KEYSTONE
ENGINEERING &
CONSULTING, INC.

Silver Point Condominium

Freeport, Bahamas

Balcony and Walkway Inspection

Inspection Report and Recommendations

Prepared By
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October 2012

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KEYSTONE
ENGINEERING &
CONSULTING, INC.

December 27, 2012

Silver Point Condominium Association, Inc.
83 Silver Point
Freeport, Grand Bahamas

Re: Balcony and Walkway Building Inspection

EXECUTIVE SUMMARY

Keystone Engineering provided a sample inspection of the balcony and walkway structures at Silver Point in October of 2012. The purpose of the inspection was to determine the apparent extent of concrete damage caused by chloride induced reinforcing steel corrosion. Keystone inspected several balconies and walked all walkways to gather as much information as possible to advise the Silver Point Board of Directors and owners to achieve proper repairs of existing damage and extend the time between repair cycles by employing effective corrosion mitigation techniques.

The undersigned engineer has extensive background in this type of endeavor and is a practicing and licensed as both a Professional Engineer and Certified General Contractor in Florida, U.S.A. with over 20 years of experience with similar structures and conditions. We have completed numerous high profile concrete repair projects including winning eight (8) International Concrete Repair Institute (ICRI) Awards and the prestigious Vehicle Assembly Building (VAB) 5 acre reinforced concrete roof repair at NASA's Kennedy Space Center.

In general, the project can be broken into three general aspects required to achieve a successful repair and long term solution:

1. Properly repair all existing concrete damage to ICRI standards- this step is to avoid redoing improper repairs over and over.
2. Implement effective corrosion mitigation-this is to minimize future concrete damage that will occur in the future in areas outside of the current repairs. The corrosion of steel in chloride contaminated concrete is cyclic in nature for a building of this age. Implementing Impressed Current Cathodic Protection (ICCP) is the only known and effective way to prevent reinforcing steel corrosion in chloride contaminated concrete. Our ICCP solution is designed to last 20-25 years and we are the world's leading expert on condominium balcony and walkway applications.
3. Protect the structure form additional chloride and water intrusion-to fully realize the benefits of steps 1 and 2, the structure needs to be sealed and

waterproofed to protect from future water intrusion and chloride contamination by implementing the use of appropriate coatings and sealants. These can also be aesthetically pleasing, easy to maintain solutions. Tile and pavers are not recommended in these applications and will continue to exacerbate the concrete damage situation.

We hope to work closely with your Board and owners to establish a mutually beneficial joint venture and provide the necessary team and technology to restore the Silver Point building to its full potential.

Sincerely,

James E. Emory, P.E.
President
Keystone Engineering and Consulting, Inc.

KEYSTONE
ENGINEERING &
CONSULTING, INC.

December 27, 2012

Silver Point Condominium Association, Inc.
83 Silver Point
Freeport, Grand Bahamas

Re: Concrete Balconies and Walkways Survey and Evaluation

Dear Board and Association Members:

Keystone Engineering was engaged to perform a sample inspection of the balcony and walkway structures at the Silver Point Condominium in Freeport Bahamas. Within this report you will find a description of our survey process, our findings and recommendations, as well as budget items for consideration to complete a restoration project of the building structure. Once this document is reviewed, Keystone will be presenting a PowerPoint of the report on January 12, 2013 to discuss the recommendations and other considerations of the project.

Building Structure Description

The Silver Point condominium is an 8-story ocean front structure located in Freeport, grand Bahamas. The building is constructed in a semi-circular fashion with balconies facing the water and common access walkways on the land side. The building appears to be constructed using conventionally reinforced, poured in place concrete. The building was constructed in 1968 and reportedly had significant concrete repair work done in 1989 and 2003-2003.

The balconies are finished with a variety of materials including coatings, tile, and pavers. The walkways are all covered with tile. The perimeter balcony and walkway fall protection is a concrete knee wall with a textured finish. The balconies and walkways also have a reinforced turned down beam at the edge.

Investigation Methodology

The inspection process was completed on a visual and hands-on basis by the undersigned Florida Registered Professional Engineer and a trained assistant. The engineer inspected only a sampling balconies and walkways to determine the general overall condition of the structure. Generally the inspection of an oceanfront condominium focuses on the existing and potential for future concrete damage that occurs due to chloride-induced reinforcing steel corrosion. This electrochemical phenomenon is normally the driving force in oceanfront building maintenance and repair efforts. As a result of the actual and potential concrete damage, affected building components such as floor finishes, railings, sliding glass doors, and storm shutters are also evaluated as applicable.

