cutler-gallaway services, inc.
STRUCTURAL ENGINEERS

Earl G. Cutler, P.E.
Thomas M. Gallaway, P.E.

January 20, 2003

Ms. Gwen Peterson
Olmos Tower
700 E. Hildebrand
San Antonio TX 78212

Re: Olmos Tower Roof Investigation

Dear Ms. Peterson:

Attached for your further use is our report on the structural evaluation of portions of the roof slab at Olmos Tower, in accordance with Phase A of our proposal of November 15, 2002. Our evaluation was for the purpose of determining the most likely cause of distress in the roof slab, with recommendations for remedial measures.

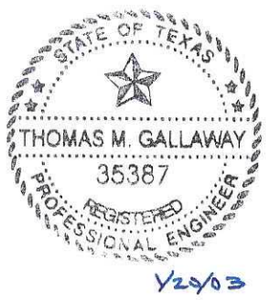
In general, we found approximately 250-350 square feet of roof slab at the mechanical penthouse to be significantly damaged by corrosion from the penetration of sodium chloride salt from the water softener area above. This damage has left those portions of the roof slab with a significant reduction in load capacity. Substantial repairs will be necessary to restore the integrity of the roof structure.

We have suggested two different methods to make the necessary repairs, along with some additional items noted in the penthouse.

Thank you for the opportunity to work with you on this project; please feel free to call if you have any questions or comments.

Sincerely,

Thomas M. Gallaway, P.E.
Principal



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Structural Evaluation Report

Olmos Tower Roof Investigation
700 E. Hildebrand, San Antonio

INTRODUCTION

This report details visual observations and measurements of portions of the subject building by personnel of ***Cutler-Gallaway Services, Inc.***, in accordance with Phase A of a proposal for Limited Professional Services dated November 15, 2002. The purpose of these observations was to determine the most probable cause of distress indicated in the roof slab, and to make recommendations for any remedial measures.

Limitations

The opinions stated in this report are based upon visual observations and limited computations related to specific framing members. We have made no calculations to determine either the adequacy of the building's structural system to meet intended loading criteria or its compliance with accepted building code requirements.

Background

The basic building was apparently constructed in about 1965, according to construction documents provided by the Owner. The building consists of a 15-story concrete frame with concrete, flat-plate floors. A basement and an adjacent parking garage are included in the property but are not a part of this study.

The roof level is also a concrete flat plate, with integral beams to support an elevated mechanical room and steel-framed roof. Steel columns for the penthouse bear directly on the concrete beams at the roof level.

Areas of Concern

According to Mr. David Reyna, Maintenance Supervisor for Olmos Tower, one of the residents on the top floor reported moisture on one of her bathroom walls. Upon investigation of the mechanical space above the ceiling, he discovered evidence of water penetration through the 8-inch roof slab. Rust stains were also noted on the bottom surface of the slab. He also found similar conditions in the mechanical space above the adjacent public hallway.

Mr. Reyna had samples of the concrete tested for the presence of chlorides and received positive indications from the testing laboratory. It was his opinion the source of the salt was due to spillage of water softener salt on the top surface of the slab in the penthouse over many years. This condition had been noted at sometime in the recent past, and a new concrete slab was placed in the penthouse to cover the old slab surface.

OBSERVATIONS

On or about 3 December 2002, personnel from our office visited the site to make observations and photographs of the slab conditions. A set of the original construction drawings was also provided for our reference. Our findings are as follows:

1. The new slab for the water softener covers approximately 150 square feet (SF) of the penthouse floor. It is approximately 6-inches thick and abuts the mechanical slab on the westerly end of the penthouse. *(Figs. 1 thru 4)* We do not know what reinforcing was used within the added slab.

2. The new slab was cast against the existing concrete curb with no apparent special treatment of the interface. We noted that the curb was significantly fractured, apparently as a result of the salt penetration. Pieces of the concrete could be lifted off by hand. *(Fig. 3)*

3. At the underside of the roof slab in the area of the water softener, several areas of corrosion were noted. In addition, spalling of the concrete surface was evident. *(Figs. 5 & 6)* Large sections of the concrete could be removed with a small tool, exposing corroded reinforcing steel. Some of the light gage steel wall framing was also noted to be corroded, possibly requiring replacement.

