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A Look at Building Recertification in South Florida

BY **JOHN C. PISTORINO**, PE, SI

On June 24, 2021, a portion of a 12-story, concrete-frame condominium in Surfside, Fla., crashed to the ground, killing 98 people.

It was thought that collapses such as Champlain Towers South weren't supposed to happen. Miami-Dade County, and neighboring Broward County, had a 40/50-year building recertification program in place. No other jurisdiction in the country had such a program.

A Brief History

The only other poured-in-place concrete building to have collapsed in the United States — a federal building housing the Drug Enforcement Administration Miami Field Office — happened in downtown Miami on Aug. 5, 1974, killing seven.

At the time, my evaluation of the cause of the federal building collapse revealed that corrosion of embedded reinforcing steel had compromised the ability of concrete members to support the gravity loads.

The on-going corrosion of the steel had not been addressed, and the cracks in the concrete members (spalling) had been filled with caulking and aesthetically painted over on a continual basis. The building was originally constructed in 1925 and underwent renovations from time to time, so we considered the building was equivalent to a 40-year-old structure. An engineer had inspected and deemed the building safe six years before, in 1968.

We (Herbert M. Schwartz and Associates), as consultants to the Dade County Board of Rules and Appeals, were asked for a recommendation to prevent such an occurrence from happening again. We recommended that any building in Dade County older than 25 years be inspected by a competent structural engineer and be certified to be safe for occupancy. Many buildings were in this category, and ultimately the 40-year criteria were decided upon, with a follow-up every 10 years thereafter.

The South Florida Building Code (SFBC), a uniform building code for all of Dade County and its cities, incorporated Subsection 104.9, *Recertification* (1979 Edition).

Subsection 104.6, SFBC, *Structural Determination*, defined structural as "*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 removal of which part, material or assembly could cause, or to be expected to cause, all or any portion to collapse or to fail.*"

The building officials were required to send a "Notice of Required Inspection" to owners of buildings 40 years or older regarding recertification. The owner had to provide a written report, prepared by a Professional Engineer or architect registered in Florida, certifying that a building was structurally safe for the specified use or continued occupancy in accordance with the Recommended Minimum Procedural Guidelines for Building Recertification issued by the Building Official.

This applied to all buildings except single-family residences, duplexes, and minor structures. Minor structures have an occupant load of 10 or fewer and a gross area of 2,000 square feet or less.

"*The report shall only be made by an engineer or architect qualified by training and experience. The report must indicate the manner and type of inspection forming the basis for the report,*" as stated in the building code.

The recertification program was incorporated into the Miami-Dade County Ordinance, Subsection 8-11(f), *Existing Buildings,* because it was not carried through in the new Florida Building Code that replaced the SFBC in 2002. The last edition of the SFBC was 1994, and electrical recertification was added as a result of observations made in damaged buildings after Hurricane Andrew in 1992.

Recertification was also added to the Broward County Code Subsection 110.15.

Needless to say, the recertification program was intended to prevent a reoccurrence of the 1974 collapse.

Enforcement of Recertification Program

At this writing, it is unknown why Champlain Tower South collapsed. However, the incident revealed that many buildings in Miami-Dade and Broward counties, including Champlain Tower South, had not been recertified as required for one reason or another.

Irrespective of the recertification program, the SFBC required that buildings be maintained in a safe condition from the time they were constructed (SFBC Section 105, *Maintenance of Buildings and Property*). Building owners weren't intended to wait for 40 years before inspecting and maintaining their buildings. In fact, the 40-year recertification was envisioned to confirm that the building had been maintained and was safe for occupancy.

It would be a relatively easy task to prepare a Recertification Report if the building was properly maintained over its life. Unfortunately, this was not the case in many buildings where sufficient funds and reserves were not available, and therefore critical maintenance was deferred.

Because of the unique mandatory and legal requirements of the 40-year recertification program, owners of buildings are required to produce the engineering reports or face fines and possible eviction. The Building Official has the authority to withdraw occupancy permits and declare a building unsafe in the absence of a Recertification Report.