The inspection process was completed in a non-destructive manner by the project engineer. The concrete damage evaluation was achieved by visual inspection, chain-drag and hammer sounding. These devices when utilized by personnel with appropriate experience are proven to be a cost-effective means of evaluating corrosion induced concrete damage and the overall condition of the structure. The inspection process described and completed are acceptable means in accordance with the International Concrete Repair Institute (ICRI) and the American Concrete Institute (ACI). The concrete evaluation performed is generally in accordance with:

ACI 201.1R-92 Guide for Making a Condition Survey of Concrete in Service

ACI 364.1R-07 Guide for Evaluation of Concrete Structures Before Rehabilitation

The results of the inspection and evaluation will generate an anticipated and recommended scope of work. It must be considered and understood that many work items identified are interrelated and therefore not easily or cost-effectively addressed separately. For example, in order to repair or protect the balcony concrete surfaces, the perimeter railings, balcony finishes and possibly the sliding glass doors and/or shutters will be affected and therefore must be considered as part of the repair process.

It should also be well understood that portions of the work anticipated are estimated quantities, while other items are fixed quantities. In general, all of the concrete repair work is an estimated quantity due to the number of variables involved and the high likelihood for hidden damage. Therefore the concrete work is typically completed on a unit cost basis, since we can establish the necessary concrete repair task items accurately, but cannot estimate the exact quantities. Unit cost basis provides the most fair basis for both owner and contractor, as the contractor is paid only for the number of each units completed at the unit rate bid, whether the quantities are higher or lower than the engineers estimate

The remainder of the bid items will generally be at fixed cost, as they are directly measurable quantities and known scope of work. Railing work, waterproofing of walls and floors, corrosion mitigation are examples of fixed items as both the task and quantities can be generally established accurately in advance.

Observations

Silver Point is currently experiencing a moderate to severe amount of corrosion induced concrete damage. This is due to the long term exposure to the coastal salt air combined with poor concrete surface protection. This allows chlorides to migrate through the concrete and reach the reinforcing steel over time. Once the chlorides accumulate at the reinforcing steel level within the slab, the corrosion process will accelerate in an exponential fashion, resulting in cracking and spalling of the surrounding concrete. Left unabated, this process will lead to increasingly costly building repair projects.

One of the most significant factors in the time and magnitude of reinforcing steel corrosion induced concrete damage is the ease of access for the chlorides to enter the concrete. Properly sealing and waterproofing the building, including all penetrations from new construction will greatly minimized chloride intrusion and corrosion. As part of a restoration project for an aged building both existing and future chloride contamination must be considered and reduced.

It was also observed that past repairs for similar damage have been performed on the structure. Currently there are areas of new damage occurring (outside of the past repairs), some past repairs in failure and numerous past repairs that are of questionable quality. These past repairs of questionable quality may continue to fail in the future or fail during the vibration caused during new repairs. The new areas of repairs are to be expected due to the typical corrosion cycle for a building of this age and location. The past repairs, if properly executed, should not be in a failure mode at this time.

Quality, long lasting repairs are crucial in controlling future maintenance costs. Additionally the control of the corrosion rate is the primary factor in reducing the rate and magnitude of future repair projects and costs. Proper structural concrete repairs should not become cyclic type repairs and should last for 20 to 30 years depending upon the level of protection from the elements employed. Original cyclic structural repairs to areas of the structure outside of past repairs can be controlled through corrosion mitigation. There are several corrosion mitigation strategies available, each with varying costs, performance and life expectancies. The most effective choice is Impressed Current Cathodic Protection for this type of situation.

Taking steps to reduce the cyclic nature of corrosion induced structural concrete damage has proven to be a good investment of maintenance dollars. Eliminating

the redundancy of repairs to the same area can be achieved by ensuring proper industry standard structural repairs are accomplished during the restoration project. Protecting the newly repaired areas and slowing/mitigating the corrosion in the surrounding areas will greatly reduce future maintenance costs, increase the time between repair cycles and lessen the magnitude of each repair cycle.

From a cost perspective, the structural concrete repair costs alone are significant. However, additional costs need to be considered, and strategically avoided as best possible, including the many collateral building components and aspects of a restoration project. The engineering costs, access to the building via swing staging, building permits, shipping, storage, equipment and manpower mobilization all add to the actual costs of accomplishing concrete repairs. Additionally balcony finishes, railings, sliding glass doors and shutters can be impacted during a restoration project, including the removal, reinstallation and/or replacement of these elements. The removal of these items to complete concrete repairs may require the owner to upgrade to newer models that are compliant with current building codes.

