WESTERN ARCHITECTURAL
forensic architects & engineers

PORTLAND
LAS VEGAS
SALT LAKE CITY

PROJECT NAME:	**Transition Center for Women**	*PROJECT #:*	**OR12-081**
FIELD REPORT:	**Basement Assessment**	*ISSUE DATE:*	**3-20-12**

Multnomah County Oregon
c/o Michael McBride
Facilities & Property Management
401 N. Dixon St.
Portland, OR 97227
email: michael.c.mcbride@multco.us

Dear Mr. McBride,

The following is a report of conditions observed during my March 15th site visit, where we discussed the problems associated with the basements at 722, 732, & 736 NE Couch St. All three houses have various histories of leaks and moisture intrusion, particularly 722, which recently underwent abatement for mold.

These three houses were built around the turn of the century. Due to the use of unwashed and poorly graded aggregate, along with crude mixing and placing practices, concrete from that era is notoriously poor compared to modern concrete, often earning the nickname "kitty litter". Indeed most of the concrete basement walls poured during that era can be picked apart with a simple nail or awl. These three basements are no exception.

That being said, even this imperfect concrete maintains a 1500 psi compression strength and, at six inches thick, is more than capable of supporting the dead and live loads of the houses. Several large areas along the east basement wall of 722 NE Couch show reduced wall thickness due to mold abatement efforts. The remaining wall thickness appeared to be roughly 5 inches and still does not represent a structural problem. However, these areas should be patched with repair mortar (e.g. Ardex B20) to restore the wall's appearance and original structural strength, as to well as prevent any further reduction.

Concrete is a porous material and will transmit water if not sealed. These three basements have no waterproofing on the walls or floor slabs to prevent moisture transmission. The higher the water content in the soil against the wall or slab, the more moisture will be transmitted into the basement. The soil against the east basement wall of 722 seems to have high moisture. In addition to causing moist basement conditions, saturated soil also does a poor job of supporting loads, and can cause the basement walls to subside (sink) slightly. This subsidence is usually uneven (called "differential settlement") and causes stress cracks in the concrete. Indeed, several large settlement cracks were observed.

For these reasons, it is imperative that the soil surrounding these three houses be dry and properly drained.

The most common source of basement-damaging water is roof drainage. Improperly installed gutters, downspouts, and drain pipes can deposit large quantities of water around basements and foundations. There are many reasons to believe roof drainage water is responsible for the problems at these three houses. The drain line along the west side of 722 was visibly backed up. The drain line along the east

side of 722 was found to be disconnected and full of debris. The drain line along the west side of 736 was found to be disconnected.

The first order of business must be to investigate, test, scope or otherwise verify the proper functioning of the existing rain drain lines. They may need to be cleared using a water jet technique. New drain lines may be required. The new lines will need to terminate in new catch basins, or tie into the City storm water system.

Once the roof run-off is properly routing water away from the basements, a large portion of the problems will likely cease, assuming there are no other significant sources of water. Other sources of water include leaking water lines, suspended water tables, or natural sub grade (underground) channels transporting water from surrounding properties. Such sources are very difficult to detect or identify.

Modern construction features water proofing on basement walls, and vapor barriers (plastic) beneath basement slabs to prevent moisture intrusion. While installation of a vapor barrier beneath the existing slab is not feasible, epoxy vapor barrier coatings (e.g. "Xypex", "Koster Vap 1 2000") can by applied to the top surface ("negative side") of the slab to retard vapor transmission significantly. Substantial repairs and surface preparation (shot blasting) are required to ensure adhesion of the coating, leading to costs approaching $6 per square foot. These same coatings can be applied to the interior of the basement walls to retard vapor transmission. The coatings may also offer some protection against leaks, but without guarantee.

Excavating and waterproofing the outside surfaces of the basement walls is the best way to prevent leaks. Since these basement walls are accessible and only half-buried, this is a reasonable option to consider. Typically, the new exterior wall coating is also covered with a drainage mat that routes water to a new perforated drain along the base of the wall to channel sub grade water away. Costs for this work probably fall in the range of $15K to $25K per house. Actual estimates should be obtained from contractors prior to any decision making.

Any future plans for carpeting, installing sheetrock, or otherwise "finishing" the basement spaces will require waterproofing the basement walls. Even with waterproofing, and especially without, the air humidity may exceed desired levels, requiring a ventilation (exhaust and make-up air) system, or dehumidifiers.

A final approach worth mentioning for controlling leaks is the installation of small, interior trench drains, routing leaking water to sump pumps or existing floor drains. These trench drains are made by saw cutting small "grooves" into the existing concrete floor slab and epoxying small plastic "gutters" into the floor, so that leaking water is controlled, rather than free to spread across the floor. This is a common and dependable way to allow use of a leaky basement space. The trench drains can be concealed by new interior wood-framed walls built up against the concrete basement walls. This work is comparatively inexpensive, costing $2K-$3K per basement. Actual estimates should be obtained from contractors prior to any decision making.

