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May 21, 2009

Architects Hawaii Limited
American Savings Bank Tower
1001 Bishop Street, Suite 300
Honolulu, Hawaii 96813

Attention: Alan Atkinson, AIA, CSI, CCS

Re: Structural Assessment at Kuhio Park Terrace Building Complexes A and B

Dear Mr. Atkinson:

At your request, we had the opportunity to review the condition of the Kuhio Park Terrace Building Complexes A and B, located at 1475 Linapuni Street, Honolulu. This review was requested to assess the probable structural integrity and remaining service life of the buildings.

DESCRIPTION

Building Complexes A (Photo 1) and B (Photo 2) are similarly configured high-rise apartment structures constructed in the early 1960s. Each complex consists of three 16-story building wings radiating out from a central elevator and stair core structure and separated from the central core with 6 in. wide seismic joints. The buildings are constructed of reinforced concrete with 6 in. thick slabs spanning to columns and bearing walls supported on spread footings tied together with grade beams. The drawings show each wing contains 6 to 7 units per floor. Transverse bearing walls appear to separate the wings into 4 to 5 separate spaces at each floor. Exterior cantilevered walkways with reinforced concrete guardwalls provide access to the units. Each unit also contains a cantilevered lanai with reinforced concrete guardwall.

Unit partitions are typically constructed of concrete masonry units (CMU). The front face of the central core and stairwells at the ends of each wing are covered with a CMU screen block grill supported on structural steel angles attached to the leading edge of each floor. The screen block is reinforced with No. 3 rebar at 24 in. vertically and Dur-o-Wall reinforcing horizontally placed in the joints.

The first floor porte cochere canopy at the front entrance to the building is a structural steel framed roof structure supported on reinforced concrete columns.

SCOPE OF WORK

Our scope of work consisted of the following items:

- Review of the original building drawings provided by the Hawaii Public Housing Authority.
- Site survey to visually observe the condition of the building and sound bare concrete surfaces with a hammer to identify delaminated locations. Nondestructive observations took place from exterior ground level locations and publicly accessible walkways and stairwells. In addition, access was provided to one unit lanai at each floor of each wing, or 96 (16%) of the 592 lanais in the complexes.

- Assessment of the structural integrity of the buildings based on our visual observations and drawings review. Any deficiencies that were readily apparent were reported and preliminary recommendations are provided for repairs concerning the structural integrity and deterioration of the buildings.
- Report summarizing the results of our assessment.

Our scope of work did not include the following items:

- Review of hidden conditions such as those covered by floor, ceiling or wall panels and coverings.
- Survey to verify the accuracy of the drawings with respect to the existing construction.
- Physical testing of structural elements or quantitative structural analysis to determine the adequacy of structural elements and systems.
- As-built drawings and construction documents.
- Geotechnical engineering services and hazardous material investigation.

The opinions and comments formulated during this assessment are based on observations made at the time of the investigation. No guarantee or warranty as to future life, performance, or need for repair of any reviewed conditions is expressed or implied.

OBSERVATIONS

From our review, we have the following observations:

- Roof fascia corrosion (Photo 3) and soffit cracks (Photo 4) were observed in the porte cochere canopies for both buildings.
- Concrete spalling and delaminations were observed at the leading edge (Photos 5 and 6) and top surface (Photos 7 and 8) of exterior walkways and lanais as well as at the top of guardwalls (Photo 9). Isolated spalling was also observed at the exterior building walls and masonry partitions (Photo 10). At many of these locations where the rebar was exposed, concrete cover was observed to be ½ in. or less. In general, the reinforcing did not appear to have significant section loss.
- Spalling at Building Complex B appeared to be less extensive than at Building Complex A. Reportedly, Building B had been repainted a few years ago while Building A has not been repainted for a longer period of time. It is assumed that spall repairs were performed on the exterior of Building B during repainting, resulting in less observed spalling currently.
- Spalling was also observed in the screen block grill, particularly at the central core for Building Complex A (Photo 11). Portions of the support angle were also observed to be corroded, particularly at the bottom floor (Photo 12).
- Interior concrete walls, columns and floors as well as interior CMU partitions were observed to be in good condition.
- No significant cracks or other distress was observed in structural elements to indicate damage from differential foundation movement, gravity loads or extreme events.
- Building drawings show the buildings to be designed to the 1958 Uniform Building Code. Although the building may have met the lateral load requirements of this code, lateral load forces and detailing have increased since then. However, the inclusion of earthquake joints and other details indicate that considerations for lateral loads were made in the design.