Current Status

Deferred maintenance has placed a major responsibility on structural engineers and architects to evaluate buildings that have been neglected and to make judgements as to the significance of the deterioration observed in such buildings. Therefore, the structural inspections have become more difficult as the significance and degree of spalling concrete in key structural elements — such as columns, beams, or slabs that are carrying significant and critical loading — must be made by the engineer.

Concrete buildings exposed directly to salt-laden air and rain and that may have workmanship deficiencies are candidates for concrete spalling deterioration long before the 40-year period has been reached. Deferred maintenance, such as painting and waterproofing, add to the potential for early significant deterioration of the building's structural elements.

The conclusion that an engineer or architect makes after conducting a 40-year structural inspection must be documented with a written opinion as to the continued safe occupancy of a building, even if the building requires significant repairs. Such judgement will be relied upon by the occupants and the Building Official, and with limitations as to when the repairs will be undertaken and completed. In fact, the common denominator is the judgement of the engineer/architect.

This is also true of the electrical engineer who is providing that phase of the recertification. Deficiencies in the maintenance of the electrical system may also lead to a potentially unsafe building.

Qualifications of Recertification Engineering/Architect Experts

The recertification program requires that the report be made only by a Professional Engineer or architect qualified by training and experience. The FBPE licensing program relies upon an engineer to provide services only in areas for which he or she is competent, as well as qualified. Therefore, the mere designation of "PE" after ones' name does not qualify an engineer to perform recertification inspections on buildings. As stated above, the occupants and building official must rely upon the *judgment of an engineer* as to whether a building should continue to be occupied.

Such judgments are life-safety decisions, and therefore, a Building Official may review the qualifications of an engineer and decide to accept a Recertification Report from the engineer or advise a building owner to obtain the services of another engineer/architect who, in the opinion of the Building Official, is qualified.

For purposes of this article, only the structural aspects will be discussed at this time.

The construction of a building and the significance of the load-carrying members must be well known by an inspecting engineer. Generally, this author is of the opinion that the engineer must be familiar with the design of buildings, as well as the activity during the construction phase. Such qualifications are similar to requirements for Special Inspectors (SI) of Threshold buildings, wherein minimum two years of design and three years of construction inspection are required by the Florida Board of Professional Engineers.

The SI is expected to observe all aspects of construction in new buildings and the repair of significant damage in existing buildings in accordance with the permitted plans. The permitted plans are used and not the shop drawings. The SI must measure the concrete cover that will be provided and observe the placement of concrete ensuring that required concrete sampling is taken. This experience during construction provides firsthand knowledge as to the original condition of concrete members as constructed. The concrete quality and workability are also observed, including curing methods used.

The significance of a damaged structural member must be recognized and identified by the engineer who understands what loads and what capacities members are carrying, as well as their connection details. This requires design experience wherein load paths are developed and reinforced concrete structural capacities are established for shear, moment, and flexure in accordance with American Concrete Institute (ACI) Standards and building frame load path distribution. Therefore, engineers/architects must assure and demonstrate to the end users (building occupants and the Building Official) their relative experience and capability regardless of how many years of work in the field. Simply being part of a design and construction team does not qualify an engineer/architect. However, prior responsibility, including the signing and sealing of structural documents during design and the construction phase, will help demonstrate the required knowledge.

The engineer who is inspecting a building may use full-time employees who are also engineers to assist in the actual inspections. Employees who assist the engineer (*duly authorized representatives*) are under the engineer's supervision and therefore can facilitate such inspections in a more timely and economical manner. A Building Official may require the employees to be identified by the engineer prior to conducting inspections.

Regarding Shoring

Familiarity with shoring techniques and capabilities is also a requirement when critical conditions are observed.

When cantilevered balconies are determined to be in imminent failure, shoring must be provided quickly. Most structural engineers are not qualified to specify shoring systems, as this is a specialty that revolves around shoring contractors and shoring-system manufacturers. Therefore, shoring engineers must be engaged who are familiar with a specific shoring system and its capabilities.