In severe cases of concrete damage occurring under and due to the leaking sliding glass door assemblies, the door may need to be removed and a temporary barricade installed in order to accomplish the structural repairs. This type of repair can also affect the interior flooring and finishes of the unit. There are a few of these conditions requiring a door intrusion barricade anticipated at Silver Point. Lastly a concrete restoration project provides for a disruption to the quality of living at the facility, loss of use and rental income, noise, vibration, dust and limited balcony and walkway access and view can all be expected.

There are currently conditions on the project that will cause continued deterioration of the concrete, reinforcing steel if left unabated. This will greatly increase the magnitude, cost and duration of the project with respect to time.

Because of these direct structural issues, collateral and lifestyle issues and substantial costs, a restoration project should be given due consideration to implement the most cost effective use of skilled labor, proper materials and methods along with technology to extend the time between repair projects and reduce the magnitude of the corrosion induced damage in the future. Poorly executed restoration projects, with improper repairs and inadequate consideration for future protection, will inevitably cost the Association significantly more in terms of dollars, inconvenience and time.

Findings and Recommendations

There is currently a moderate to severe amount of concrete spalling due to reinforcing steel corrosion detectable on the balcony and walkway structures at Silver Point. This includes new spalling and spalling of past repairs. This type of

spalling will grow exponentially with time causing an increase in the overall building damage, repair costs as well as adversely affecting the areas under the sliding glass doors. It will also create cracks and openings in the concrete, further exposing the structural elements and creating more damage. This current damage should be properly repaired as soon as practical. The repairs should be accomplished by an experienced restoration contractor under the supervision of a restoration engineering expert.

The concrete spalling is occurring at the balcony slab edges, columns, surfaces and ceilings. Some of this damage is encroaching and/or occurring under the sliding glass door tracks. This can and will affect the operation of the sliding glass doors as the tracks are pushed up and bent. There was also evidence of concrete damage inside of the units beyond the sliding glass door tracks.

Consideration should also be given to the sealing and waterproofing of the exterior walls of the building and replacement of original sliding glass doors. Leaks that can occur during tropical storms can cause very expensive interior damage to the units. There appear to be existing leaks and other vulnerable leak areas at Silver Point. The goal of any oceanfront structure should be to protect the structural elements for the harsh coastal elements. The sliding glass doors of the building are particularly vulnerable to leaking. Proper and professional waterproofing materials and installers can minimize leaks. Replacement of aged doors should be strongly considered to better protect the buildings interior from the elements including; salt, water, tropical storms and thermal loss/gain.

The balcony and walkway surfaces should also be better protected from the elements once repairs are completed using appropriate decorative water resistant coating systems. The existing tile and paver finishes are inappropriate finishes to adequately protect the structural components of the building. The tile will tend to hide concrete damage allowing it to worsen before repairs are initiated.

There also appears to be an inappropriate application of elastomeric paint on the balcony and walkway ceiling surfaces. Elastomeric coatings are appropriate for vertical surfaces and top surface applications to keep moisture out. Ceiling surfaces should be finished with a breathable acrylic finish. The combination of porous tile and paver finishes topside with heavy elastomeric underside is an undesirable situation for protection of the structure. Salt laden moisture is allowed easy access to the reinforcing steel via the tile and pavers, while the elastomeric locks it in to prevent drying. This accelerates the corrosion rate unnecessarily in what is already an inhospitable environment. There is much evidence of this trapped moisture intrusion as indicated by the numerous large paint bubbles on the ceilings of the balconies and walkways.

The aged sliding glass doors of the building also will contribute to the rate of concrete corrosion damage and leaking. If possible, doors should be replaced

when possible using a good quality, code compliant model for better protection from the elements.

As part of the repair process, many, if not all of the shutters will need to be removed to properly access the areas of work. There are also likely areas of damage currently hidden by the shutter assemblies. Once removed, the old shutters may not be able to be reinstalled based on their condition and compliance with current building codes. With the installation of quality code compliant sliding glass doors, shutters are not necessary.

It should be strongly considered to expedite the structural restoration of the building including the balconies, walkways, stairs and columns. Additionally the building should be properly sealed and coated to better protect it from the elements including salt intrusion and water leaks. The Association should consider effective corrosion mitigation to reduce the ongoing corrosion of the reinforcing steel in the balconies and walkways. It is also recommended that the unit owners consider updating their sliding glass doors to a current, quality code compliant model. This would greatly reduce the leaking of wind driven rain into the units and also provide much improved protection from high winds and reduced cooling costs.

