KARINS ENGINEERING

1626 Ringling Blvd, Ste 400
Sarasota, FL 34236
(941) 927-8525
www.karins.com

Milestone Inspection Report

KEG Project #22RS-0498
February 8th 2023
FINAL REPORT

Report for:

Golden Strand Apartments, Inc.
109 The Esplanade South &
716 Grenada Blvd
Venice, FL 34285

Digitally signed by David Karins
DN: E=david@karins.com,
CN=David Karins,
OU=Engineering, O="Karins
Engineering Group, Inc.",
L=Sarasota, S=Florida, C=US
Date: 2023.09.20
11:57:08-04'00'

DAVID G. KARINS
LICENSE
No 0052677
STATE OF
FLORIDA
PROFESSIONAL ENGINEER

THIS ITEM HAS BEEN DIGITALLY SIGNED & SEALED BY DAVID G. KARINS, PE ON THE DATE ADJACENT TO THE SEAL

PRINTED COPIES OF THIS DOCUMENT ARE NOT CONSIDEDRED SIGNED AND SEALED AND THE SIGNATURE MUST BE VERIFIED ON ANY ELECTRONIC COPIES

KARINS® ENGINEERING

1626 Ringling Blvd. Suite 400
Sarasota, Florida 34236
(941)927-8525
Fax (941)927-8075
Karins.com

February 8th 2023

Mr. Mark Cox - Board Member
Golden Strand Apartments, Inc.
109 The Esplanade South
Venice, FL 34285

Via Email: markcoxdallas@gmail.com

RE: ***Golden Strand Apartments***
109 The Esplanade South, Venice, FL 34285
KEG File# 22RS-0498
Professional Engineering Services – Milestone Inspection

Dear Mr. Cox:

Karins Engineering Group, Inc. (KEG) agreed to render professional engineering services in connection with a Building Envelope and Structural Component Existing Condition at **Golden Strand Apartments, Inc., 109 The Esplanade South and 716 Grenada Blvd, Venice, FL 34285** (hereinafter called the "Project" and the "Client") on July 6th, 2022. Per the signed agreement dated July 6th, 2022, KEG made a site visit to Golden Strand Apartments in August of 2022 to complete a limited condition observation and evaluation of the building conditions and construction, as it relates to the building envelope and related structural components that are readily accessible.

Our observations are intended to identify significant deficiencies, problems, or ongoing maintenance concerns that are visible at the time of our observations; the intent of our review was to ascertain the general condition of these components and to make recommendations for appropriate repair and protection. This included an inspection of the exterior ground as well as walkways and balconies.

This structural inspection is for the sole purpose of identifying structural deficiencies of the building or structure that pose an immediate threat to life, safety, or where a failure of a critical component is imminent. This structural inspection shall be for the purpose of determining the structural 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.

Neither our observations nor this report is intended to address hidden defects, mechanical, electrical, architectural, code compliance, or other areas of the building not specifically mentioned herein. Our investigation was not intended to be exhaustive or to detect deficiencies except as specifically mentioned herein Due to the limited scope of this investigation, we cannot attest to the structure's compliance with applicable building codes and/or accepted construction techniques, except as noted herein. KEG did not attempt to verify the adequacy of the original design or supplant the responsibility of the Engineer of Record.

Aerial View of Golden Strand Apartments from Google Maps

LEGAL BRIEF:

The newly passed bill, CS/HB 5D creates a statewide building milestone inspection requirement for condominiums and cooperative buildings that are three (3) stories or higher in height thirty (30) years after initial occupancy and twenty-five (25) years after initial occupancy for buildings located within three (3) miles of the coast.

Golden Strand Apartments consists of two 5-story buildings with each story in each building being a living story. Golden Strand Apartments were built circa 1965.

Golden Strand Apartments does not appear to have substantial structural deterioration. This report meets the requirements of a Phase 1 inspection. An inspection every 10 years after this initial Phase 1 inspection will be required by Golden Strand Apartments.

Golden Strand Apartments currently does not require an additional more intensive Phase 2 inspection.

Karins is to provide this milestone Phase 1 inspection report to the local building official for Sarasota County and Golden Strand Apartments' community association is to make this report part of the association's official records. Golden Strand Apartments is also required to make this report available to all unit owners as well as any potential purchaser of a unit.

Further to this inspection report, Golden Strand Apartments is to conduct structural integrity reserve studies every 10 years. Karins is equipped to handle this task.

EXECUTIVE SUMMARY

Golden Strand Apartments are located at 109 The Esplanade South and 716 Grenada Blvd, Venice, FL 34285. Golden Strand Apartments units are located within two five-story midrise condominium buildings totaling 42 units located across from the Gulf of Mexico. Built circa 1965, units range from 855-1167 square feet. The building amenities and configuration include elevators, covered parking, and a pool to accommodate the residents.

The building's structural elements *appear* to be built with Reinforced concrete beams and columns, composite steel decking and joists for the floors with lightweight concrete overtop, infill Concrete Masonry Units (CMU), and a flat roof system comprised of a joist system with lightweight topping and TPO membrane. Stairs are Poured In Place concrete. The interior finishes appear to consist of conventionally built framing and drywall. The exterior-facing balconies and walkways connect to columns surrounding the exterior.

The building sits within 1000 feet of a shoreline to the west and has asphalt parking on the north and east sides of the complexes. Paving and sloping appear to be used for drainage.

Based on the scope of the inspection and for the areas that were able to be assessed, within a reasonable degree of engineering certainty, we have not observed any conditions that would compromise the safety of the building for its intended use and occupancy. We reserve the right to amend our opinion should new information be brought to our attention.

Golden Strand Apartments does not appear to have substantial structural deterioration. This report meets the requirements of a Phase 1 inspection.

GENERAL INFORMATION

KEG visited Golden Strand Apartments on 08/31/2022. During our visit, Karins observed the following building components with board members and maintenance staff:

- Roof – Flat roof
  - Roof Coating observed
  - AC stands observed
  - Gutters and Downspouts
- Ground Floor Structural Columns
- Walkways and Stairwells
- Interior of Units on every floor of each Building were entered
  - Esplanade – 403,402,304,302,301,204,202
  - Granada – 504,501, 404,303,204
- Laundry Rooms
- Exterior of Balconies
- General Overview of the Exterior

Karins visit was observational only. No destructive testing was undertaken during the tenure of our time at Golden Strand Apartments. At no time did Karins move or alter any unit configuration to view components or access items whether structural or non-structural (drywall over a structural wall was not inspected beyond a visual overview). Karins did not take note of the following:

- Major mechanical components beyond obvious deterioration
- Major electrical components beyond corrosion
- Major plumbing components beyond obvious and present leaks
- Doors and windows beyond visual inspection of sealants
- Inspection of exterior finishes beyond a ground-floor level view
- Foundations or groundwork
- Major drainage systems beyond its influence on erosion

Building plans were provided to Karins by the Client.