CONCLUSIONS AND RECOMMENDATIONS

From our observations, we have the following comments:

Corrosion of the porte cochere fascia and cracks in the soffit indicate that water may be infiltrating into the enclosed soffit space. The roof framing and soffit/fascia framing should be inspected and any framing members exhibiting significant corrosion, particularly the lighter gage soffit framing members, should be repaired or replaced.

The observed spalling is due to corrosion of the embedded reinforcing in the concrete or masonry. As the steel corrodes, it expands to several times its original volume, resulting in spalling of the surface concrete cover. As most of the exposed reinforcing at spalled concrete or masonry areas was observed to have a cover less than ¾ in., it appears that much of the spalling is the result of insufficient concrete cover. For the screen block grill, corrosion of the reinforcing located in the mortar joints and possibly of the support angle is resulting in splitting and separating across some of the joints as well as spalling of portions of the block. Due to the fact that the block itself is not reinforced, further corrosion of the reinforcing or the support angle over time may compromise the integrity of the block to the point that the grill may need to be replaced. In addition, protection of the angle or joint reinforcing from further corrosion may be difficult to achieve.

For the remaining concrete and masonry partition elements, as the spalling concrete can be a falling or tripping hazard and as continued corrosion of the reinforcing will eventually adversely affect the structural integrity of the buildings, the spalls should be repaired. Repairs should consist of identifying and removing the unsound concrete, sawcutting and squaring the edges of the repair area, removing additional concrete to completely expose around the reinforcing, cleaning and treating the reinforcing, and patching the void with an appropriate repair mortar.

Extrapolating from the visual survey of the exterior of the building and 16% of the lanais, a rough quantity of existing spalls has been estimated. These quantities along with an opinion of probable cost for repairs is provided in Table A. Exact quantities should be verified by sounding of all concrete surfaces and actual performance of the work.

TABLE A: OPINION OF PROBABLE SPALL REPAIR COST

BUILDING A

Spall Repair Type	Quantity	Unit	Unit Cost	Amount
Top Surface	2,200	Sq Ft	$150	$330,000
Leading Edge	1,200	Lin Ft	$220	$264,000
Top of Wall	150	Lin Ft	$200	$30,000
Vertical Surface	300	Sq Ft	$180	$54,000
			SUBTOTAL:	$678,000

BUILDING B

Spall Repair Type	Quantity	Unit	Unit Cost	Amount
Top Surface	1,300	Sq Ft	$150	$195,000
Leading Edge	500	Lin Ft	$220	$110,000
Top of Wall	50	Lin Ft	$200	$10,000
Vertical Surface	100	Sq Ft	$180	$18,000
			SUBTOTAL:	$333,000

TOTAL:	$1,011,000

To further protect the exterior reinforced concrete and masonry, waterproof coatings, sealers, anti-corrosion inhibitors and other protection mechanisms should be considered to mitigate further corrosion and spalling. If properly maintained, including periodic recoating and spall repair, it is not unreasonable to assume that the building service life may be extended 50 years or more.

Please call me should you have further questions on this matter.