THE CORROSION PROCESS:

The concrete damage occurring on the balconies and walkways at Silver Point is primarily caused by reinforcing steel corrosion. The reinforcing steel corrosion is due to ongoing exposure to salt air and eventual saturation with chlorides. It is helpful to have some basic understanding of this phenomenon when faced with decision-making responsibilities for repair of such structures.

Uncontaminated reinforced concrete provides a natural corrosion-inhibiting environment due to the protective nature of high alkalinity concrete surrounding the reinforcing steel. However, in salt-water environments, the chloride intrusion eventually breaks down the concrete's natural ability to inhibit corrosion by creating corrosion cells throughout the concrete. A corrosive environment is created whereby corrosion cells are established due to slight variations in corrosion potential throughout the structure. This is due to the slight inconsistency of the chloride intrusion. Therefore, areas with higher levels of chlorides have higher corrosion potential versus adjacent areas with lower potentials. These higher potential areas (called anodes or anodic areas) corrode and spall, while lower potential areas (called cathodes) do not.

Unfortunately, when these partial anodic areas are repaired and localized chlorides are removed, the adjacent cathodic areas become the higher corrosion potential area (or now the anodic area) due to the remaining chlorides. The repair

cycle at Silver Point illustrates this situation closely. The building was constructed in 1968 and exposed to the high chloride oceanfront environment. The first repair cycle was 1989 or 21 years after construction for the chlorides to build up and begin the corrosion activity. Then only 13 years later in 2002, additional repairs were required due to the corrosion cycle and imbalances that were created in 1989. Finally, as expected, accelerated corrosion again requires repairs only 10 years later. The lack of the use of corrosion mitigation technology and proper surface protection increased both the magnitude and speed of the cycle.

Accelerated corrosion then takes place due to the larger difference in corrosion potential between the anodic and cathodic areas. Impressed Current Cathodic Protection (ICCP) overcomes this chloride imbalance by providing a low DC powered artificial anode, which reverses the corrosion current making all of the reinforcing steel the cathode, or the non-corroding part of the circuit.

The proper understanding of the corrosion process allows for a project to address the problem of rebar corrosion as well as the symptom of concrete spalling. It is therefore an important aspect of the project to take measures to mitigate the corrosion of the reinforcing steel while also repairing the damaged concrete. Effective corrosion mitigation can delay or greatly minimize future concrete spalling from rebar corrosion.

RECOMMENDATIONS

It is recommended that Silver Point undergo an exterior structural balcony/walkway concrete repair, weatherproofing, corrosion mitigation and preventive maintenance project as soon as practical. We are willing to lend our expertise and technology to the project in a joint venture fashion with the owners at Silver Point to keep costs as low as possible, provide the most effective repair and preventative maintenance solution available and mutually reduce the risk involved with controlling the cost considering the location and access to manpower, equipment and materials. This can be achieved by utilizing local manpower along with a few members of our team with specific knowledge and leadership abilities in building restoration and cathodic protection. We can procure all needed materials and equipment from our sources for cost effective shipping to the project.

The best course of action is to remove all of the existing exterior balcony and walkway floor finishes to allow for proper repairs and subsequent application of protective finishes. As part of the structural repairs, integrate Impressed Current Cathodic Protection to provide the best technology available to prevent future concrete damage due to reinforcing steel corrosion. Finally, utilize proper coatings and sealants to protect and beautify the building.

Once the information in this report is reviewed, discussed and understood, the Association can reach conclusions as to the planning and timing of the recommended repair work. Keystone Engineering can provide valuable input and services towards this discussion and decision-making process.

CONCLUSION

It is our intention to assist and guide you to complete a quality and cost-effective project that will both enhance the value of your building and provide extended service life.

Enclosed you will find survey summary quantities, survey results and project budget considerations.

We look forward to our meeting on January 12 and discussing the project further and answering any questions you have in order to assist with the ongoing decision process.

Sincerely,

James E. Emory, P.E.
President
Keystone Engineering & Consulting, Inc.