SCOPE OF STRUCTURAL INSPECTION:

1) Foundation
2) Concrete Systems, Structural Beams, and Columns
3) Roofing Systems
4) Exterior Finishes
5) Windows and Doors
6) Life Safety
7) Exterior Balconies

It was not found necessary to open any areas for inspection of typical framing members.

REFERENCES AND CONTACTS:

Karins had access to the following documents and discussed the making of this report with the following contacts:

Documents:

- Drawing Set Golden Strand - partial

Contacts:

- Gerry Kohlbecker
- Mark Cox Dallas

OBSERVATIONS

Figure 1 Esplanade Building (left) and Granada Building (right)

STRUCTURAL

Other than an explanation of critical factors that affect the structural integrity of buildings - such as spalling and rebar corrosion - all expanded knowledge and background about the conditions observed at Golden Strand can be further read and understood in Appendix A.

1. **Foundations**

The foundation, soils and accompanying systems were not observed or investigated at Golden Strand. The foundations are buried under ground and soil testing at this time was not offered as part of our structural scope.

The partial drawing set appears to show pile caps and auger cast piles as the foundation for Golden Strand.

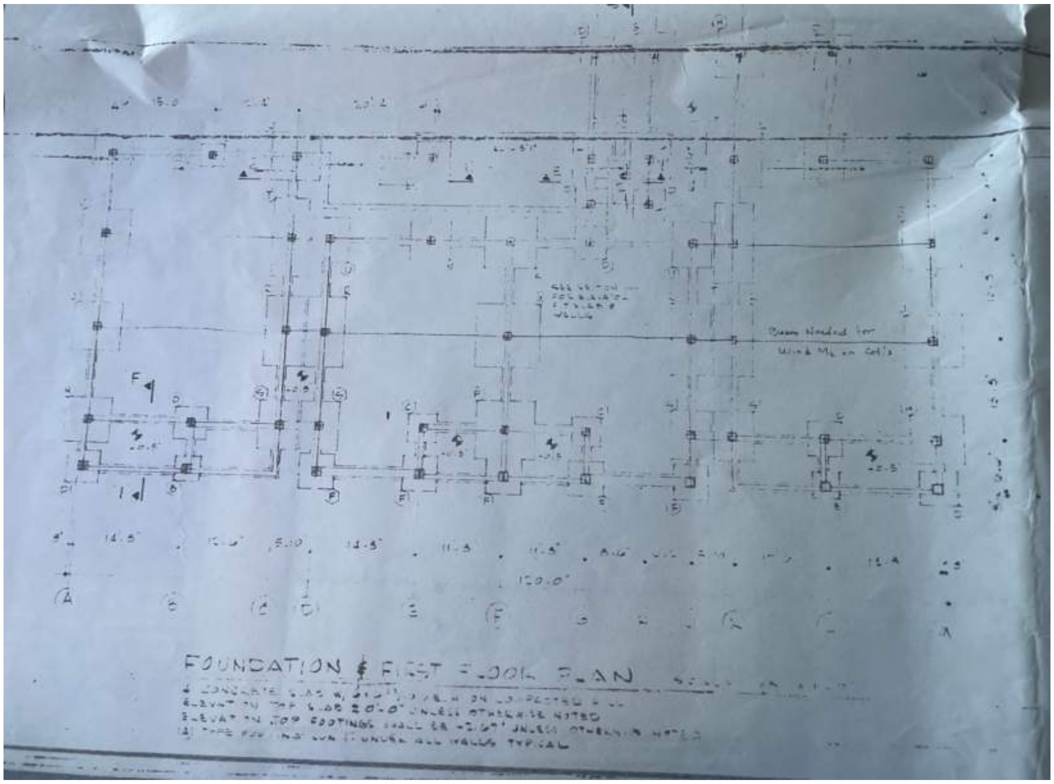

Figure 2 Foundation at Golden Strand

2. Concrete Systems, Structural Beams and Columns

A. Concrete Masonry Units

8" concrete masonry units (CMU block) were seemingly used as the building in fill material between the columns, beams and floors at Golden Strand. This means that anywhere there is a dividing wall (other than any shear walls) it appears to be from CMU block. This includes the stairwells and interior unit dividing walls. More than likely, corners are filled with grout and vertical rebar and any openings have vertical and horizontal rebar around the perimeter.

Figure 3 CMU construction in between columns

Figure 4 CMU wall in the stairwells

B. Clay tile Roof

This section does not apply to Golden Strand.

C. Reinforced concrete columns

Godlen Strand seemingly utilizes reinforced concrete columns throughout the entire building as its primary method of construction.

