October 26, 2011

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RE: On-site damage inspection report – Town of Oakland Garage

Background

This report presents the findings of Chequamegon Bay Engineering's inspection, performed on October 25, 2011. The inspection was performed at the request of the town Chairman to assess extent of damage to; and structural stability of the town hall as resulting from long term exposure of some building components to moisture.

The 89 year old town hall consists of a single story, wood framed structure 65½ feet long by 30 ½ feet wide. The floor framing consists of 2x8 floor joists at 16" o.c. spanning the short direction of the building, with two interior bearing lines for three equal spans of approximately 10' each. The interior bearing lines consist of heavy timber beams supported at 10' to 12' o.c. by timber blocking and masonry piers. Figure 1 shows elevation views of the exterior of the property.

Figure 1: North-West Elevation View Oakland Town Hall

Damage Observations

The existing floor framing of the building shows evidence of extensive deterioration caused by moisture contacting the untreated floor joists, sills, rim joists and sub-flooring. The amount of deterioration varies with the worst examples occurring along the north

wall. Figure 2 shows a rotted floor joist bearing condition where it meets the sill along the north wall. In this case the joist and sill are both showing severe deterioration with the joist failing in bearing. The portion of sub-floor nearest the wall is also failing, and the rim joist has been removed entirely leaving the exterior insulation exposed.

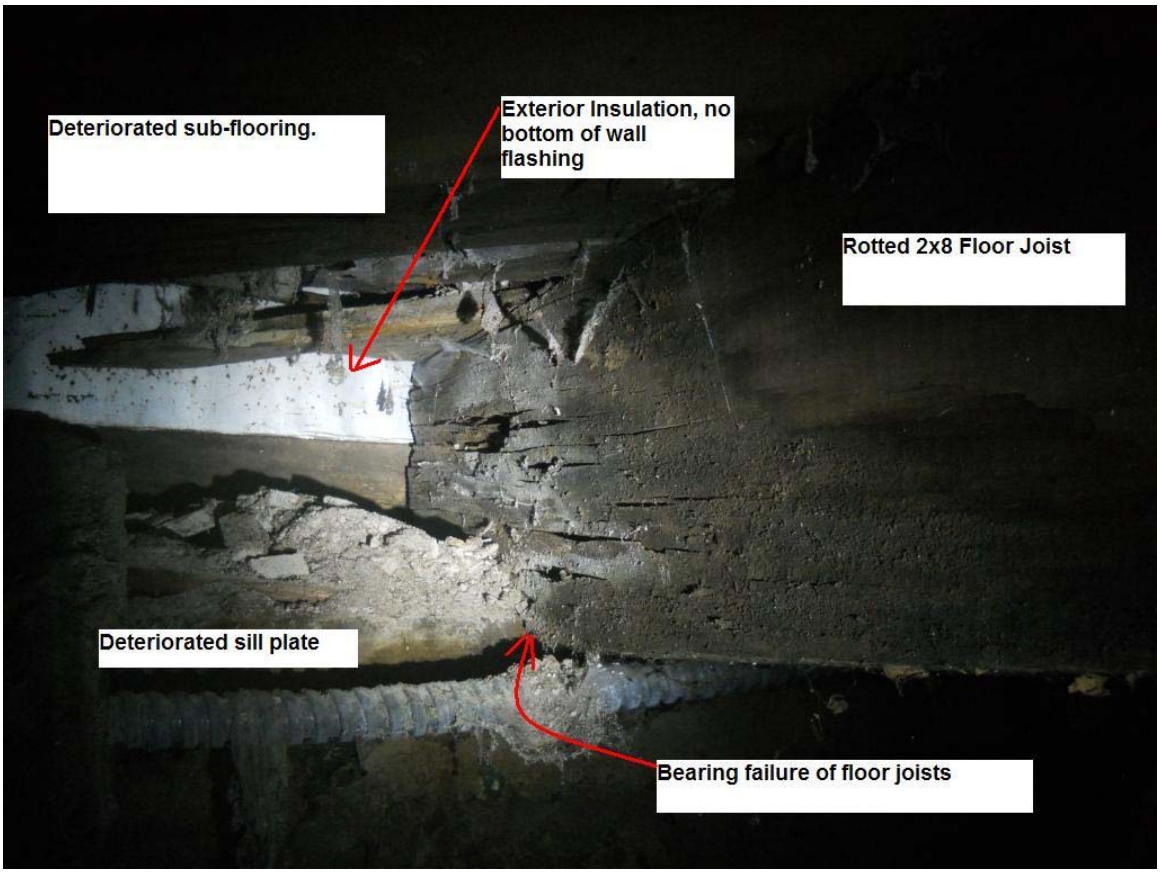

Figure 2: North Foundation Wall with Observations

The beams forming the interior bearing lines also showed evidence of deterioration along the bottom surfaces of the beams. The deterioration extended to a depth of approximately one inch into the cross section of the beams. The beams do not yet show evidence of overload, however further structural analysis would be required to determine the reduction in load capacity due to cross section loss. Figure 3 shows a typical interior support beam and concrete pier.