Budget Items and Quantites for Consideration-**BALCONIES**

Silver Point
Freeport, Bahamas

Keystone Engineering
October 2012

	A	B	C	D	E	F
1			**Estimated**		**Estimated**	**Estimated**
2		**Item**	**Units**		**Unit Cost**	**Extended Cost**
3	1	Mobilization/Design/Set-up	1	Ea.	$ -	$ -
4	2	Removal of Finishes				
5		a.Ceiling Elastomeric Paint	17,952	SF	$ -	$ -
6		b. Floor Finishes-tile/coating	19,872	SF	$ -	$ -
7	3	Concrete Repairs				
8		a.Slab Surfaces	2980	SF	$ -	$ -
9		b. Ceiling Surfaces	993	SF	$ -	$ -
10		c. Full Depth	436	SF	$ -	$ -
11		d. Beam	138	CF	$ -	$ -
12		e. Knee Wall	81	CF	$ -	$ -
13		f. Columns	55	CF	$ -	$ -
14		g. Stucco	2500	SF	$ -	$ -
15	4	Cathodic Protection	19,872	SF	$ -	$ -
16	5	Finishes				
17		a. Wall Paint	50,000	SF	$ -	$ -
18		b. Floor Coating	19,872	SF	$ -	$ -
19	6	Drainage/Profiling Allowance	1250	SF	$ -	$ -
20	7	Sliding Door				
21		a. Remove and Reinstall	9	Ea.	$ -	$ -
22		b. Replace	1	Ea.	$ -	$ -
23					$ -	$ -
24						
25		**Estimated Balcony Total Budget**				$ -

Concrete repair quantites are estimaes only based on a partial non-destructive inspection. Additional damage and costs may exist for hidden conditions and additional damage that will occur with time