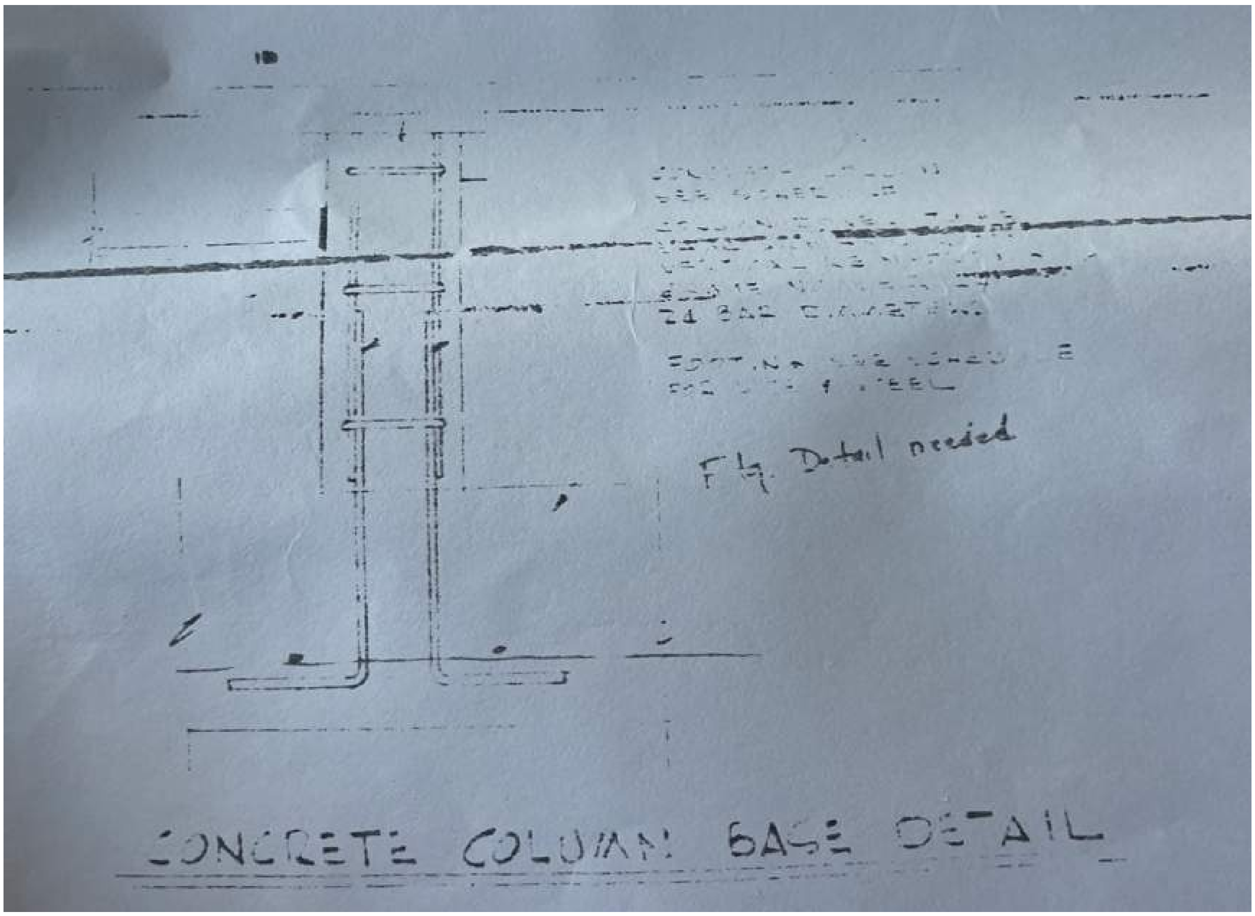

Figure 5 Drawing showing columns

These columns are seemingly connected via rebar to the probably pile caps at the foundation level and then connected to the floor plank planks all the way up to building. This applies to both buildings.

These columns are fully vertical and do not change planes or offset in any way.


Figure 6 Columns typical


Figure 7 Typical columns on exterior face

D. Beams –

Golden Strand seemingly uses beams to connect the columns and offer support for the bar joist floor system.

The beams are connected and embedded in any columns they cross.

Figure 8 Typical Beams at staircase

Figure 9 Typical Steel Beam configuration

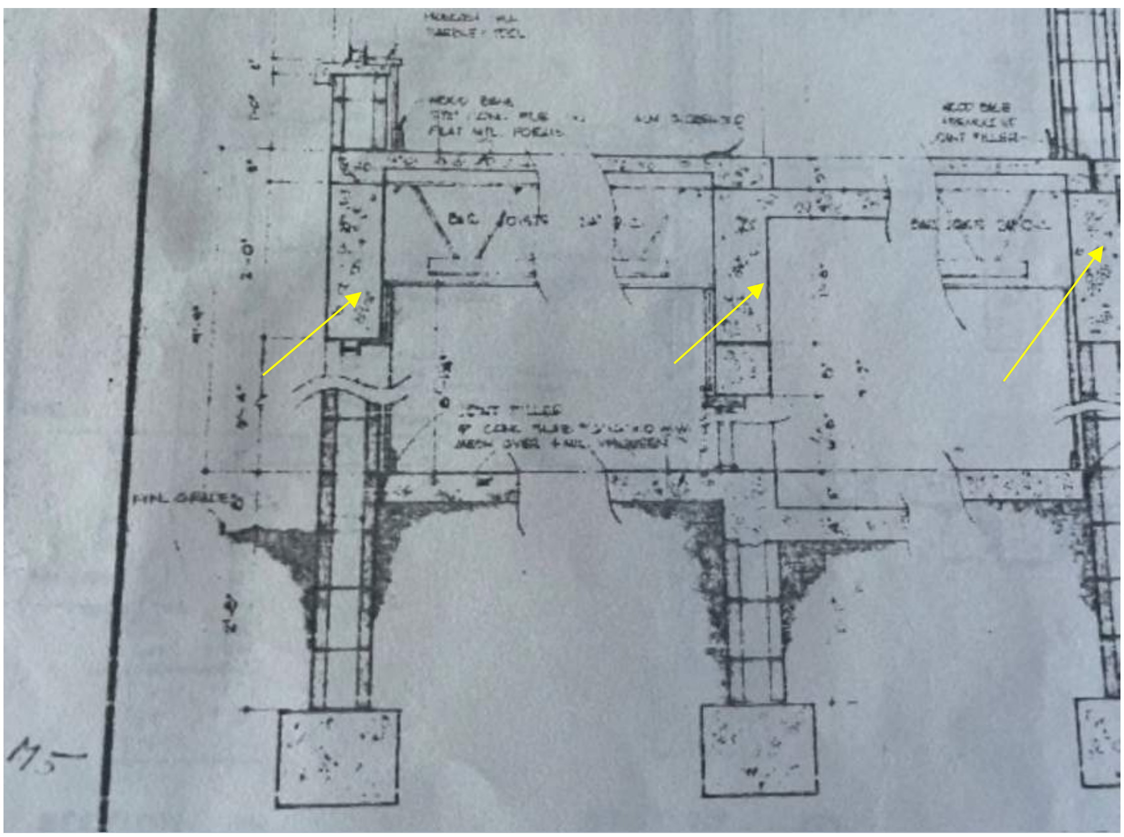

Figure 10 Typical beams as seen in the drawings

E. Lintels

Lintels are seemingly employed over exterior wall penetrations of the CMU buildings like window openings. These masonry U-block lintels are typically reinforced with rebar horizontally.

F. Other types – Stairs

Golden Strand appears to use a combination of columns, beams and stairwell CMU walls to prevent the building from sliding off its foundations due to seismic and wind lateral forces. This is a vertical element of a main resisting system. At Golden Strand, actuall shear walls as defined by the current code do not seem to appear or at least were not observed. The other two elements –beams and stairwells – appear to take the main force in the lateral resisting system.