Sincerely,
MKE Associates LLC

Glenn H. Miyasato
Its member

Photo 1. Building A

Photo 2. Building B

Photo 3. Roof Fascia Corrosion

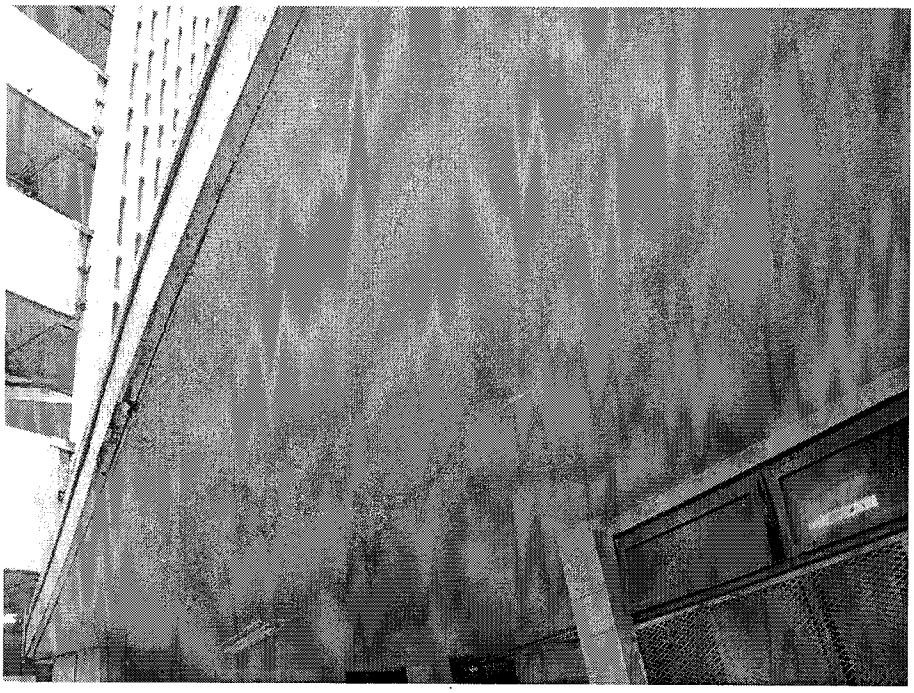

Photo 4. Soffit Cracks

Photo 5. Leading Edge Floor Spall

Photo 6. Leading Edge Soffit Spall

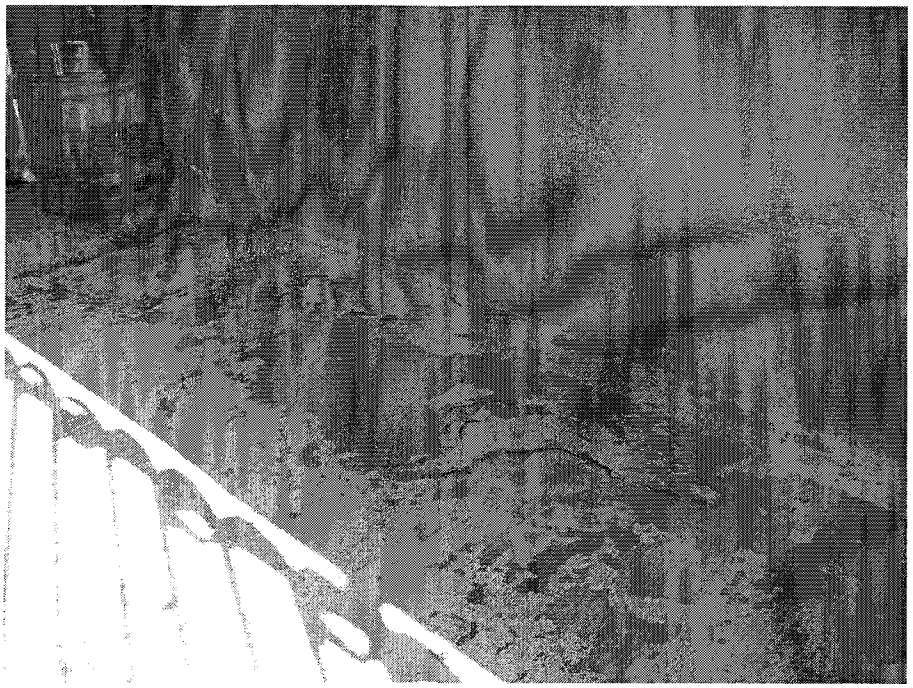