Budget Items and Quantites for Consideration-**WALKWAYS**

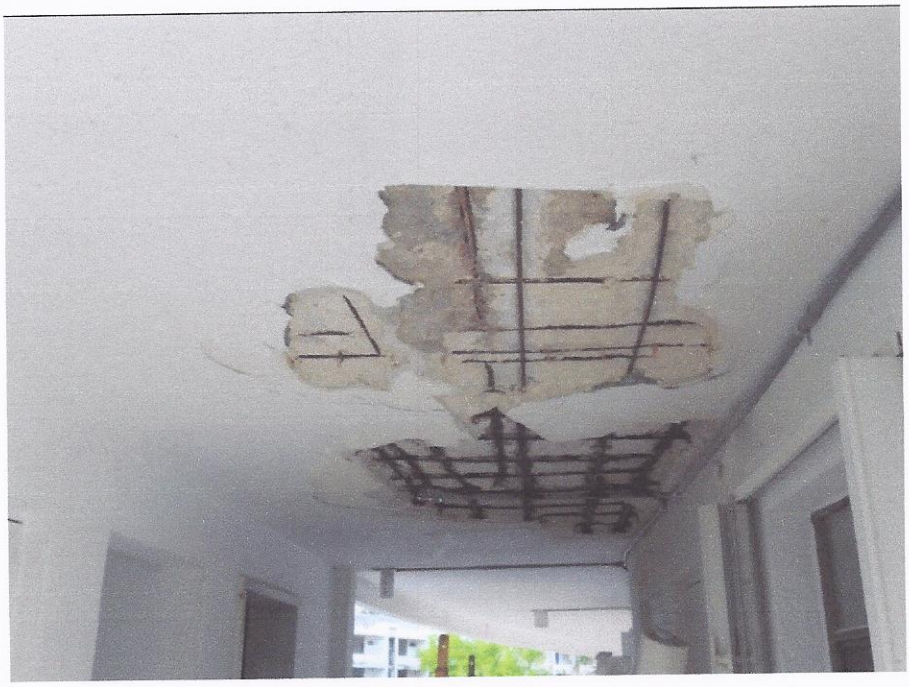
Silver Point
Freeport, Bahamas

Keystone Engineering
October 2012

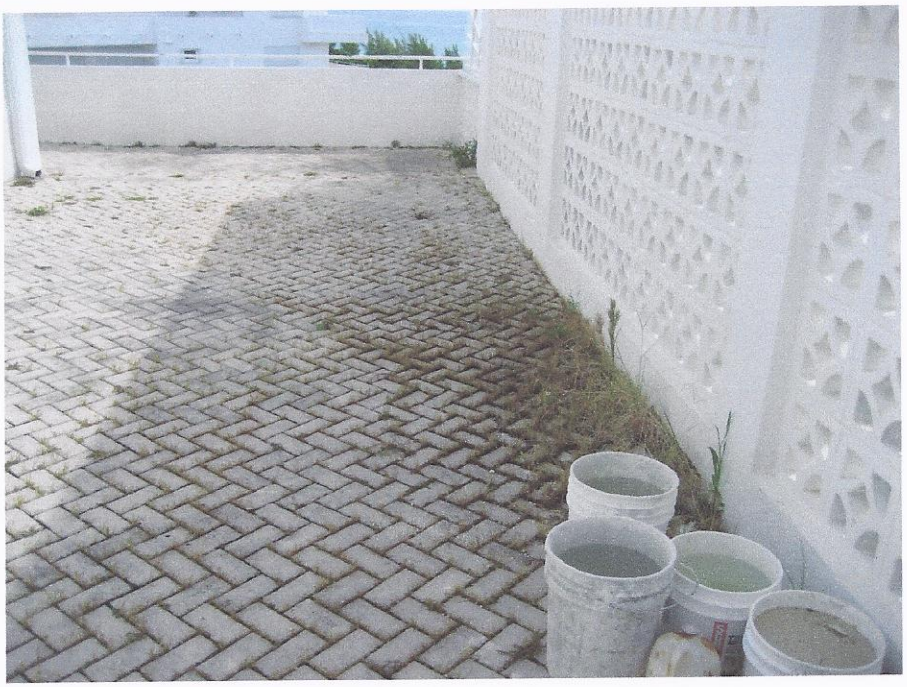
	A	B	C	D	E	F
1			**Estimated**		**Estimated**	**Estimated**
2		**Item**	**Units**		**Unit Cost**	**Extended Cost**
3	1	Mobilization/Design/Set-up	1	Ea.	$ -	$ -
4	2	Removal of Finishes				
5		a.Ceiling Elastomeric Paint	22,736	SF	$ -	$ -
6		b. Floor Finishes-tile/coating	22,736	SF	$ -	$ -
7	3	Concrete Repairs				
8		a.Slab Surfaces	2237	SF	$ -	$ -
9		b. Ceiling Surfaces	1136	SF	$ -	$ -
10		c. Full Depth	657	SF	$ -	$ -
11		d. Beam	92	CF	$ -	$ -
12		e. Knee Wall	94	CF	$ -	$ -
13		f. Columns	65	CF	$ -	$ -
14		g. Stucco	3000	SF	$ -	$ -
15	4	Cathodic Protection	22,736	SF	$ -	$ -
16	5	Finishes				
17		a. Wall Paint	60,000	SF	$ -	$ -
18		b. Floor Coating	22,736	SF	$ -	$ -
19	6	Drainage/Profiling Allowance	1500	SF	$ -	$ -
20	7	Below Building-Water Side				
21		a. Ceiling Surface Repair	135	SF	$ -	$ -
22		b. Column Repair	157	CF	$ -	$ -
23		c. Beam Repair	65	CF	$ -	$ -
24						
25		**Estimated Walkway Total Budget**				$ -

Concrete repair quantites are estimaes only based on a partial non-destructive inspection. Additional damage and costs may exist for hidden conditions and additional damage that will occur with time

Repairs underway on unit 81 November 2012-typical of expectations



Repairs underway on 2nd level walkways-west end near elevator-November 2012



View of Pavers on Penthouse balconies-poor protection for structure

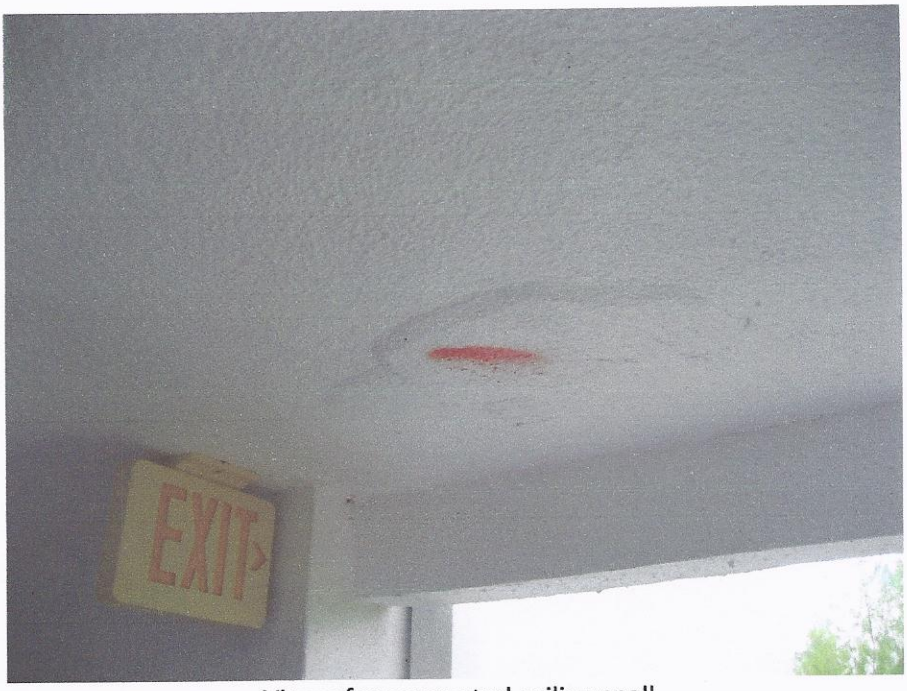
View of leaking evidence at Walkway knee wall edges

