

# Existing Structures Engineering, Inc.



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Prepared for:

**Riverbend Condominium**

**3360 S. Atlantic Ave.**

**Cocoa Beach, FL 32931**

**December 20, 2022**

**Osborn Engineering**

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## Executive Summary

Existing Structures Engineering, Inc. conducted a condition survey at Riverbend Condominium located at 3360 S. Atlantic Ave. in Cocoa Beach, Florida. The condition survey was designed to support follow-on production of a Project Manual for the implementation of recommended restoration work.

Based on the results of the condition survey, the following work is recommended:

- **Balconies** - The damage on the balconies consisted mostly of edge damage which is not uncommon for Post Tension buildings in a harsh costal environment. This and other damage should be repaired.
- **Balcony Railing** – The balcony guardrails are of aluminum construction and although are up to current building code most are in fair to poor condition. The coating is in failure and many of the rails are exhibiting excessive corrosion. New guardrails are recommended.
- **Walkway Coating** – All walkways currently have a knockdown textured acrylic coating system which is showing signs of traffic ware and dis-bonding. A new two-coat acrylic coating system should be installed at the next restoration cycle.
- **Walkway Guardrails** – The walkway guardrails are of aluminum construction and although are up to current building code most are in fair to poor condition. The coating is in failure and many of the rails are exhibiting excessive corrosion. New guardrails are recommended.
- **Deck-O-Drain System** – The system was installed to help eliminate standing water on the second-floor walkway area between the North and South buildings. The drain system has failed and is now allowing water to drip through the slab and down the walls into the restroom area.
- **A “Milestone Inspection”** at Riverbend Condominium was completed on Thursday, December 8, 2022. The inspection satisfies the requirements for a phase one and phase two milestone inspection and NO significant structural deficiencies were found. Milestone inspections should be conducted every 5-year.

## Overview

Existing Structures Engineering, Inc. (ESE) has been commissioned to conduct a Condition Survey in support of a planned Restoration Project at Riverbend Condominium in Cocoa Beach, Florida. This report documents the defects found and summarizes the recommended maintenance actions required. Once reviewed and approved by the Association, these actions will be incorporated into the Project Manual during the design and bid phase (Phase 2).

The complex consists of a single “U” shaped building with a garage on ground floor. There are fifty-two units in the complex. The building is constructed of post-tension cable reinforced concrete and CMU walls.

Specific items of interest to the Client include:

- Quantification of concrete repair scope
- Recommendations on corrosion control technologies
- Service life and cost of repair

## Technical Approach

### *Visual and Hands-on Inspection*

The majority of the inspection work was conducted by visual and hands-on inspection by trained professionals. The tools used to supplement this effort were rods and chains, sounding hammers, hand tools, and tape measures. The inspection was intended to be non-destructive. By its nature, a visual non-destructive inspection is limited to that which can be seen or heard. Although it is limited, it is quite effective for preliminary inspection and for allocating inspection and repair resources.

The hands-on aspect included acoustic soundings and examination of items within the scope of inspection including:

- Balconies
- Walkways and Stairs
- Handrails and handrail attachment points
- Columns and Beams

Visual inspection and soundings are acceptable preliminary inspection methods in accordance with the International Concrete Repair Institute (ICRI), the American Concrete Institute (ACI), and the American Society of Civil Engineers (ASCE) guidelines. The concrete evaluation is in general accordance with:

- ACI 201.1R-92, Guide for Making a Condition Survey of Concrete in Service
- ACI 224.1R-93, Causes, Evaluation and Repair of Cracks in Concrete Structures
- ACI 364.1R-94, Guide for the Evaluation of Structures Prior to Rehabilitation
- ACI 546R-96, Concrete Repair Guide
- ASCE 11-98, Guideline for Structural Condition Assessment of Existing Buildings

## Corrosion Control

The primary reason for concrete corrosion damage is water and chloride intrusion. When chlorides permeate through concrete and come into contact with reinforcing steel, the normally protective passive layer is disrupted, and the reinforcing steel begins to corrode. As corrosion progresses, the more voluminous corrosion products impose tensile stresses within the concrete, eventually leading to concrete cracking and spalling. Because this creates an additional water intrusion point, the concrete damage increases exponentially. Waterproofing, together with the proper selection of repair mortars and corrosion inhibitors, is the best course of action to provide effective corrosion control.