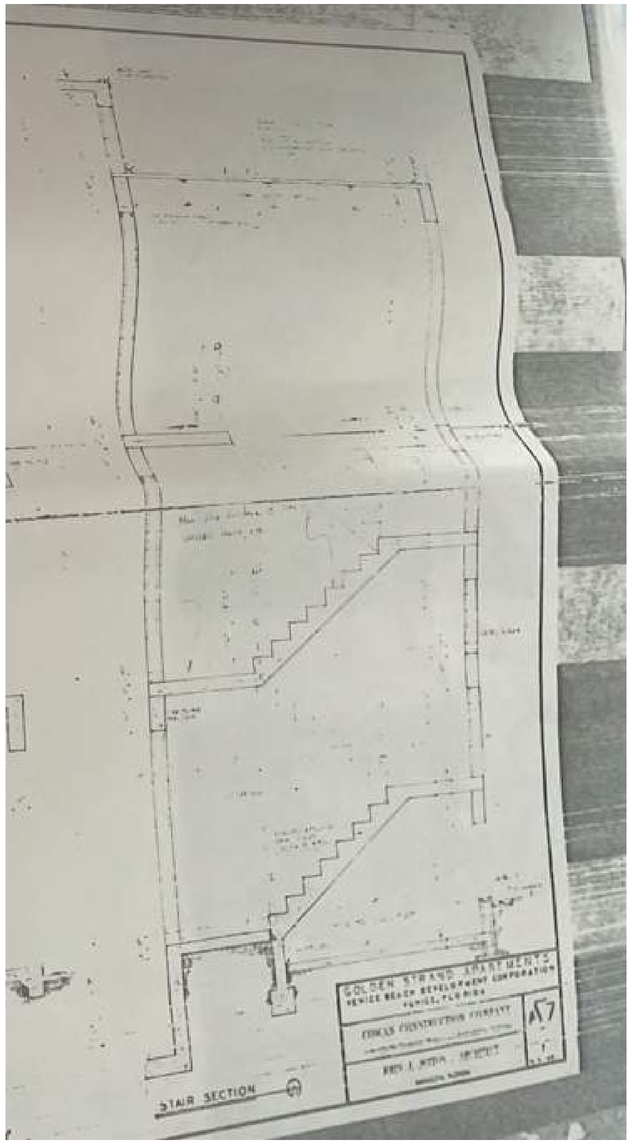

Figure 11 Poured CMU in stairwells at all buildings highly probable

Figure 12 Exterior Staircase

Figure 13 Interior of Maintenance Room showing framed wall, columns and beams

G. Floor Systems – Bar Joist System

Golden Strand is constructed with a Bar Joist system that uses formed steel pans, wire mesh reinforcement and lightweight concrete poured atop the steel pan decking.

Figure 14 Golden Strand Flooring System

Figure 15 Lihgtweight topping over steel pans

H. Structural Observations

Golden Strand uses a construction methodology of columns, in filled CMU block and hollow core planks for flooring. Due to its location in a high wind zone, along with characteristics inherent in any type of concrete, cracking will and has occurred.

Cracks – Karins identified crack sizes as such:

- HAIRLINE if barely discernible.
- FINE if less than 1mm in width.
- MEDIUM if between 1 and 2 mm in width.
- WIDE if over 2 mm.

Hairline and Fine Cracks

Hairline and fine cracks are visible in very few places at Golden Strand.

These hairline and fine cracks are of no structural concern and are considered shrinkage or movement cracks. Some cracks may be exterior finish or sealant related. See Appendix C.

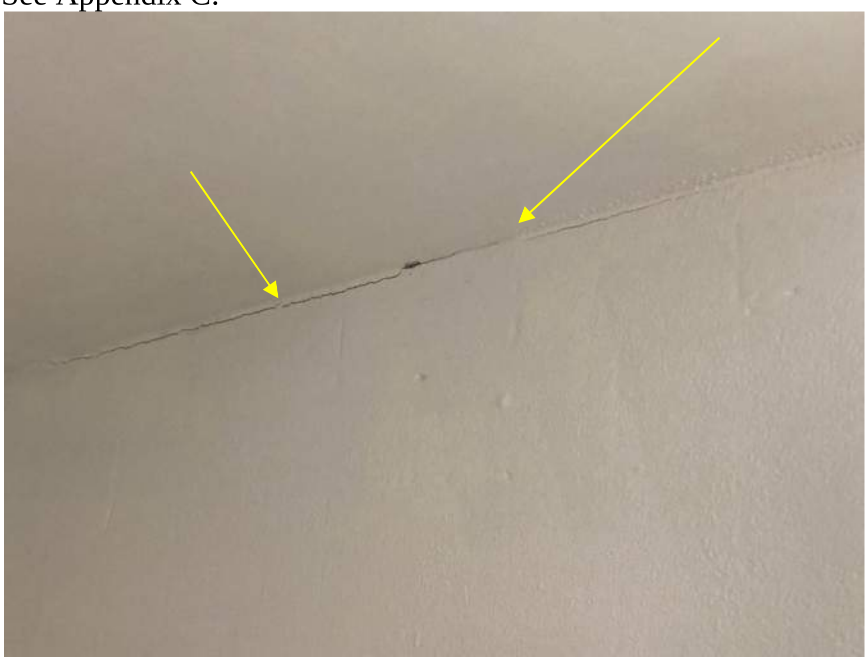

Figure 16 Typical finecracks

However, chlorides in the water migrating through the structural concrete plank results in corrosion of the reinforcing steel. This corrosion will eventually lead to structural failure of the concrete planks, beams and columns if waterproofing measures are not taken.

Medium and Wide Cracks

Medium and wide cracks were observed during our review at Golden Strand with respect to the window sills at Golden Strand**.**

Figure 17 One location of Window Sill cracking

Figure 18 One location of Stairstepping

I. Spalling

Overview of Structural Spalling

Evidence of cracking and deterioration generally becomes visible at beams, planks, columns and plank edges at the onset of spalling and exposed reinforcement. Concrete deterioration occurs due to nature's universal characteristic that all things tend toward a more stable state. Reinforcing steel as installed in concrete structures is a refined product whereby iron alloys are made to exhibit favorable strength characteristics. Unfortunately, these metal alloys are not chemically inert; i.e. outer electron valences are not full. Under favorable conditions, the metal reacts with available oxygen to create iron oxides, which are more stable than the original metal. When reinforced concrete is first placed, the surrounding concrete protects the reinforcing steel. Chemical characteristics of the concrete affect the oxidation reaction, creating a protective layer of non-expansive iron oxide around the reinforcing steel. This protective layer is known as a "passivating layer."

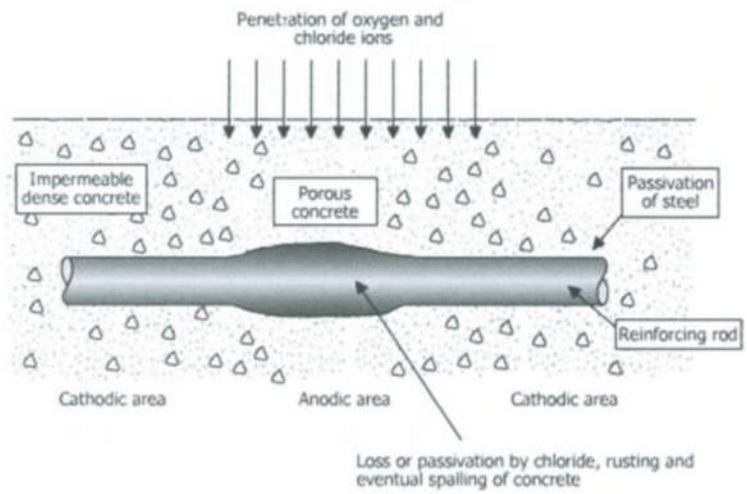

Figure 19 Corrosion of rebar

Following formation of the passivating layer, further oxidation does not occur if the characteristics of the concrete remain unchanged. However, as concrete is exposed to the elements, the chemical characteristics of the concrete change, resulting in an environment conducive to corrosive oxidization of the metal. The oxides formed by this reaction are considerably more voluminous than the base metal (up to eight times greater) and are commonly known as rust. Unlike the passivating layer, corrosive oxidation continues until all the base metal has been converted to iron oxides. In reinforced concrete, the results of this corrosion are a loss of strength and, eventually, collapse.