View of improper heavy elastomeric paint applied to walkway ceiling

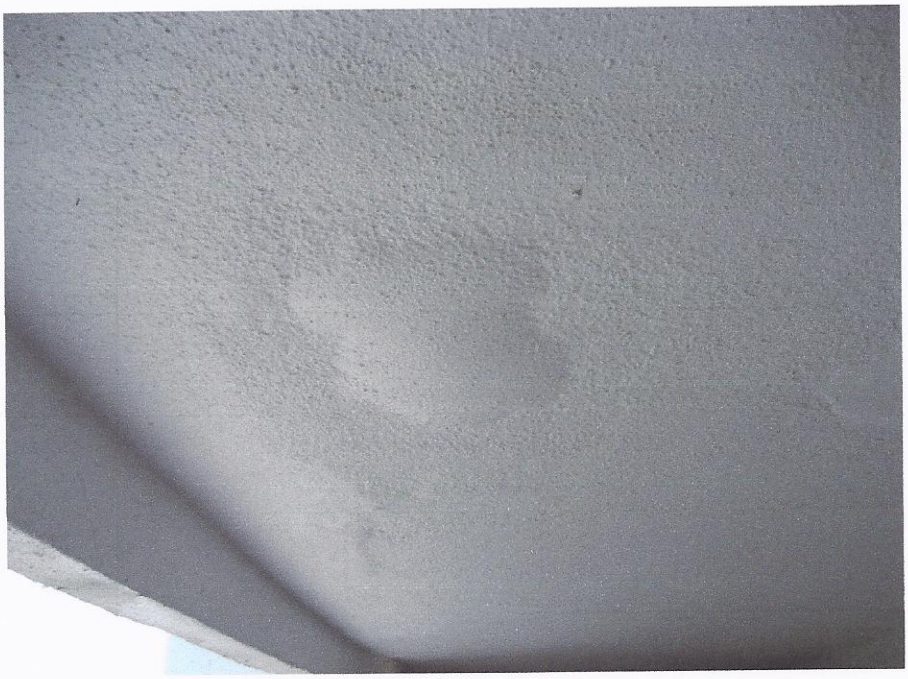
View of exposed concrete spall and rebar corrosion on walkway ceiling

View of typical concrete spall in turned-down perimeter beam

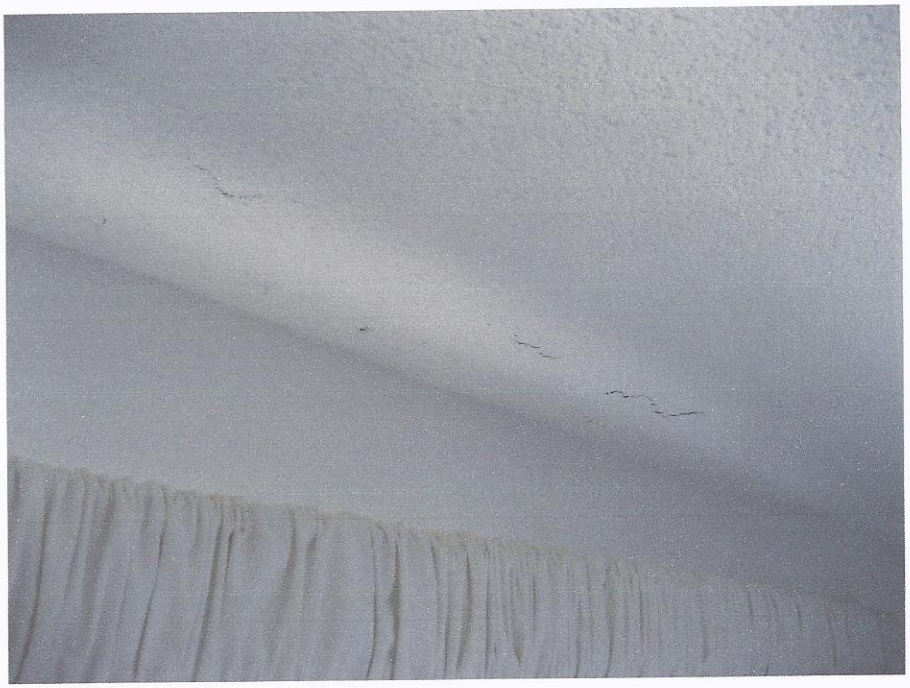
View of exposed reinforcing steel corrosion in turned-down perimeter beam
Note-loss of cross sectional area of steel reinforcement due to corrosion activity