## Defect Identification

General concrete defects typically start with corroding reinforcing bar (rebar) which causes cracking, spalling and delamination, as shown below.

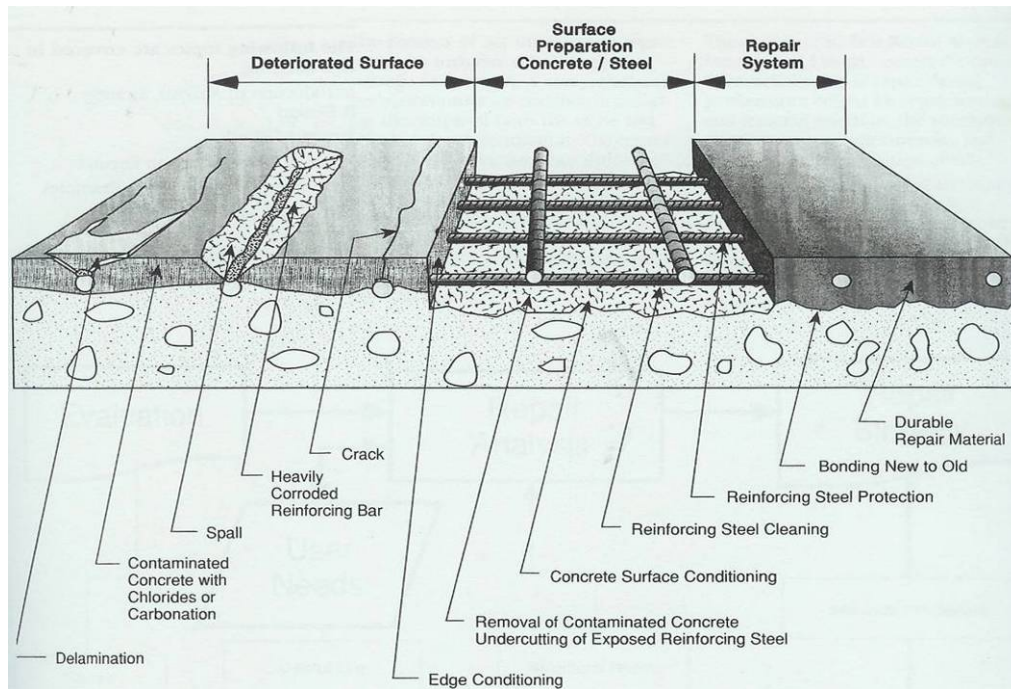


Figure 1: Deteriorated concrete proceeding to repair system

Concrete defects are further broken down into the following categories because although most exhibit the same symptoms (i.e. spalling and delamination), repair methods differ. Please note that all the listed items may not be present in every instance.

Deck damage consists of damaged or spalled concrete found on an elevated floor surface which does not telegraph through the entire thickness of concrete. Deck damage essentially requires rectilinear excavation using hand tools and, in most cases, does not involve replacing reinforcement. Estimates

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of deck damage assume excavation of 3 inches deep of concrete and do not require the installation of formwork.

Thru damage consists of spalled concrete which does telegraph through the entire thickness of concrete. Depending on the size and severity of the spall, replacing reinforcement is sometimes necessary. Repairing thru damage requires installation of formwork.

Any damage which is found within 12 inches of the edge of the deck is referred to as edge damage. Edge damage assumes excavation of the entire thickness of concrete and sometimes will require replacing reinforcement. Edge repairs also require formwork.

Overhead damage is the same as deck damage except it is located on the overhead (or underside) of the elevated concrete surface. Overhead repair estimates also assume excavation of 3 inches of concrete as well as sometimes installing formwork.

Column damage can refer to any damage found on columns, beams, or stairs. This type of damage sometimes will require replacing reinforcement. Formwork installation is required, normally on two surfaces.

Another deficiency sometimes found is spot corrosion, which are rust spots created by the support members used in laying reinforcing steel.