4. A buildup of chemicals leached out of the concrete was visible over approximately 250-350 SF of the slab. These areas were apparently the result of water penetrating the 8-inch slab and leaching out chemicals and salts. They indicate a fairly large extent of chemical activity. *(Fig. 7)*

5. Spalling was noted in several areas where the concrete had separated from the reinforcing and was suspended in place. We were able to slide a screwdriver several inches into the separations. In other areas, the separated concrete could be removed by hand. *(Figs. 8, 9, & 10)*

6. The corrosion and spalling was noted to extend over the hallway and the adjacent residence. We found that visible evidence terminated within approximately 20-ft either side of the elevator doors, but additional laboratory testing will be need to determine the full extent. *(Figs 11 & 12)*

7. The integral beams supporting the steel framing of the mechanical penthouse did not appear to have been damaged below the bottom of the slab, probably due to the significant increase in the concrete thickness. It is our opinion the main reinforcing in the beams is undamaged, but some exploratory testing should be performed.

8. Within the mechanical penthouse, we noted significant corrosion at the floor drain on the westerly end. *(Figs. 13 & 14)* This drain apparently is meant to handle condensate

drainage for several pieces of the mechanical equipment, since there are at least four lines terminating at the drain. Each of the lines discharge directly onto the floor surface instead of into the drain; we anticipate this will soon become a maintenance problem.

9. We noted that the floor area on the western side of the penthouse appears to inadequately drain and may introduce additional maintenance concerns. *(Fig. 15)*

CONCLUSIONS

Based upon our observations, additional information obtained from the construction documents, and Mr. Reyna's findings, we have reached the following conclusions:

1. It is our judgment that the observed corrosion and spalling of the roof slab was caused by the intrusion of sodium chloride salt into the slab. This was most likely the result of years of spilling salt onto the slab surface above, followed by moisture condensation and/or rainwater penetration which dissolved the salt.

2. With the introduction of brine onto the surface of the concrete, penetration through the slab would have occurred over an extended period of time, causing oxidation and corrosion of the reinforcing steel.

3. Casting the new slab at the water softener served an immediate purpose of providing a new working surface, but the damage by salt penetration into the concrete was not stopped. It is also our opinion that water is still able to penetrate through the interface between the new and old concrete, thereby keeping the corrosion process active.

4. Since we were only able to observe the bottom side of the roof slab at the softener, it is our opinion that the top layer of reinforcing steel is more severely corroded than the visible bottom layer.

5. Due to the loss of significant portions of the reinforcing steel within the affected areas of the roof slab, there has been a loss in the load capacity of the slab.

RECOMMENDAITONS

Based upon our findings, we make the following recommendations:

1. No materials or equipment should be stored within 10-feet either side of the new concrete slab in the mechanical penthouse until such time as structural repairs have been made.

2. The roof structure should be repaired to restore its load-carrying capacity by one of the two following methods:

   Method A: *Remove the damaged portions of the roof slab and replace with new concrete and reinforcing steel.*

   a. Relocate certain equipment in the mechanical penthouse.
   b. Remove the new concrete slab at the water softener, and remove damaged portions of the penthouse curb.
   c. Temporarily support mechanical piping and HVAC equipment in the ceiling space below the slab.
   d. Demolish and dispose of approximately 350-400 SF of existing roof slab, leaving the beams and steel penthouse framing intact.
   e. Install concrete forms and cast new portions of the roof slab.
   f. Reinstall mechanical equipment and add permanent supports in the ceiling space.

   This method results in the least amount of future maintenance problems, but will cause additional disruption to tenants.

   Method B: *Add a new concrete slab on top of the existing slab, with adequate reinforcing to support the existing slab and equipment.*

   a. Relocate certain equipment in the mechanical penthouse.
   b. Remove the new concrete slab at the water softener, and remove damaged portions of the penthouse curb.
   c. Clean and waterproof the top surface of the existing roof slab.
   d. Clean loose materials from the bottom surface of the slab.
   e. Cast about 450-500 SF of additional slab on top of the existing roof slab.
   f. Add reinforcing at two concrete beams as needed for the extra weight of the new roof slab.

   This method results in the least disruption to tenants, but may result in additional future maintenance due to the salts remaining within the concrete.

3. Repair all mechanical penthouse penetrations and sources of moisture to limit further

damage to the roof structure.

4. Replace all condensate lines and the floor drain at the westerly end of the mechanical penthouse.

5. Provide for adequate floor drainage around the mechanical equipment to prevent standing water or moisture penetration.