However, the inspecting engineer must recognize how the shoring will transfer loads and whether loads must be transferred all the way to the ground or distributed to other

supporting members. In such cases, a decision must be made as to the reliability of the shoring so that a building can remain occupied while corrective work is underway. The Special Inspector must confirm that shoring plans and calculations have been provided to the Building Official and that the specialty-shoring engineer has inspected the shoring system in place and approved it. The shoring must be maintained and reinspected frequently by the shoring engineer. An SI does have the experience of observing shoring installed and certified by a shoring engineer during original construction and can rely on that experience when observing an older building that will require shoring.

Shoring for the main load-bearing concrete-frame components (columns, girders, transfer beams, etc.) can be a major undertaking in a multistory building. Such shoring often requires the removal of all loading on the member being repaired. Complex shoring systems that transfer vertical loads down to the foundations can require intrusion into occupied spaces and apartments. A determination must be made whether to temporarily vacate a building that requires such shoring until the repairs have been made and the shoring removed.

In no case should substantial structural damage in which "there exists a significant risk of collapse, detachment, or dislodgement of any portion, member appurtenance or ornamental of the building or structure under service loads" [FBC-E] be allowed in an occupied building.

Reinforced Concrete

Cracks in concrete increase its permeability. The corrosion of embedded reinforcing steel affects the durability and load-carrying ability of structural elements especially in harsh environments where chlorides are present in the air and water.

The embedded steel is protected by the alkalinity of the concrete and therefore is resistant to corrosion. However, when chlorides reach the steel, an electrochemical reaction takes place in the presence of oxygen that causes the steel to corrode and expand, creating a force larger than the tensile strength of the concrete resulting in cracking, delamination, and ultimately spalling.

It is known that concrete that is underwater may not have significant corrosion due to the absence of higher levels of oxygen.

Information on the mechanism of corrosion of steel in concrete may be read in ACI 222R.

Other types of cracks may be the result of settlement, volume change, temperature changes, redistribution of loading, vibration, impact, overloading, excessive long-term deflection, and the effects of aging and other events during the life of a building, including the wind force of

hurricanes. The recertification inspector is expected to recognize the type of cracks, delamination, and spalling, and their significance and cause.

0-year Inspection Procedure

Engineers who inspect a building for the purpose of recertification should observe, as a minimum, the following procedures. (These are recommended procedures, and under no circumstances are these minimum recommendations intended to supplant proper professional engineering judgement.)

1. Undertake an initial, cursory inspection for the purpose of becoming familiar with the general condition of the structure. Photographs may be taken at this time.
2. Obtain the permit plans (original design) for the building if they are available.
3. Research the permit history of the building, and become familiar with the previous work undertaken on the building, including concrete repairs, additions, modification to the main structure, reroofing, window and door replacement, painting, guard-rail repair or replacement, waterproofing, expansion joints, and all items that could affect the structural frame of the building.
4. Obtain a list of observations or reports previously made by the management company or residents.
5. Identify persons most familiar with the condition of the building, such as building maintenance engineers who may have extended experience with many aspects of the building.
6. Obtain information on previous claims made to insurance companies, such as for hurricane damage, pool leaks, and water intrusion.
7. Obtain documentation on all service contracts, such as roofing.
8. Become familiar with the structural system and the main load-transfer components.
9. Create a check list of adjacent improvements that will be inspected, such as pool deck, seawall, retaining wall, rooftop equipment, etc.
10. Create a plan identifying and locating each structural component inspected, such as columns, soffit beams, and transfer beams. This will provide a documented history for each item to be included in follow-up inspections, including future 10-year recertifications.
11. Begin inspecting and evaluating at locations where the initial inspection documented deterioration and determined the failure mechanism.
12. Starting with the lower foundation or garage area, focus on the main supporting-load-bearing systems of the building (columns, pile caps, structural slabs, cast in place transfer beams and framing beams and joists. Observe and make note of each element observed.