The details of any work performed would best be specified by a reputable building consulting firm such as Western Architectural, who could also provide 3rd party inspections and oversight to ensure the job is executed properly and the objectives are reached. Ideally, waterproofed walls would be flood tested, and vapor transmission rates would be measured to verify actual results.

Please find the attached captioned photos documenting my observations.

A. *OBSERVATIONS:*

1.01 The east basement wall of 722 NE Couch has been remediated for mold. Large areas of concrete on this wall have been removed, exposing voids, "rock pockets", and reducing the effective wall thickness.

1.02 The turn-of-the-century concrete could easily be picked apart by hand. This is typical for basement walls of this vintage.

These areas should be patched to restore their appearance and prevent further erosion of the wall thickness.

1.03 On the other side of this wall, a gutter downspout routes water to a drain line running along the exterior side of this wall.

The drain line may be clogged, disconnected, missing, or otherwise depositing large quantities of storm water to the soil surrounding the basement.

These drain lines must be investigated and repaired or replaced as the first order of business in addressing the basement leaks.

1.04 The concrete basement walls at 732 NE Couch exhibit the same poor concrete quality and moisture intrusion issues as 722.

1.05 This wall could be picked apart by hand, revealing visibly moist concrete behind the surface.

1.06 This protruding conduit at 736 receives water from a downspout, but is disconnected from any functional rain drain below grade, as I discovered when I moved it by hand.

1.07 This downspout at the southwest corner of 722 leads to a drain line featuring a typical bell as well as a clean out. This drain line appears blocked/ clogged, as standing water was visible at the surface of the bell.

B. *CONCLUSIONS AND RECOMMENDATIONS:*

The basement walls of all three houses are being exposed to excessive moisture, causing leaks, high rates of water vapor transmission, higher hydrostatic pressures, and differential settling in some areas.

The source of water is most often roof drain systems. The existing systems show obvious signs functioning poorly or not at all. All drain lines should be verified, cleared, repaired, or replaced as the first step.

The walls should be repaired by a skilled contractor, using Ardex B20 or a similar product to patch the damaged areas, and epoxy injections to fill structural cracks.

If leaks persist, or if lower humidity levels are desired in the basement areas, waterproofing should be performed. Exterior waterproofing is recommended, complete with drainage mat and footing drains. This offers the most assurance against future problems, known or unknown. Additionally, the footing drains will help protect against further subsidence and structural cracking in the walls.

Epoxy vapor barrier coatings can be applied to the slab surface to lower the rate of vapor transmission. This will also allow for the installation of floor coverings. These coatings can also be applied to the walls, although this has less benefit if the walls also receive exterior waterproofing.

Thank you for choosing Western Architectural to assist you in this matter. Should you have any questions or require further clarification on anything discussed in this report please contact me at your convenience.

Respectfully Submitted,

Edward W. Crabaugh, P.E.

C. *CONSULTANT ROLE AND DISCLAIMERS:*

Our inspection techniques consist of visually inspecting and sampling areas of the building where, in our experience, problems are likely to show themselves. However, because we do not remove exterior cladding, windows, and other materials overlaying the structure, we may not be able to identify some or all of the defective material (or installation of said materials) as would only be revealed if all of the cladding and windows were removed, and the surrounding surfaces were examined. Thus, please understand that there may be anomalies regarding the construction of the structure that we could not see and therefore cannot report. Western Architectural Forensic Architects and Engineers will not be held responsible for any concealed or undetected damage to your structure including microbial (mold) contamination.

Because of the necessarily limited nature of our inspection, any information we produce as a result will be limited to those conditions we actually observed during the inspection. This means, and you acknowledge, that our reports may not cover all repairs that are needed. This is why it is crucial that you retain highly qualified, detail-oriented repair contractors as part of your project team in addition to our professional services.

You also understand that Western Architectural Forensic Architects and Engineers is neither a guarantor nor an insurer of the adequacy of any construction, reconstruction or recommended action, and that our services are being rendered solely as an inspection consultant. We therefore disclaim, and you acknowledge our disclaimer of, any and all liability of any source or nature, to you or any third party, for any claims arising out of or related to the inspection process. Western Architectural may only be held to the same standard of care imposed upon a professional firm providing comparable inspection services.

You acknowledge that any reports issued by Western Architectural are to be used in light of the foregoing. You also agree that Western Architectural is in no way providing any assurance to you or any other party that any documents issued by us are exhaustive as to your project, nor that the project will be (or has been) completed in accordance with any particular plans or specifications, whether or not issued by, provided to or reviewed by Western Architectural. The responsibility for quality control of (and adherence to) the construction guidelines, specifications and plans is yours and that of your chosen project team.

This report is strictly limited to your use and should, in any event, be used only in its entirety with this disclaimer included.

END OF REPORT