and anchorage of the roof to the load resisting elements of the building (gravity, uplift and lateral loads) are critical to the building's structural integrity. The roof must not only be designed to resist the imposed loads, but the method of anchoring the roof to the structural elements such as bearing walls and shear walls must be evaluated. As such, the anchorage must be checked for cracks and possible corrosion. Similarly, roof top units such as chillers and solar panels must be evaluated relative to their anchorage to the roof as well as confirmation of an adequate load path to the supporting elements.

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. Flat roofs also pose another possible hazard relative to ponding in the event that the roof drainage system becomes blocked. Such ponding not only induces an additional load on the roof, but also can accelerate degradation of the roofing material.

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.

Where visual examination indicates a need for further evaluation and assessment of concrete roof elements, such evaluation and assessment shall be performed in accordance with Chapter 4 of ACI 562 Code Requirements for Assessment, Repair and Rehabilitation of Existing Concrete Structures.

### **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.

Where visual examination indicates a need for further evaluation and assessment of concrete floor systems, such evaluation and assessment shall be performed in accordance with Chapter 4 of ACI 562 Code Requirements for Assessment, Repair and Rehabilitation of Existing Concrete Structures.

### **D. Masonry Bearing Walls**

Periodic inspection of mortar and grout in joints of masonry units is necessary to ensure integrity of joints and no loss of joint materials. 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 units or scored clay tile, may adversely impact adjacent reinforced concrete columns, tie beams, or lintels.

### **E. Structural Steel/ Cold-Formed Steel Framing**

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.

Vertical and horizontal cracks where masonry units abut steel structural elements or other 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.

Steel bar joists are sensitive to corrosion. Most critical locations will be web member welds, especially near supports, where shear stresses are high.

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.

References:

- AISC Design Guide 15 – 2018 Rehabilitation and Retrofit



## 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. The same applies to post tensioned slabs at the location where the stressing anchor is applied. 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. If non destructive testing is recommended by the Registered Design Professional to evaluate the in-situ concrete strength, such test shall be one of the following: testing of the concrete cores obtained and tested in accordance with ASTM C42 and conditioned in accordance with ACI 318; or by penetration resistance testing in accordance with ASTM C803. 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.

Moisture vapor penetration, sometimes abetted by salt laden aggregate and corroding rebars, will usually be the most common cause of deterioration. Repairs involving cleaning and patching of the concrete to effectively seal the member may often suffice. Where the rebar corrosion is significant, an analysis of load capability using the cross section of unaffected concrete and remaining actual rebar area may be required.

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.

The drainage and discharge of surface waters on slabs exposed to the elements must be assessed. Standing water can adversely impact the integrity of the concrete slab and possibly parts of the building located beneath the slabs. This is typically evaluated by assessing the proper slope of the slab and the methods of discharging the water. This issue can be exacerbated in buildings with flat concrete slabs above other parts of the building such as parking garages.

Where visual examination indicates a need for further evaluation and assessment of concrete framing systems, such evaluation and assessment shall be performed in accordance with Chapter 4 of ACI 562 Code Requirements for Assessment, Repair and Rehabilitation of Existing Concrete Structures.

## 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 1/8" 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  $\frac{1}{8}$ " with moderate hand pressure, will indicate the possibility of further concern.

Possible wood construction failures are locations which employ wood framing with stucco. Of note is the condition of the moisture barrier and fasteners which are often staples. The condition of the metal flashing (and its attachment) can be a possible source of water infiltration.

## **H. Exterior Envelope/Windows and Doors**

The exterior envelope plays a crucial role in maintaining the requisite weather resistance of the structure and its structural elements to make sure it is free from water penetration into the building. Special attention should be focused on cracking and water penetration around door and window openings for walls constructed with EIFS or stucco.

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. In order to do a proper assessment, the type of window and door must be assessed. This includes:

- Type: Sliding glass doors, side swinging doors, horizontal rolling windows, etc.
- Material: Wood, steel, aluminum, vinyl etc.
- Glazing: Annealed, heat strengthened, tempered, laminated, etc.
- Impact rating: Impact or non-impact rated for hurricane force winds
- Framing: Including anchor spacing and location; Mullions; True or false muntins;
- Weatherstripping: Condition of the installed weatherstripping

## II BUILDING MATERIALS EVALUATION

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 typically occurs in the presence of moisture.

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  $\frac{1}{8}$  to  $\frac{1}{2}$  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 below.

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.

## 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<br>loss of strength & stiffness |
| Pre/post-stressed concrete | carbonization, chlorides                | corrosion of the reinforcement, cracks | reduction of cross section<br>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.

### III DESIGN LOADS EVALUTION

An existing building may be exposed to the following loads:

- Dead loads and imposed loads
- Soil and water pressure
- Wind 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).

## IV EXISTING DESIGN EVALUATION

### A. Code of Record

The code of record used for the initial building design is the minimum building design. Where such documents are available, 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

The design strength of construction materials used in the original building construction play a critical role in structural analysis and design considerations. This includes but is not limited to:

- 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 *Florida Building Code – Existing Buildings* shall be used for any subsequent additions, alterations or repairs.

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

## V ELECTRICAL/FIRE ALARM SYSTEMS EVALUATION

### A. Electrical Service and Other Power Production Sources

A description of the service and other power production sources supplying the building or structure must be provided, including but not limited to the phase, voltage, and ampere ratings along with the type of overcurrent protection being provided. Grounding and bonding of the service and other power production sources should be in compliance with NFPA 70. Electric rooms should have sufficient working space and dedicated equipment space to allow for safe working and inspection practices to be performed. Auxiliary gutters, wireways, and electrical panels, switchboards, and switchgear should all be in good operational condition throughout the entire building or structure premises wiring system.

### B. Feeders, Branch Circuits, Wiring Methods and Materials

Feeders and branch circuits in the building must all be identified, and an evaluation of the wiring methods and materials must be performed. There should also exist proper grounding and bonding of devices, equipment and systems installed in the building, such as lighting, appliances and motors.

All types of wiring methods and materials present in the building must be detailed and individually inspected. The evaluation of each type of raceway or cable assembly, if applicable, must be done individually. The raceways in the building should be free from corrosion and checked for any physical damage. All conductors, cables and flexible cords should be damage free, and rated for the connected load.

### C. Utilization Equipment for Life and Property Safety

Means of egress lighting, illuminated exit signs and emergency lighting, along with voice annunciation systems and a functional fire alarm must be tested to confirm they are in good working condition. Other life and property safety devices including but not limited to ground-fault circuit interrupters, smoke detectors, carbon monoxide detectors, heat detectors, and surge-protective devices should be inspected and tested for proper operation.

### D. Emergency Lighting/Emergency Power

Exit sign lighting and emergency lighting shall be 100% tested. All required devices shall be present and each one tested when operating on both normal power, emergency power (where applicable), or battery power.

Emergency power systems shall be tested monthly and annually in accordance with NFPA 110 and the *Florida Building Code*. All required emergency systems and equipment shall be confirmed as operational under normal and emergency power such that the emergency power system is not overloaded.

### E. Fire Alarm Systems

Fire alarm systems and emergency voice alarm systems shall be tested as required by the *Florida Fire Prevention Code* and Chapter 14 of NFPA 72.

### F. Fire Protection Systems

Fire protection systems shall be inspected and tested in accordance with the *Florida Fire Prevention Code* and NFPA 25. Non water based fire extinguishing systems shall be inspected and tested in accordance with the applicable NFPA standards.