## Findings and Discussion

Within this section we will discuss the findings of our inspection. We will end each discussion with a recommended repair. The priority of repair shall be based on:

*Life Safety* — These items may present a hazard to persons. This hazard may be in the form of structure stability, falling debris, loss of fire system, electrical shock hazard, etc. These are the highest priority of action.

*Asset Preservation* — These items need action to preserve an asset. This action may be corrosion control to stop spalling, crack repair to limit water egress, etc. These are the second highest priority of action.

*Aesthetics* — These items need action primarily for aesthetics or beautification. These actions may be crack repair that does not preserve assets, painting for architectural purposes, landscaping, etc. These are the lowest priority items.

## ***Balconies***

The damage on the reinforced concrete balconies consisted mostly of edge spalls, window sills, and deck spalls which is common to beachside condominiums. There were also some spot corrosions, and some delaminated stucco. These are all asset preservation items and should be repaired. The balconies are constructed of post-tension cable reinforced concrete and CMU walls.



Photograph 1: Deck spall



Photograph 2: Edge Crack



Photograph 3: Edge Spall



Photograph 4: Column Crack

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The distributed post-tension (PT) cables that are running throughout the building are anchored in the edges of balconies and walkways. As the edges of the balconies corrode and the concrete becomes more damaged, there is a greater chance that the anchor will pop out of the edge due to this concrete damage. An example of a repair would be as such: in order to repair the south edge of a balcony, the cables with anchors in the repair area have to be “locked off” so that the tension on the cable is moved away from the edge and the workers do not harm themselves or the building. The cables are spliced with a new section of cable and anchor in the new concrete repair area. The cable is pulled through the new anchor and re-tensioned and the lock-off is removed. The lock-offs are located at least two feet away from the edge in order to have room for the splice. This creates a greater repair expense due to the cable repairs, lock-offs, and additional concrete. However, buildings built with PT cables generally see a greater period of time between repair cycles.



Photograph 5: Lock-off on the left and a cable splice on the right (Example)



Photograph 6: New cable ends and anchors being installed (Example)

PT buildings are difficult to quantify because the anchors and cables are unable to be seen. The estimate is based on approximate anchor locations per the provided building plans plus knowledge acquired working on other PT buildings. However, without being able to see the condition of the cable or anchor, the PT lock-off quantities estimated are a best educated guess value. The only way to determine exact repair quantities is to start the repair process. A high contingency is recommended on any restoration project involving PT construction. This is an asset preservation item.

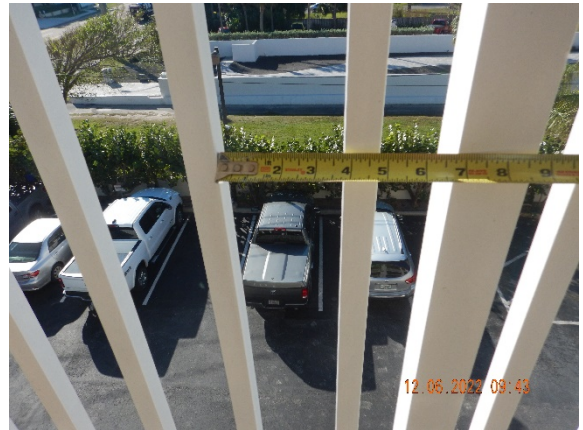


## Balcony Guardrails

The guardrails on the balconies are of aluminum construction and are up to current building code. The coating is no longer fully adhered to the aluminum in areas and there is significant coating failure and corrosion throughout. It is recommended that the guardrails be replaced at this time. This coating defect has become increasingly common among oceanside communities. After some research regarding coating failure analysis on aluminum guardrails, it has become apparent that this issue stems directly from improper surface preparation. Aluminum railings can last 20 plus years in a highly corrosive environment if properly surface prepped, properly coated and correctly maintained. New aluminum guardrails should also have a 5 (or more) year warranty. Balcony coating and balcony guardrail pricing have been input into the engineering estimate under Alternates. This is an asset preservation item as well as an aesthetic one.