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Fig. 1 - Water Softener Slab and Equipment

Fig. 2 - Water Softener Equipment

Fig. 3 - Deteriorated Curb at Water Softener

Fig. 4 - Equipment Slab in Mechanical Penthouse

Fig. 5 - Spalled Concrete on Underside of Roof Slab

Fig. 6 - Corrosion and Spalling Under Water Softener

Fig. 7 - Leaching of Salts Through Roof Slab

Fig. 8 - Developing Spall Underneath Roof Slab

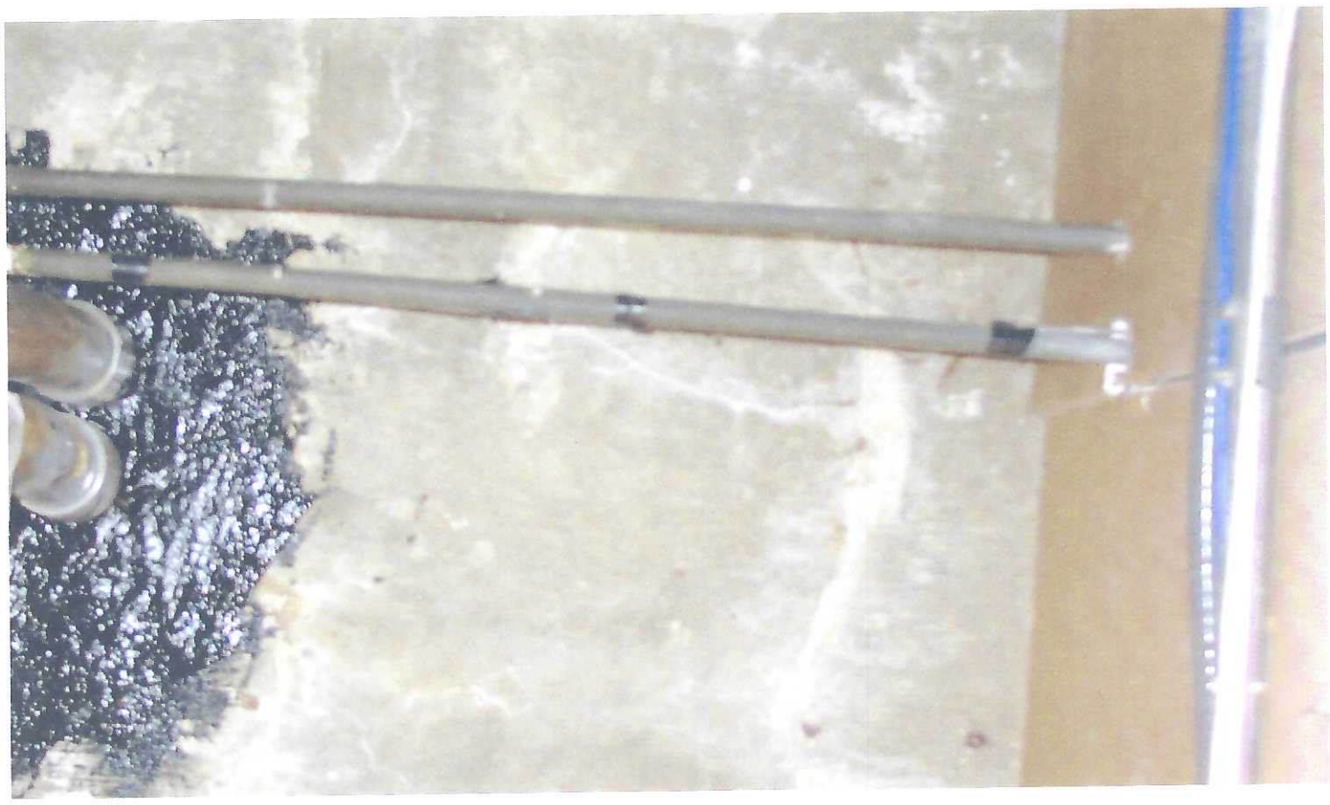

Fig. 9 - Roof Slab Above Electrical Equipment Room

Fig. 10 - Developing Spall Above Electrical Equipment

Fig. 11 - Leaching and Spalling of Roof Slab

Fig. 12 - Spalled Concrete and Corrosion of Roof Slab

Fig. 13 - Floor Drain Near Mechanical Equipment

Fig. 14 - Detail of Floor Drain

Fig. 15 - Floor Condition at Air Intake