View of unexcavated ceiling spall



View of paint bubble in ceiling due to water intrusion trapped by elastomeric coating

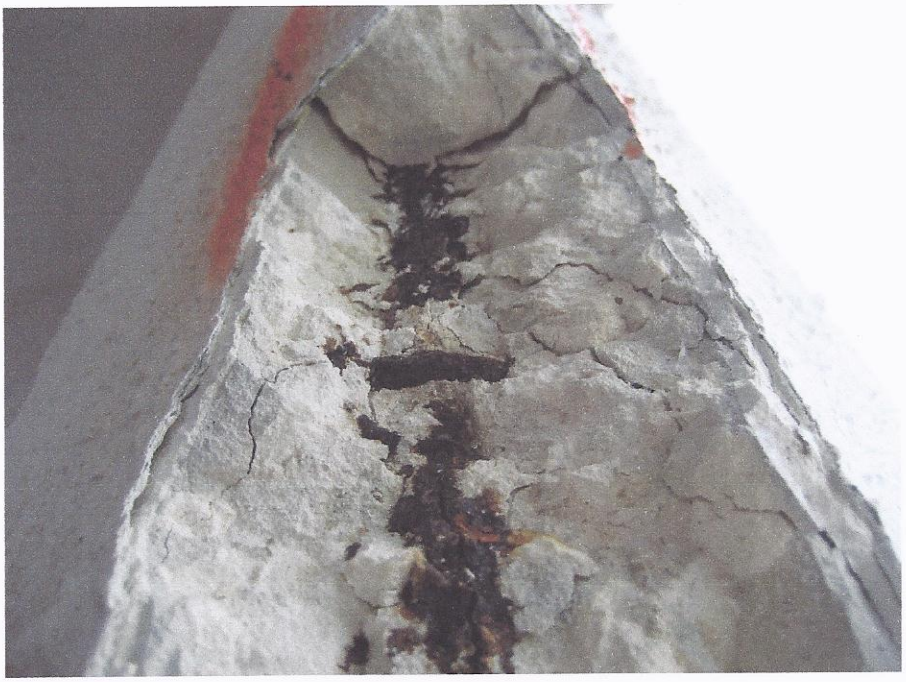


View of interior concrete spalling at ceiling near balcony sliding glass door

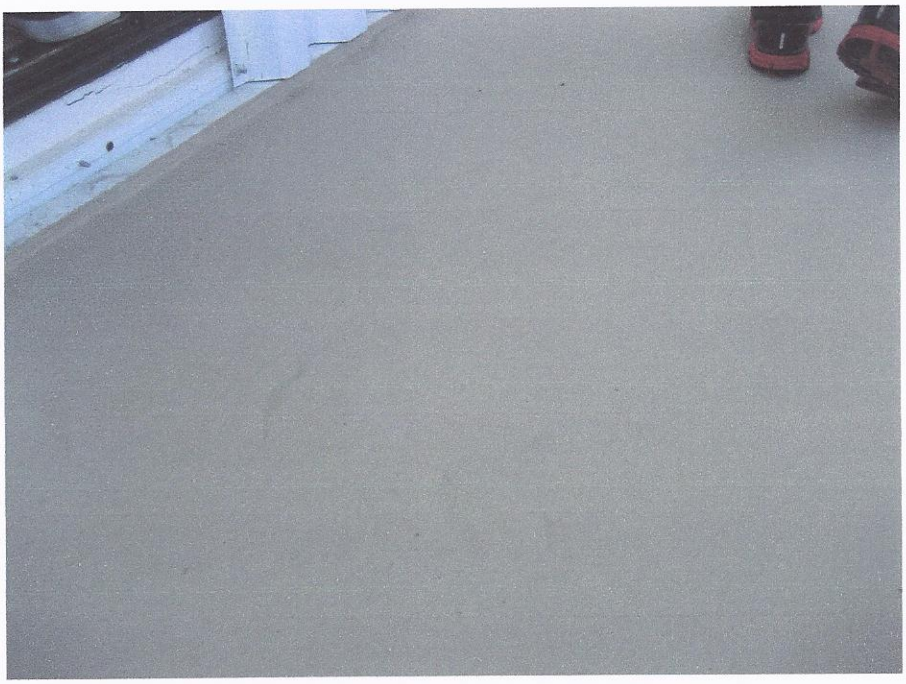
Example of probable concrete spalling under cracked tile on balcony

Example of probable interior spalling under cracked tile

Example of spalled header beam above sliding door



Example of spalled concrete at vertical support column



Example of unexcavated floor spalls