Photograph 7: Typical Railing – Coating Failure



Photograph 8: <4" spacing



Photograph 9: Railing Alignment Issues



Photograph 10: Coating Failure/Picket Corrosion

## Walkway Coatings

The walkways currently have a knock down textured acrylic coating system installed. On most floors, the coating appears to be at the end of its protective life cycle. Since it is recommended that new rails be installed, it would be a good opportunity to install a new acrylic coating system. A new acrylic coating system will extend the service life of the walkways as it will delay corrosion of the reinforcing bars. Coatings are your first line of defense against the harsh coastal environment. This is an asset preservation item as well as an aesthetic one.



Photograph 11: Walkway Coating Failure



Photograph 12: Walkway Sill Spall



Photograph 13: Walkway Coating Failure



Photograph 14: Typical Walkway Texture

## ***Walkway Guardrails***

The guardrails on the balconies are of aluminum construction and are up to current building code. The coating is no longer fully adhered to the aluminum in areas and there is significant coating failure and corrosion throughout. It is recommended that the guardrails be replaced at this time. This is an asset preservation item as well as an aesthetic one.



Photograph 15: Railing Coating Failure



Photograph 16: Railing Coating Failure

## ***Deck-O-Drain***

There is a deck-o-drain system installed on the second floor between the East and West buildings, above the pool restrooms. This system was installed to help eliminate standing water in that area of the walkway system. The drain system has failed and is now allowing water to drip through the slab and down the walls into the restroom area. The deck-o-drain itself is made of plastic and is unlikely allowing water to seep through it. The more likely culprit is the interface between the existing concrete and the plastic deck-o-drain. Osborn believes the least intrusive, and best possible solution to the problem, would be to cut a half inch wide, half inch deep groove next to the drain on either side and fill the new void with a good urethane caulk to seal the interface between the concrete and the deck-o-drain. This would allow for a bit of expansion and contraction without breaking the bond between the two surfaces.

## Scheduled Maintenance Program

The suggested maintenance program is to conduct concrete condition surveys at four and a half years after a repair cycle. The restoration contractors provide a five year warranty to repairs. We recommend that an inspection is done in year four to insure warranty coverage of any items which need so.

## Shutter Removals

Some units will need to have part or all of their shutters removed before the balcony restoration project begins. Typically, shutter removals are not included in restoration contractor's contract since these are the responsibility of each individual unit owner, as opposed to the balcony which is common element and falls under the Association's responsibility. Owners will be notified of required shutter removals prior to project commencement. For estimate purposes the shutter removals have been included in the attached quantities and in some instances the restoration contractor may undertake this work.

## Project Cost, Phasing, and Delay

According to NACE International "It is common during concrete repairs for the delaminated area excavated to be far more extensive than delamination surveys indicate.... An underestimate of 40% or more is not unusual and should be borne in mind when budgeting for repairs<sup>1</sup>." At the least a 20% contingency is highly recommended when assessing funds for any construction project.

If the project is to be delayed or completed in phases, the costs outlined in this "snapshot" report can be expected to dramatically increase. The actual percentage increase cannot be accurately predicted but, for example, concrete damage has been reported (Concrete International, Monitoring Parking Structure Repairs, Bickley and Liscio) to double and a 100 percent increase could be anticipated for prolonging the project a year.

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<sup>1</sup> NACE International Stand Practice Publication SP0308-2008 Item No. 21128

## Milestone Inspection Certification Statement

A "Milestone Inspection" at Riverbend Condominium was completed on Thursday, December 8, 2022. The inspection satisfies the requirements for a phase one and phase two milestone inspection and NO significant structural deficiencies were found. Milestone inspections should be conducted every 5-years.

Certified by \_\_\_\_\_

**James Byron Evetts – FL PE #37261**

## **Appendix A – Survey Results & Recommended Remediation Work**

The attached summary worksheet(s) provides a cost estimate for the recommended repair work. This cost estimate is based on knowledge of current and past concrete restoration projects. Actual project bids will vary by contractor and will also depend on which options the Association chooses. The estimates are broken down by building. These estimates should NOT be distributed.