The corrosion of reinforcing steel in the concrete of coastal buildings is further affected by the presence of airborne salts. The salts are highly chemically reactive, accelerating the above-mentioned change in the chemical characteristics of the concrete. When in contact with the reinforcing steel, the salts react directly with the passivating layer and the metal, also accelerating the corrosion process. The corrosion of reinforcing steel is not only a chemical process, but an electrical one as well. The above-described reactions take place through the exchange of electrons. Consequently, electrical currents are generated within the reinforced concrete.

As corrosive oxidation takes place, the volume increase in the reinforcing exerts large tensile forces on the surrounding concrete, easily overcoming the concrete's relatively low tensile strength. To relieve these tensile forces, cracks and failure planes form in the concrete. As the corrosion continues, the concrete continues to crack (or delaminate) and eventually breaks off. Cracks that have propagated to the extent where concrete has broken off are known as spalls.
To reduce this problem of corrosion, the American Concrete Institute (ACI) has established minimum requirements for concrete cover. ACI currently prescribes a cover of 1-1/2" for smaller bar sizes in structural elements that are not protected from the elements. In normal environments, this cover should provide protection adequate to extend the life of a structure to its anticipated useful life, generally 50 years.

Prior to the 1970's, the requirement was 3/4" but was increased to its current level following studies of concrete porosity and resistance to chloride penetration by the U.S. Army Corps of Engineers, ACI, the International Concrete Repair Institute (ICRI), and others.
These minimum concrete cover requirements recognize that the chemical changes in the concrete as described above take time to occur, and, in general, protect the reinforcing for the anticipated life of the structure. However, corrosion frequently occurs before the design life of the structure is reached. Premature corrosion occurs due to concrete cover that is less than prescribed (generally due to construction errors in steel or concrete placement), poor quality concrete, cracks (which allow reactive chlorides a direct path to reinforcing steel), or exposure to corrosive environments.

Removing chloride-contaminated concrete and replacing it with fresh concrete is more likely to produce a durable repair rather than simply repairing what appears to be wrong. However, there is still no guarantee that the procedure will be 100% successful**. This is because it is extremely difficult to identify precisely how much concrete needs to be removed to ensure that future corrosion sites are eliminated. It is also very difficult to remove all chloride contamination from the reinforcement; particularly where pitting corrosion has occurred. And, most of all, a repair of this nature may, in many situations, accentuate corrosion in the reinforcing steel adjacent to the repair area. This phenomenon is often called ring anode corrosion or halo effect**.

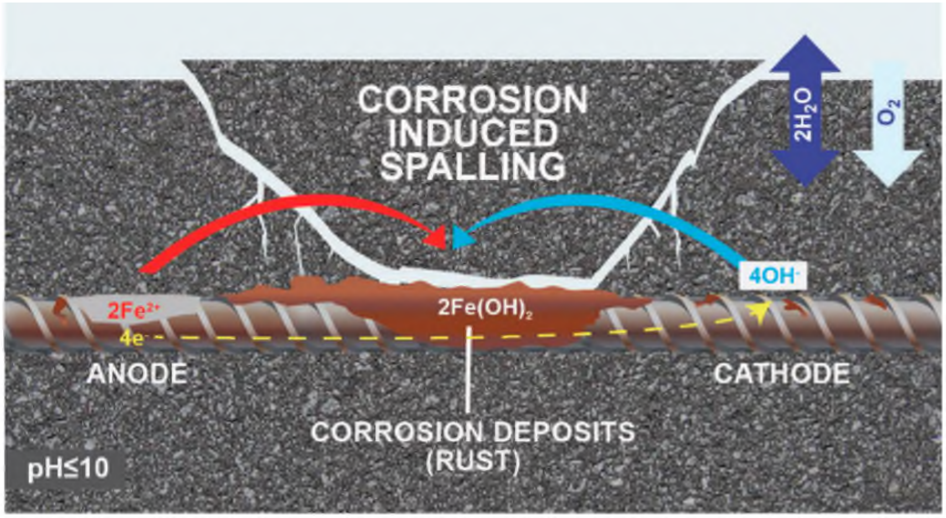

Figure 20 Before Halo Effect

Ring anode corrosion results from electro-chemical incompatibilities between the repair and the substrate concrete. Differences between the base concrete and the repair can create differences in electrical potentials that drive new corrosion cells across the interface between the patch and the substrate concrete.

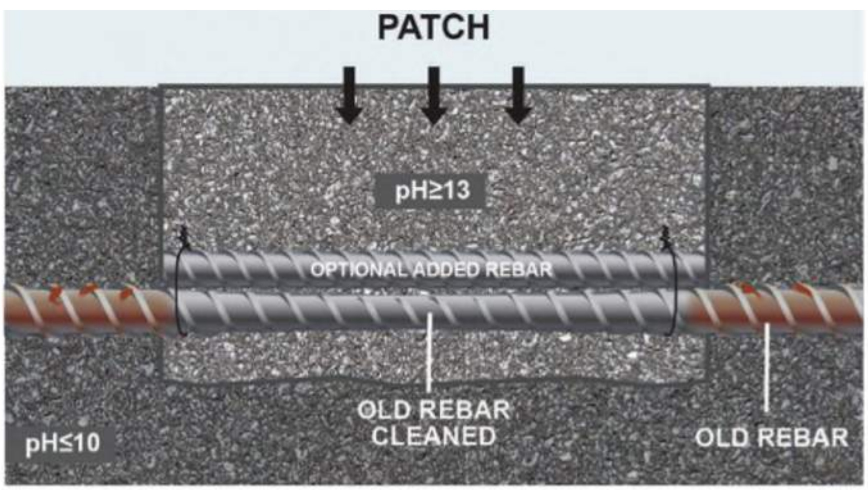

Figure 21 Ring anode corrosion

Factors that can lead to corrosion problems include differences in chloride ion content, pH, permeability, or even different types of reinforcing steel that are coupled together. These factors may accelerate corrosion in the repair itself, but more often results in deterioration of the concrete adjacent to the repair. The rate of deterioration due to ring anode corrosion is dependent upon the same factors that control the overall rate of corrosion. These include the amount and difference in chloride content, moisture availability, temperature, and permeability of the concrete.

Spalling at Golden Strand

At Golden Strand, no evidence of spalling or extensive corrosion of rebar or steel that might jeopardize the integrity of the building was observed, at any building.

There may be present and existing or spalling and corrosion occurring, but Karins did not visually observe this occurring beyond the exposed steel beam as described above.

II. Rebar Corrosion and Corrosion

Corrosion of components like AC Units and outlets were evident, however.

Figure 22 corroding AC unit typical

Figure 23 corroding AC unit bracket typical

3. Roofing Systems - Flat Roofing Systems

Golden Strand employs flat roofing systems consisting of a TPO membran applied over the lightweight concrete and bar joist system at both buildings.

Figure 24 Flat roofing at Grenada Building

Figure 25 Flat roofing at Esplanade Building

Overall, both roofs are in very good condition.