13. For reinforced concrete, begin by using the traditional sounding technique of a tapping hammer. This method will provide a strong ping for solid concrete and a dull sound for hollow concrete that may have internal spalling, delamination of concrete cover, and void areas. The use of simple equipment, such as tape measures, depth gauges, keel markers, and caliper gauges, is recommended. Information is noted together with sketches, photographs, and even video. This is referred to as nondestructive testing (NDT) and allows for a quick determination of the overall condition. Soundings, as they are called, are the first of the NDT methods.
14. Observe all cracks, and denote their configuration with sketches. Pay particular attention to those that are subject or exposed to water intrusion. Determine the cause of such cracks if possible. Strain gauges may be installed on cracks that are not caused by corroding steel but may be the result of settlement, overstressing, or movement. Such strain gauges can be electrically monitored if desired. In addition, elevations of critical members may be established to monitor movement using benchmarks from a licensed land surveyor. The use of feeler gauges and crack-width meters will document the size of the cracks at the time of inspection.
15. Observe and note any corrosion stains and their sources.
16. If spalling is evident at the surface of concrete members, it may be removed with a handheld non-mechanical chipping hammer to expose the steel. A photograph of the condition should be made first. Such spalled concrete is no longer providing strength or support to the member and may be removed. Ensure that a maintenance person or assistant is available to collect and preserve the removed pieces. Spalled, damaged concrete is usually removed to expose sound concrete. The removed concrete may be tested for chloride ion, strength, sulfates, and carbonation.
17. Observe the condition of the embedded steel behind the removed spalled concrete, and measure its diameter. Compare the existing diameter with the original size as constructed.
18. Observe the bond of concrete behind the exposed embedded steel.
19. Evaluate the surrounding concrete for strength and consistency by observing and probing with a handheld tool. If the evaluation indicates low or significantly reduced characteristics, a core sampling location must be determined so that a laboratory can test the in-place concrete for strength, carbonation, sulfates, PH, and chloride ion content. Refer to ACI PRC-214.4-21 as a guide to obtain cores and interpret compressive strength results in accordance with ACI 301. The inspector can assess the issue of poor consolidation in the concrete by using nondestructive techniques of ACI 228.2R-13, *Report on Nondestructive Test Methods for the Evaluation of Concrete in Structures*.

20. In-place strength values including sample size and locations can be selected using ASTM E122-17 and ASTM C823/C823M. Obviously as sample size increases, accuracy improves, but do not risk weakening the structure.
. Other methods for NDT testing include the use of Ferroscan magnetic equipment and Profometer to locate embedded steel. Such equipment will establish the presence of steel and the concrete cover if the size of the steel is known. Ground penetrating radar (GPR) is another useful method to be used with a consultant that offers those services.
22. Review and become familiar with the *ACI SP-2 Manual of Concrete Inspection* by ACI Committee 311. In particular, Chapter 11 has detailed recommendations about using NDT methods and destructive sampling testing (DST) methods in Tables 11.1 and 11.2 of that Standard. Methods include Windsor Probe, pulse-echo, impact-echo testing, short-pulse radar, infrared wave, x-ray, and petrographic testing.

The Report

The engineer must decide on what concrete restoration is required based upon the potential hazard of a defect and the continued deterioration that can take place. Defects that affect the structural integrity and durability must be repaired. If the defect is a hazard that threatens safety, immediate remedies must be taken, such as emergency shoring or evacuation of the building, and the Chief Building Official must be notified.

While the report is not a document to be used to implement repairs, it can refer to ACI 546 R, wherein an engineer must be retained to specify the repairs to be made by a qualified contractor with building department permits in place. In general, the report must document surface imperfections, such as cracks, distortion, sagging, excessive deflections, significant misalignment, signs of leakage, and peeling of finishes, which are all indications of possible structural deficiencies in load-carrying capacity.

The fundamental purpose of the report is to confirm, in a reasonable fashion, that the building is safe for continued use under present occupancy, even if repairs are necessary.

It will most likely not be possible to visually examine all concealed construction, nor should it be generally necessary. However, a sufficient number of typical structural members should be examined to permit reasonable conclusions that are representative of the total structure.