Stack	UNIT	CF	CF	CF	EA	SF	LF	CF	EA	SF	TYPE	LF	NOTES
Balconies		DECK	EDGE	COL	SPOT	STUCCO	CRACK	SILL	PT CABLE	COATING	COATING	RAIL	
1	201				2.00					428.00	Acrylic	91.00	
	301			0.74						428.00	Acrylic	91.00	
	401		2.20						1.00	428.00	Acrylic	91.00	
2	202									261.00	Acrylic	30.00	
	302									261.00	Acrylic	30.00	
	402							0.51		261.00	Acrylic	30.00	
3	203		0.55		1.00					266.00	Acrylic	29.00	
	303									266.00	Acrylic	29.00	
	403									266.00	Acrylic	29.00	
4	204									274.00	Acrylic	29.00	
	304							0.01		274.00	Acrylic	29.00	
	404							0.11		274.00	Acrylic	29.00	
5	105				1.00		2.00				Acrylic		
	205		0.82		1.00			0.10		378.00	Acrylic	91.00	
	305									378.00	Acrylic	91.00	
	405				1.00			0.08		378.00	Acrylic	91.00	Loose rail brackets (nw & se Corners)
6	106							0.12			Acrylic		
	206							0.13		163.00	Acrylic	36.00	
	306									163.00	Acrylic	36.00	Loose bottom rail bracket (nw corner)
	406									163.00	Acrylic	36.00	
7	107							0.17			Acrylic		
	207									166.00	Acrylic	36.00	
	307				1.00					166.00	Acrylic	36.00	
	407									166.00	Acrylic	36.00	
8	108				3.00			0.23			Acrylic		
	208									167.00	Acrylic	36.00	
	308									167.00	Acrylic	36.00	
	408							0.11		167.00	Acrylic	36.00	
9	109				2.00			0.52			Acrylic		
	209				1.00					162.00	Acrylic	36.00	
	309				1.00					162.00	Acrylic	36.00	
	409									162.00	Acrylic	36.00	
10	110				1.00			0.52			Acrylic		
	210									167.00	Acrylic	36.00	
	310				1.00					167.00	Acrylic	36.00	
	410							0.17		167.00	Acrylic	36.00	
11	111							0.17			Acrylic		
	211									322.00	Acrylic	74.00	
	311									322.00	Acrylic	74.00	
	411							0.36		322.00	Acrylic	74.00	
12	212				1.00					261.00	Acrylic	30.00	
	312		0.55							261.00	Acrylic	30.00	
	412							0.51		261.00	Acrylic	30.00	
13	213							0.17		249.00	Acrylic	27.00	
	313							0.52		249.00	Acrylic	27.00	Loose top rail bracket (w side of rail)
	413							0.08		249.00	Acrylic	27.00	
14	214									253.00	Acrylic	31.00	
	314							0.52		253.00	Acrylic	31.00	Loose bottom rail bracket (nw corner)
	414									253.00	Acrylic	31.00	
15	215				1.00			0.12		425.00	Acrylic	92.00	
	315			0.22						425.00	Acrylic	92.00	
	415									425.00	Acrylic	92.00	
	Allowance					50.00							
	<b>TOTAL*</b>	-	5.00	2.00	20.00	50.00	2.00	5.23	1.00	11,826.00		2,112.00	

Floor	UNIT	CF	CF	CF	EA	SF	LF	CF		SF	TYPE	LF	NOTES	
Walkways		DECK	EDGE	COL	SPOT	STUCCO	CRACK	SILL		COATING	COATING	RAIL per FL		
1 (Ceiling)	105										Acrylic			
	106										Acrylic			
	107										Acrylic			
	108										Acrylic			
	109										Acrylic			
	110										Acrylic			
	111										Acrylic			
2	201									3768.00	Acrylic	490.00		
	202										Acrylic			
	203										Acrylic			
	204										Acrylic			
	205		4.00								Acrylic			
	206										Acrylic			
	207										Acrylic			
	208										Acrylic			
	209										Acrylic			
	210										Acrylic			
	211										Acrylic			
	212								0.14		Acrylic			
	213								0.21		Acrylic			
	214								0.21		Acrylic			
	215										Acrylic			
3	301									3900.00	Acrylic	516.00		
	302										Acrylic			
	303										Acrylic			
	304										Acrylic			
	305										Acrylic			
	306								0.14		Acrylic			
	307								0.47		Acrylic			
	308										Acrylic			
	309										Acrylic			
	310										Acrylic			
	311					1.00					Acrylic			Loose bottom rail bracket (nw corner)
	312										Acrylic			
	313										Acrylic			
	314								0.11		Acrylic			
	315		2.67								Acrylic			
4	401									3659.00	Acrylic	482.00		
	402								0.17		Acrylic			
	403										Acrylic			
	404			0.67							Acrylic			
	405										Acrylic			
	406										Acrylic			
	407										Acrylic			
	408										Acrylic			
	409										Acrylic			
	410										Acrylic			
	411										Acrylic			
	412								0.17		Acrylic			
	413										Acrylic			
	414										Acrylic			
	415										Acrylic			
Allowance														
<b>TOTAL*</b>		2.67	4.67	-	1.00	-	-	1.62		11,327.00	-	1,488.00		