4. Exterior Finishes

A. Stucco & Paint

A stucco finish is used as the exterior finish of Golden Strand. Very minimal stucco delamination, stucco cracking, paint failures, and sealant failures are seen at Golden Strand.

Figure 26. Paint at Golden Strand typical and in good condition

Figure 27. stucco previous repair noted

5. Windows and Doors

The condition of the windows and doors at Golden Strand varies; from newly installed to original. Karins observed the ability to open any sliding glass balcony windows, the tracks, and the sealant of each unit Karins entered.

Figure 28 Example of window conditions from the interior

Figure 29 Example of sliding glass doors

6. Life Safety

Karins did not observe any condition at Golden Strand that would be considered urgent and important to remediate for life safety concerns.

To Be Noted: A few units have windows that may or may not meet new building code for sill heights. Golden Strand to review code for compliance.

Figure 30 Windows sill height must be 24” if window is 6 ft above ground.

7. Balconies

KEG inspected the tiles, grout, sealant, weep system, railings and any potentially damaging furniture on all balconies entered. With balconies that have concrete tile, the lightweight concrete condition is unknown as we cannot see under the tile. All weep system appears to be in good condition but were not water tested.

The tiles and grout are in fair condition with minor signs of cracked tiles and efflorescence on grout. Stains on tiles indicate ponding of water and should be remediated by thorough cleaning. Efflorescence should be cleaned but does not compromise the integrity of the tiles.

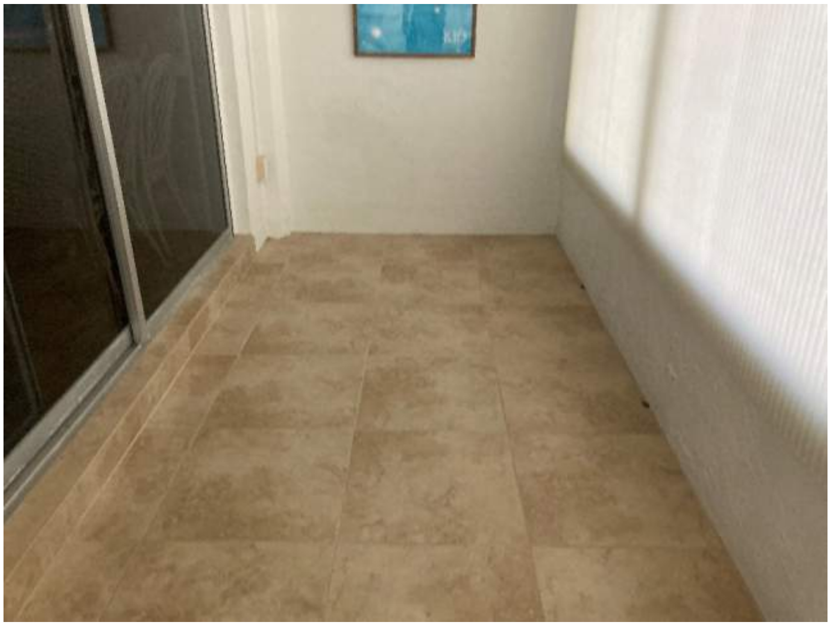

Figure 31 Typical Balcony at Golden Strand

Figure 32 Typical Tiled Balcony at Golden Strand with railing enclosure on outside

Figure 33 Typical Balcony to sliding glass door transition

Figure 34 Typical balcony built out with interior sliding door removed

OPINIONS AND RECOMMENDATIONS

Based upon our visual observations of the above-listed systems at Golden Strand Apartments, Karins has provided a list of opinioned recommendations below. These recommendations are further broken down by priority, with the most important items listed first, for the prudent implementation and scheduling by Golden Strand Apartments.

Based on the scope of the inspection and for the areas that were able to be assessed, within a reasonable degree of engineering certainty, we have not observed any conditions that would compromise the safety of the building for its intended use and occupancy. We reserve the right to amend our opinion should new information be brought to our attention.

Golden Strand Apartments does not appear to have substantial structural deterioration. This report meets the requirements of a Phase 1 inspection.

It is our professional opinion that the following course of action should be taken to protect the building in the future:

1. Any future deteriorated concrete should be repaired in accordance with International Concrete Restoration Institute (ICRI) industry standards. Instances of cracking occur in Unit 403 of the Esplanade Building, in the stairwells of both buildings, and on one windowsill at the Granada Building.
2. The existing windows should be inspected for lack of sealant at least every 10 years. Door weather stripping should be inspected by owners in conjunction with major weather events. Sealants should be applied to all window frames and door sills to prevent water intrusion into the unit and instead direct the water towards the weep holes and to the exterior.
3. Determine the efficacy of the AC components on the roof of both buildings. Many fasteners and brackets appeared to be rusted/corroded. If not taken care of, these units could detach from the stands on which they sit. In addition, general cleaning of the roof should take place, scrub coating, cleaning gutters of debris, etc.
    - Replace all rusted AC unit connection brackets on roof. Also, consider elevating disconnect conduit off roof as it will rub against roof membrane in high wind events.
4. Inspect railings for loose fasteners. Seal all bracket connections and top rail connections where sealant is failing.
5. Inspect bolt connections on the ladder leading to the roof hatch on 109 The Esplanade South roof.
6. Inspect cracking in stucco around the property to determine if there are any structural issues.

7. KEG recommends the following for the balconies:
    - Clean the grout and tiles of all balconies.
    - Keep at a distance of at least one foot between planters and any wall to avoid premature paint damage.
    - Remove and replace areas of hollow tiles.
    - Clean or reinstall any missing fasteners in tracks or frames of windows, doors, or screens. No instances of missing fasteners were noted at the time of the survey.
    - In the case the tile is removed, KEG does not recommend putting tiles back on top of the balcony without at minimum a waterproofing membrane. Although it is easier to maintain a waterproofing membrane on a balcony if it is not covered with tile, Karins understands that this is not always the desire of unit owners. There is no guarantee that once the tile is replaced, water will not start making its way to the slab concrete and rebar under the tile and waterproofing membrane.
8. Consider the replacement of any future rusting lighting fixtures. Also, extrusions should not have sealant applied to all sides. The bottom portion of the extrusion should be open to allow moisture to escape and not trap moisture inside the extrusion. This will reduce future issues of rusting and corrosion.
9. Consider an in-depth review of staircases and railings.
    - Current handrail configuration appears to have loose connections where some sections meet.
10. Move any stored items at least 12 inches away from building exterior to prevent premature damage of paint coating.
11. Investigate whether GFCI outlets are needed in the laundry room.
12. Life Safety – Reconcile the IRC and IBC as it relates to window openings with a sill height of less than 24 inches. Unit 204 in the Esplanade Building has a condition that could allow persons to fall over 72 inches as the window completely opens. Protection may be needed. See Unit 504 in the Granada Building.