Figure 3: Interior Bearing Beam and Concrete Pier.

Source of Moisture

Observations onsite suggest that the moisture causing the deterioration of the framing has three sources. The primary source is suspected to be a high groundwater (1) table on the site, in combination with poor site drainage (2) of rainwater shedding from the roof which causes large amounts of water to move up through the soil into the crawlspace. This moisture was evidenced by muddy soil within the crawlspace at the time of inspection, and owner observations that there have been at times, puddles within the crawlspace along the north wall. The moisture present in the crawlspace is likely responsible for raising the overall humidity to a level that permitted the deterioration of the main floor beams away from the North wall.

The second source of moisture is infiltration of rainwater directly along the North wall above as a result of water shedding from the roof and wind driven rain. Figure 4 shows moisture observed extending downward from the North Sill during inspection. Several locations on the North wall were currently wet, or showed signs of efflorescence, the

evaporative salt deposits left on concrete walls that are frequently wet over a long period of time. It was noted during the inspection that there was no visible bottom of wall flashing, or modern weather resistive barrier installed on the building. The roof and attic of the structure were inspected show no signs of significant moisture infiltration, and appear to be in good condition. The interior wall construction was also checked and found to have a vapor barrier and insulation. With the roof, and interior ruled out as sources of moisture, it was concluded that the likely source of the moisture from the North Wall is wind-driven rain and water shedding from the roof above. Water and moisture in direct contact with this wall are not being properly resisted by a barrier or drained by flashing. This moisture, infiltrating directly from the north wall is likely the cause of the extensive deterioration of floor framing at the North wall bearing.

Figure 4: Moisture along inside face of North Wall

Additional Observations

Although not the primary function of this inspection, there were two mechanical issues noted during the course of the structural inspection. Upon review by CMG & Associates, it was noted that the electric unit heater used in the crawlspace is likely in violation of required clearance to combustibles. The required clearances vary by manufacturer, however a typical residential unit similar to the one in the photograph below (Figure 5), with a low operating temperature, would require 18”-24” clearance above the unit to any combustible materials. This unit is likely mounted too close to the floor framing above. It was also noted that the sink drain in the photograph appears to have a slope which is reversed. CBE recommends that the drain slope be checked, and adjusted if necessary.

We recommend the unit heater be replaced with heated pipe tracers and pipe insulation as required to reduce the chance of freezing.