Structural deterioration that is observed will always require repair.

Written reports attesting to each inspection must be required. The report must note the location of the structure, description of the type of construction, and general magnitude of the structure, the existence of drawings and location thereof, history of the structure to the

extent reasonably known, a description of the type and manner of the inspection, and problem areas and recommended repairs.

Each report must include a statement to the effect that the building is structurally safe, unsafe, safe with qualifications, or has been made safe. The following is a paragraph that this author created in 1974 to be included in such reports:

"As a routine matter, in order to avoid possible misunderstanding, nothing in this report should be a guarantee for any portion of the structure. To the best of my knowledge and ability, this report represents an accurate appraisal of the present condition of the building based upon careful evaluation of observed conditions, to the extent reasonably possible."

Who Gets the Report?

The client is the owner or association that retains the engineer and therefore the report is provided to that entity. Eventually, the report must be furnished to the Building Official by the client as part of the 40-year recertification process. However, and always, if critical deficiencies are identified, the Building Official must also be informed immediately about the condition and status.

We recommend that upon engagement, and as part of the contract, the client agrees that the engineer will also furnish the Building Official with the report by a specific time. The client usually wants enough time to evaluate the report, especially if repairs are necessary and financial considerations are made.

The client will then be able to advise the Building Official as to a schedule to complete any repairs and as to what safeguards may be put in place if necessary to maintain occupancy. Often the initial report is modified as repairs are made, and the Building Official is kept informed.

Report Categories

When drafting the report, consider these categories:

- Foundations
- Roofs, roofing
- Bearing walls
- Floor systems
- Concrete framing systems
- Steel framing systems
- Windows, wall openings

- Wood framing
- Railing

eport Outline

Reports should follow an outline similar to this:

1. Description of structure
   a. General description, type of construction, size, number of stories, and special features.
2. Present condition of structure
   a. Good, fair, poor — with explanation
   b. Describe and show areas of distress (beams, columns, walls, floors, roof, slabs)
3. Inspection
   a. Date of notice of required inspection
   b. Date(s) of actual inspection
   c. Name and qualification of individual submitting report
   d. Description on laboratory or other formal testing.
   e. Description of shoring as determined to be required
   f. Structural repair required (describe scope and condition)
4. Supporting data
   a. Field notes
   b. Photographs
   c. Drawings and sketches showing location and condition

Each jurisdiction may have its own reporting format. The engineer may need to submit additional documents that clearly identify the findings in a format that is appropriate for the actual description.

Summary

This article is a summary of the existing 40/50-year recertification program unique to Miami-Dade and Broward counties. It is probable that other jurisdictions throughout Florida may adopt similar recertification requirements for older buildings. This author has experienced deficiencies in structures far from coastal areas so that each jurisdiction may implement requirements based upon its own experience.

About the Author

John Pistorino, PE, SI, was appointed to the Florida Board of Professional Engineers in June 2021. He has over 50 years of experience as a Professional Engineer and over 35 years as a

Special Inspector of Threshold Buildings. In 1975, he wrote the 40-year building recertification program requirements for Miami-Dade County.

atest Events

FEMC Board Meeting (via zoom)

October 13 @ 9:00 am - 12:00 pm

FBPE Board Meeting (via zoom)

October 13 @ 1:00 pm - 5:00 pm

FBPE Board Meeting (via zoom)

October 14 @ 8:30 am - 12:00 pm

FBPE Probable Cause Panel Meeting (via zoom)

November 3 @ 8:30 am - 12:00 pm

FBPE Board Meeting/Application Review (via zoom)

November 3 @ 1:00 pm - 5:00 pm

FEMC Board Operations Committee Meeting (via zoom)

November 5 @ 9:00 am - 11:00 am

FEMC Board Meeting

December 8 @ 1:00 pm - 5:00 pm

FBPE Board Meeting

December 9 @ 8:30 am - 5:00 pm

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400 Mahan Dr.
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Phone: (850) 521-0500

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