SUMMARY

This structural inspection is for the sole purpose of identifying structural deficiencies of the building or structure that poses an immediate threat to life, safety, or where failure of a critical component is imminent. This structural inspection was for the purpose of determining the structural condition of the building to the reasonable extent possible that any part, material, or assembly of a building that affects the safety of such building or structure and/or which supports any dead or designed live load may be affected by internal or external elements, components, or forces.

The deficiencies that require immediate attention are:

1. Investigation of all concrete cracking where listed above. Repair per ICRI guidelines
2. Repairing and remediating all instances of corrosion

Based on the scope of the inspection and for the areas that were able to be assessed, within a reasonable degree of engineering certainty, we have not observed any conditions that would compromise the safety of the building for its intended use and occupancy. We reserve the right to amend our opinion should new information be brought to our attention.

Golden Strand Apartments does not appear to have substantial structural deterioration. This report meets the requirements of a Phase 1 inspection.

CONCLUSION

Our statements referencing the structural integrity of the buildings at Golden Strand Apartments are in reference to the original installation. Our statements are not intended to verify compliance with building codes or acceptance.

Our opinion is that the existing conditions of Golden Strand Apartments are due to the age of the building and not a lack of maintenance; this is highly probable wherein evidenced by previous reports and our observations.

We believe that the most prudent action to be taken would be an aggressive maintenance schedule while planning to implement our above-listed recommendations based on urgency and incidence. This would allow time for Golden Strand Apartments to appropriately exhaust insurance avenues and build up balances to pay for the recommended actionable.

Special Assessments may be required to fully and completely institute our recommendations. Our office would be more than happy to review these avenues and provide you with appropriate services.

We trust this information is helpful. Should questions arise, please do not hesitate to call.

Sincerely,
Karins Engineering

David G Karins, PE
FL #52677

Index: *Appendix A – Existing Conditions Checklist Broward County*
Appendix B – General Considerations
Appendix C – Cracking in Concrete

GENERAL CONSIDERATIONS

SCOPE OF STRUCTURAL INSPECTION

The fundamental purpose of the required inspection and report is to confirm in reasonable fashion 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 procedure, and under no circumstances are these minimum recommendations intended to supplant proper professional judgment.

Such inspection shall be for the purpose of determining the general structural 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 pursuant to the Building Code.

In general, unless there is obvious overloading, or significant deterioration of important structure elements there is little need to verify the original design. It is obvious that this has been "time tested' if still offering satisfactory performance. Rather, it is of importance that the effects of time with respect to deterioration of the original construction materials be evaluated. It will rarely be possible to visually examine all concealed construction, nor should such be generally necessary. However, a sufficient number of typical structure members should be examined to permit reasonable conclusions to be drawn.

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

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

Manual Procedures such as chipping small areas of concrete and surface finishes for closer examinations are encouraged in preference to sampling and/or testing where visual examination alone is deemed insufficient. Generally, unfinished areas of buildings such as utility spaces, maintenance areas, stairwells and elevator shafts should be utilized for such purposes. In some cases, to be held to a minimum, ceilings or other construction finishes may have to be opened for selective examination of critical structural elements. In that event, such locations should be carefully located to be least disruptive most easily repaired and held to a minimum. In an event, a sufficient number of structural members must be examined to afford reasonable assurance that such are representative of the total structure.

Evaluating an existing structure for the effect of time, must take into account two, basic considerations; movement of structural components with respect to each other, and 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 actually may occur. However, it is infrequent in this area. Older buildings on spread footings may exhibit continual, even recent settlements if founded on deep unconsolidated fine grained or cohesive soils or from subterraneous losses or movements from several possible causes.

With very little qualification, such as rather rare chemically reactive conditions, deterioration of building materials can only occur in the presence of moisture, largely to metals and their natural tendency to return to the oxide state in the corrosive process.

In this 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 1/3 to 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. Since most of our local construction does not use vapor barriers, 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 shell.

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 type 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 type 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.

Written Reports shall be required attesting to each required inspection. Each such report shall note the location of the structure, description of 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, and description of the type and manner of the inspection, noting problem areas and recommending repairs, if required to maintain structural integrity.

FOUNDATION:

If all of 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 probably be uniform and of little practical consequence. In the real world, however, neither is likely. Significant deviations from either of these two idealisms 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, in themselves, 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.

ROOFING SYSTEMS:

Sloping roofs, usually having clay or cement tiles, are of concern in the event that the covered membrane may have deteriorated, or that the tiles may have become loose. Large deflections, if merely resulting from deteriorated rafters or joists will be of greater importance. Valley Flashing, and Base Flashing at roof penetration will also be matters of concern.

Flat roofs with built up membrane roofs will be similarly critical with respect to deflection considerations. Additionally, since they will generally be approaching expected life limits at the age when building recertification is required, careful examination is important. Blisters, wrinkling, alligatoring, and loss of gravel are usually signs of difficulty. Punctures or loss of adhesion of base flashing, coupled with loose counterflashing will also signify possible problems. Wind-blown gravel, if excessive, and the possibility of other debris, may result in pounding, which if permitted, may become critical.

MASONRY BEARING WALLS

Random cracking, or if discernible, definitive patterns of cracking, will of course, be of interest. Bulging, sagging, or other signs of misalignment may also indicate related problems in other structural elements. Masonry walls where commonly constructed of either concrete masonry remits or scored clay tile, may have been constructed with either reinforced concrete columns tie beams, or lintels.

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

Cold formed steel joists, usually of relatively light gage steel, are likely to be critically 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.

Wood joists and rafters are most often in difficult from “dry rot”, or the presence of termites. The former (a misnomer) 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 one eighth of an inch under moderate hand pressure. Sagging floors will most often indicate problem areas. 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, with significant deterioration. Floor and roof systems of case 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 for that purpose.

STEEL FRAMING SYSTEM

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

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

Of most probable importance will be the vertical and horizontal cracks where masonry units abut tie columns, or other frame elements such as floor slabs. Of interest here is the observation that although the raw materials of which these masonry materials are made may have much the same mechanical properties as the reinforced concrete framing, their actual behavior in the structure, however, is likely to differ with respect to volume change resulting from moisture content, and variations in ambient thermal conditions.

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

FLOOR AND ROOF SYSTEMS

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

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

CONCRETE FRAMING SYSTEMS

Concrete deterioration will, in most cases be similarly related to rebar corrosion possibly abetted by the presence of salt-water aggregate or 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, dropping into 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. Especially, since loose material will have to be removed even for cosmetic type repairs, anyway. Fairly reliable quantitative conclusions may be drawn with respect to the quality of the concrete. Even though our cement and local aggregate are essentially derived from the same sources, cement will have a characteristically dark grayish brown color in contrast to the almost white aggregate. A typically white, almost alabaster like coloration will usually indicate reasonably good overall strength. The original gradation of aggregate can be seen through a magnifying glass. Depending upon the structural importance of the specific location, this type of examination may obviate the need for further testing if a value of 2000 psi to 2500 psi is sufficient for required strength, in the event that visual inspection indicates good quality for the factors mentioned.