\* The totals contain a predetermined percent increase (10 to 30%) because it is common during concrete repairs for the delaminated area excavated to be more extensive than delamination surveys indicate.

Balcony Repair Item	Quantities	Unit	Unit Price	Extended Cost
A. Mobilization & Permit	1.00	LOT	15%	2,500.00
<b>B. Concrete Repairs - Balconies</b>				
1. Deck repair	2.67	CF	450.00	1,201.50
2. Edge repair	5.00	CF	480.00	2,400.00
3. Column repair	2.00	CF	700.00	1,400.00
4. Spot repair	20.00	EA	90.00	1,800.00
5. Stucco repair	50.00	SF	55.00	2,750.00
6. Crack repair	2.00	LF	45.00	90.00
7. Sill repair	5.23	CF	600.00	3,138.00
7. PT anchor repair	1.00	EA	3,000.00	3,000.00
8. Lock-off repair area	0.90	CF	500.00	450.00
9. R & R Shutter Track Bottoms	76.00	LF	40.00	3,040.00
<b>Total Balcony Estimate</b>				<b>21,769.50</b>

WALK	CF	CF	EA	CF	SF	TYPE	Notes		
FLOOR	DECK	EDGE	SPOT	SILL	COATING	COATING			
1		-				Acrylic			
2		4.00		0.56	3,768.00	Acrylic			
3	2.67	-	1.00	0.72	3,900.00	Acrylic			
4				0.34	3,659.00	Acrylic			
Allowance									
<b>TOTAL*</b>	4.00	5.00	2.00	2.00	11,327.00				

\* The totals contain a predetermined percent increase (10 to 20%) because it is common during concrete repairs for the delaminated area excavated to be more extensive than delamination surveys indicate.

Walkway Repair Item	Quantities	Unit	Unit Price	Extended Cost
A. Mobilization & Permit	1.00	LOT	15%	43,500.00
<b>B. Concrete Repairs - Walkways</b>				
1. Deck repair	4.00	CF	450.00	1,800.00
2. Edge repair	5.00	CF	480.00	2,400.00
3. Spot repair	2.00	- EA	90.00	180.00
4. Sill repair	2.00	CF	600.00	1,200.00
C. Prep and install 2 coat acrylic system	11,327.00	SF	10.00	113,270.00
D. New aluminum guardrails, to match existing	1,488.00	LF	115.00	171,120.00
<b>Total Walkway Estimate</b>				<b>\$ 333,470.00</b>

Additional Project Contingency	Quantities	Unit	Unit Price	Extended Cost
We recommend assessing for an addtl 20%		LOT	20%	\$ 3,680.00

Existing Structures Engineering Fees	Quantities	Unit	Unit Price	Extended Cost
Engineering Design of Repair & Bid Package	1.00	LOT	Fixed Fee	10,660.00
Construction & Engineering Inspections	1.00	LOT	Estimated	31,980.00

<b>TOTAL Project Cost (not including Alternates and Assoc. responsibility)</b>				<b>\$ 401,559.50</b>
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The items below are additional options and would increase the project cost by the amount listed:

Alternates	Quantities	Unit	Unit Price	Extended Cost
1. Prep and install 2 coat acrylic system to balconies	11,826.00	SF	10.00	118,260.00
2. New aluminum guardrails to match existing (Balconies)	2,112.00	LF	115.00	242,880.00