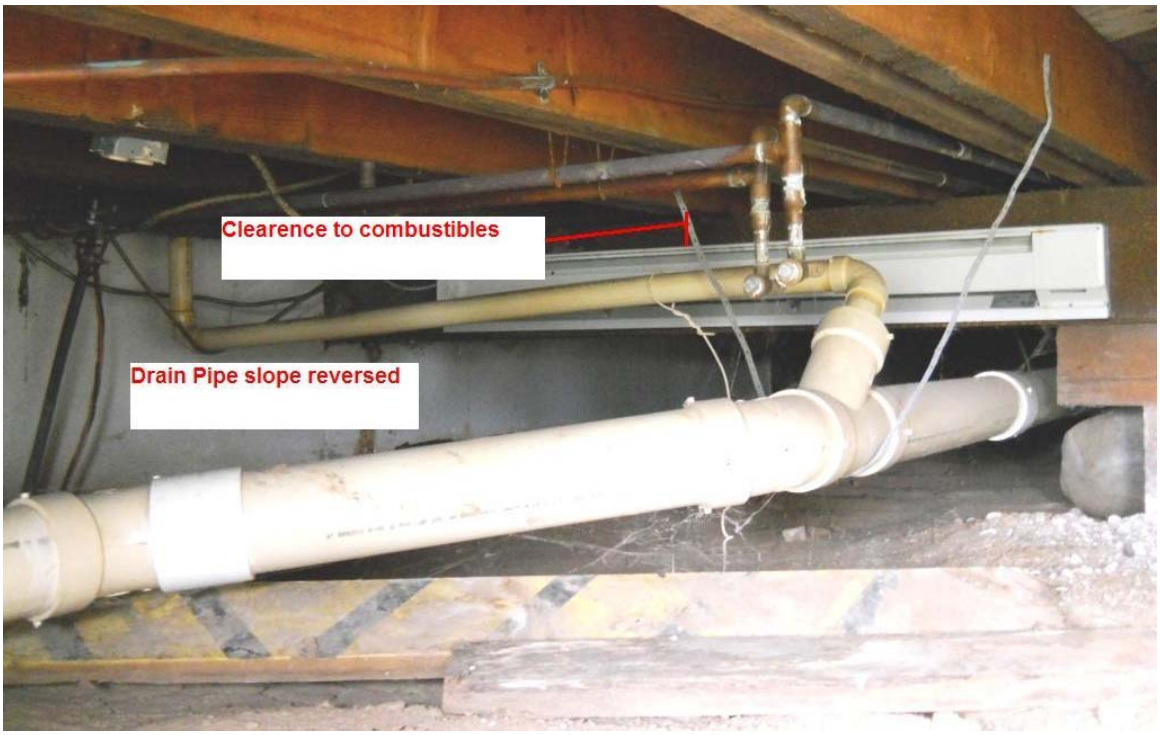

Figure 5: Mechanical Issues in Crawlspace

Building Condition and Life Safety

There were two significant structural deficiencies noted during the inspection. Both of these deficiencies should be addressed promptly if the building is to remain in service over the long term. In addition, it was noted that the floor of the assembly room in the North-West corner exceeds allowable cross slope requirements for the Americans with Disabilities Act. This cross slope is likely a result of failing floor joists and sills below the framing and foundation settlement.

1. Deterioration of the floor joists and sub-flooring. All of the floor joists bearing along the North wall are deteriorated to some extent. In places, the subflooring is deteriorated as well. This deterioration has progressed to the point of failure in several locations, which is likely contributing to the un-evenness of the floor above. While the joists are currently failing, the likelihood of an ultimate collapse failure under normal foot traffic is very low. Large point loads (greater than1000 lbs.) should not be placed along this wall.
2. Inadequate roof framing. The existing roof framing consists of site-built kingpost trusses with 2x4 top chords and 2x6 bottom chords and 1x4 web members. The existing compression web members, which are meant to provide support to the top chords are far too slender to provide meaningful support, leaving the 2x4 top

chords to span the full 14' from eave to peak. This span far exceeds a typical 2x4 rafter should not exceed a 10' span, even under the lightest load conditions. The likely result of this insufficient framing would be unsightly deflections in the roofline over time. The lack of a significant sag in the existing roof is likely due to the steep slope. The under-framed roof system is not an immediate safety concern, but should be addressed at the next re-roofing if the building remains in service.

Building Repair Recommendations

CBE recommends that given that the floor framing has been repaired in the past, and is in need of attention again, that the root source of the moisture be addressed in addition to the structural repairs to ensure that the building components are protected from further deterioration. Our recommendations are summarized below, and organized by the problem they are intended to solve. It is our recommendation that the Town of Oakland present this list to local contractors to provide budgetary estimates of repair cost to assist in decision making and planning.

1. **Soil Moisture Infiltration:**
    a. Install seamless gutters and downspouts along entire north side of building. Tie downspouts into drain tile or extend to daylight at the road ditch.
    b. Install drain tile. Trench along north and south sides of structure to 12" below crawl space grade to provide drainage of high water tables. Daylight drains to west ditch.
    c. Consider re-grading north yard and parking lot. This would involve stripping gravel driveway, re-grade from the building wall to the ditch flow line to provide greater slope away from the building, and re-installing a gravel driveway. Special attention to avoid the holding talks would be required.
    d. Install minimum 6 mil poly vapor barrier over entire crawlspace floor to reduce moisture migrating upward from the wet soil below. Heavy weight barrier is recommended since it would be subject to damage from foot and knee traffic. Secure at foundation walls and piers.
    e. Provide additional crawlspace venting at existing entrances, and provide new 2 new vents along South wall for cross ventilation. Current IBC code requires 1 square foot of ventilation opening per 150 square foot of crawl space area, per section 1203.3.1. A crawlspace of this size should have 14 square feet of total ventilation area.

2. **Rainwater Infiltration**
    a. Remove siding along North side of building.
    b. Remove bottom row of rigid insulation.
    c. Inspect rim joist, sill and bottom plate of wall along entire length of wall.
    d. Install custom galvanized flashing along entire north sill.
    e. Install modern weather resistive barrier (Tyvek or similar).
    f. Reinstall siding and insulation.
3. **Repairs to framing. (to be performed after step 2. b. above)**
    a. Raise and support entire structure just enough to allow removal and replacement of existing sills.
    b. Remove and replace sill and rim joist. This would likely involve abrasive cutting of existing anchors and nailing.
    c. Install Simpson strong tie strap anchors to re-anchor floor framing to the sill and sill to the foundation.
    d. Sister deteriorated floor joists with new 2x8 joists. Assume replacement of all joists along north wall and half of south wall for budgetary purposes, Approximately 75 joists in total.
    e. Deterioration may extend into wall bottom plate and studs along north wall. Extent of repairs to be determined upon inspection. For budgetary purposes, assume replacement of 10' of North wall framing, including one window will be required. Include temporary shoring of roof trusses, and allowance for replacing sheathing and siding on either side of opening.

We also recommend that the town have a mold inspection performed to determine if the mold spores within the occupied spaces are within acceptable levels. CBE's mold Inspector, Patrick McKuen is available at your request to perform mold sampling. He can be reached at (715) 682-6004.

Thank you for this opportunity to assist the Town of Oakland with this evaluation of structural issues at the Town Hall. If you have any questions regarding the findings our inspection please let me know.

Respectfully,

Brian P Hammond 11/3/2011

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