Photo 7. Lanai Top Surface Spalling

Photo 8. Walkway Top Surface Spalling

Photo 9. Top of Guardwall Spall

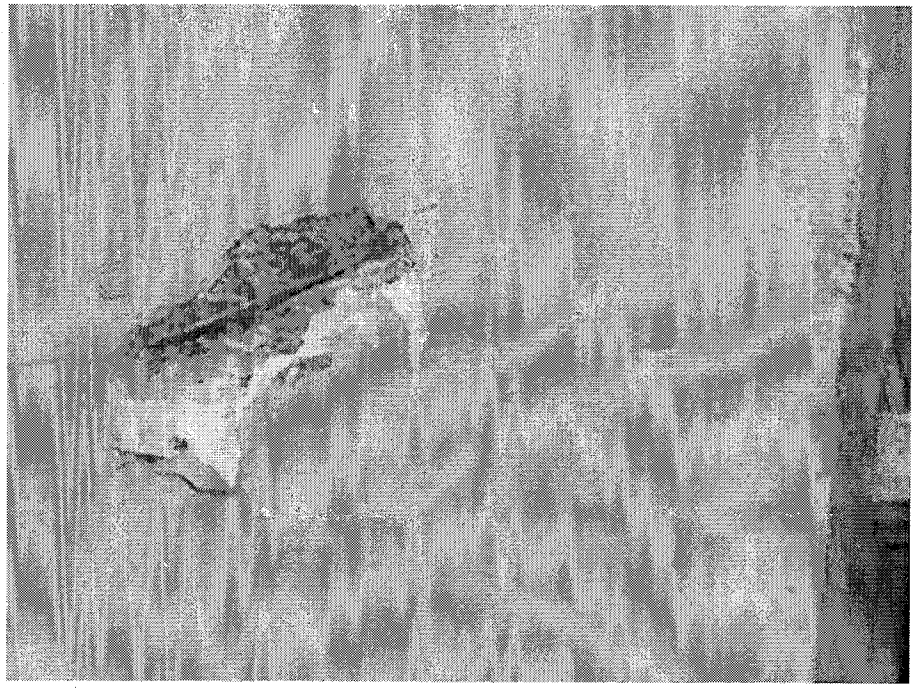

Photo 10. Wall Spall

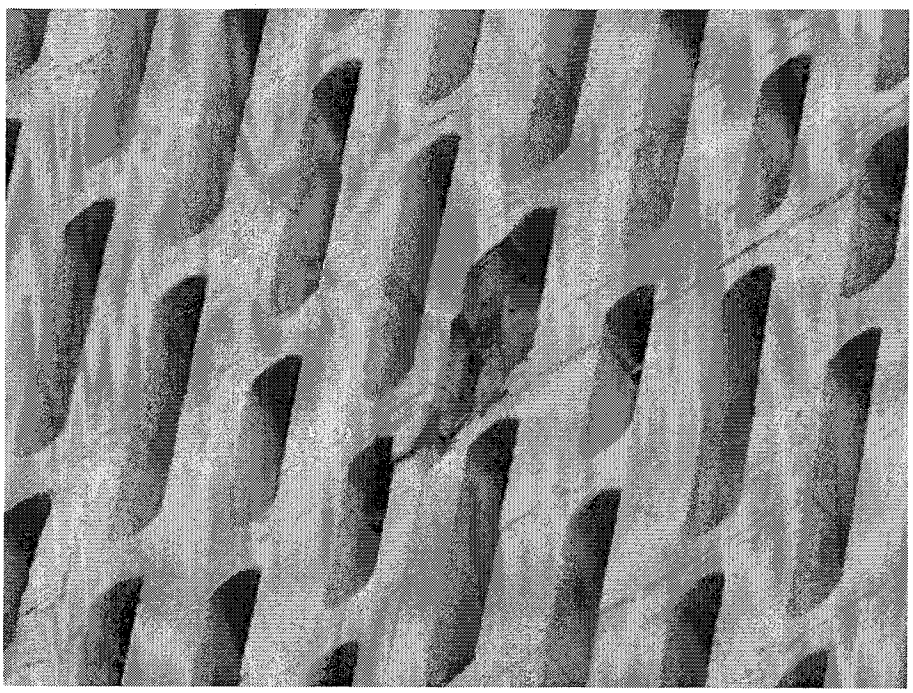

Photo 11. Screen Block Grill Spall

Photo 12. Corroded Support Angle