WINDOWS

Window condition is of considerable importance with respect to two considerations. Continued leakage may have resulted in other adjacent damage and deteriorating anchorage may result in loss of the entire unit in the event of severe windstorms short of hurricane velocity. 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 buildings.

WOOD FRAMING

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 enough. Dry rot must be considered suspect in all sealed areas where ventilation has been inhibited, and at bearings and at fasteners. Here too, penetration with a pointed tool greater than about one eighth inch with moderate hand pressure, will indicate the possibility of further difficulty.

LOADING

It is of importance to note that even in the absence of any observable deterioration, loading conditions must be viewed with caution. Recognizing that there will generally be no need to verify the original design, since it will have already been “time tested”, this premise has validity only if loading patterns and conditions remain **unchanged**. Any material change in type and/or magnitude or loading in older buildings should be viewed as sufficient jurisdiction to examine load carrying capability of the affected structural system.

MINIMUM INSPECTION GUIDELINES
FOR BUILDING SAFETY INSPECTION
STRUCTURAL

I. Masonry Walls

A. General Description

1. Concrete masonry units
2. Clay tile or terra cotta units
3. Reinforced concrete tie columns
4. Reinforced concrete tie beams
5. Lintels
6. Other type bond beams

B. Cracks:

B. **Cracks:** Identify crack size as **HAIRLINE** if barely discernible; **FINE** if less than 1 mm in Width: **MEDIUM** if between 1 and 2 mm in width; **WIDE** if over 2 mm

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

C. Spalling:

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

D. Rebar corrosion

1. None visible
2. Minor
3. Significant - structural repairs required (describe)

II. Floor and Roof Systems:

A. Roof:

1. Describe type of framing system (flat, slope, type roofing, type roof deck, condition)
2. Note water tanks, cooling towers, air conditioning equipment, signs, other heavy equipment and condition of supports.
3. Note types of drains and scuppers and condition.

B. <u>Floor system(s):</u>

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

2. Heavy equipment and conditions of support

C. **<u>Inspection</u>** - note exposed areas available for inspection, and where it was found necessary to open ceilings, etc. for inspection of typical framing members.

III. <u>Steel Framing Systems:</u>

A. Description

B. Exposed Steel - describe condition of paint & degree of corrosion.

C. Concrete or other fireproofing - note any cracking or spalling, and note where any covering was removed for inspection.

D. Elevator sheaves beams & connections, and machine floor beams - note Condition.

IV. <u>Concrete Framing Systems:</u>

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

1. None visible

2. Minor

3. Significant - structural repairs required (describe)

V. <u>Windows:</u>

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

B. Anchorage - type & condition of fasteners and latches.

C. Sealants - type & condition of perimeter sealants & at mullions.

D. Interior seals - type & condition at operable vents.

E. General condition.

VI. <u>Wood Framing:</u>

A. Describe floor system

B. Note condition connector or stress

C. Note rotting or termite damage

D. Note alignment problems

E. Note bearing deficiencies

F. Note any significant damage that might affect safety and stability of building structure.

VII. <u>Exterior Finishes / Note any structural deficiencies in the following.</u>

A. Stucco

B. Veneer

C. Soffits

D. Ceiling

E. Other

APPENDIX C

TECH NOTES

Cracking In Concrete Walls

A product of
Concrete Foundations Association of North America

TECH NOTES

Cracking In Concrete Walls

NOTES:

GOAL AND PURPOSE

This edition of *Tech Notes* answers common questions about cracking in concrete walls: What Causes Them? How Can They Be Reduced? When Should You Be Concerned?.

Cracks in concrete walls and slabs are a common occurrence. They appear in floors, driveways, walks, structural beams, and walls. Cracking can not be prevented but it can be significantly reduced or controlled when the causes are taken into account and preven-tative steps are taken. Most cracks should not be a cause for alarm.

• Causes of Cracks

Cracking can be the result of one or a combination of factors, all of which involve some form of restraint. Some examples include:
- Drying Shrinkage—This occurs as water used in the mix design evaporates.
- Thermal Contraction/Expansion—Due to temperature changes.
- Subgrade Settlement (or Expansion) - Resulting from poor soil conditions or changes in soil moisture content.
- Differential Bearing Capacity— Harder soils under part of the foundation can cause stresses as the building "settles in."
- Applied Stresses—Forces such as building load, earth load, hydrostatic pressure, or heavy equipment operated too close to the wall.

• Types of Cracks

Tremendous forces can build up inside the wall due to any of these causes. When the forces ex-ceed the strength of the material, cracks will develop. Each of these causes normally leave a "signature" in the type of crack it creates. The vast majority of cracks are of little concern by themselves.

A product of
Concrete Foundations Association of North America

Shrinkage and Temperature cracks are most often vertical to diagonal. They typically emanate from a corner of a window, beam pocket, or other opening. Cracks of this type are called reentrant cracks. These are very common and, unless they leak or show significant lateral displacement, are of no structural concern.

Cracks which are horizontal are most likely caused by an applied load. Vertical cracks which are sig-nificantly wider at the top or bottom could indicate heaving or settlement. With these cracks it is very likely that the crack itself is not the problem, but rather the result of an external problem such as poor drainage, overloading, etc.

• Minimizing the Problem

Contractors can employ several methods of reducing the occurrence and width of cracks.

- The first is the use of proper concrete mix designs. A mix with sufficient strength using the minimum amount of water necessary to distribute the concrete throughout the wall without voids should be used. The type and amount of cement, as well as course and fine aggregates, can also have a large effect on the amount of shrinkage.

continued on back

NOTES:

- A small amount of temperature steel reinforcement will reduce the width of cracks that do occur.
- Control joints are intentional weak spots designed to induce shrinkage or thermal cracks in pre-determined locations. These can be very effective if waterproofed carefully.
- Rapid water loss and extreme temperature swings while the concrete is in the early stages of curing should be avoided where possible.
- Careful backfilling is mandatory. Typical basement walls are not designed to act as retaining walls. They must be secured with the basement floor at the bottom and the floor deck at the top, or be braced adequately, before being backfilled. The use of heavy equipment near the wall should be restricted and carefully considered.
- Anchoring the deck in accordance with local building codes, including the use of anchor bolts/straps and blocking, is very important. Improper anchoring has been the cause of a number of failures.

• When Should You Be Concerned

Temperature and shrinkage cracks in walls or slabs are likely to occur in nearly all structures. When the width of a crack exceeds 1/4″ in width; when they show 1/4″ in lateral dis-placement; when water leaks through the cracks; or you find long horizontal cracks, it is probably time to seek professional assistance. The contractor that built the wall, or your local CFA member should be able to help you.

NOTES:

Concrete Foundations Association
of North America
www.cfawalls.org PO Box 204, Mount Vernon, IA 52314
Phone 319-895-6940 Fax: 320-213-5556 **Toll Free 866-232-9255**