

<u>SIB Earthquake Damage Review</u>	<u>9/22/11</u>	<u>1pm-3pm</u>	<u>01</u>
Project Name	Meeting Date	Meeting Time	Meeting Number
<u>Smithsonian Institution Building</u>	<u>SIB</u>		
Project Location	Meeting Location		
<u>n/a</u>	<u>Marcus Wilkes</u>		
Project Number	Prepared By		

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At the request of the Smithsonian, representatives from SmithGroup and Thornton Tomasetti visited the Castle to review earthquake (8/23/11) damage in an effort to identify critical scope to be included in a future repair project. Using a post-quake field report by KCE engineers as a guide, the A/E team toured the following spaces and areas where damage appeared to be most evident.

- Ground Floor: North Tower Stair Hall, Main Hall, West Range, West Wing, interior of West Tower.
- Second Floor: Mechanical Room M244 over the East Range Cloister
- Third Floor: Regent’s Room (358), East Wing offices (303 and 305) and condensed file storage (304).
- Fourth Floor: south west Upper Main Hall offices (484 and 485), South Tower Office (465) and Storage (466), North Tower Stair Hall
- Fifth Floor: Upper Main Hall Attic (trusses)
- Sixth Floor: South Tower storage (650)
- Eleventh Floor: Flag Tower

The exterior stone of the building and towers were inspected from the roofs of the East Range, East Wing, and South Tower as well as from the eleventh floor of the Flag tower using binoculars. From ground level, an inspection was conducted on all sides of the exterior.

Location of observed damage:

A large quantity of the damage observed in the KCE report existed prior to the earthquake and is further documented in the 2009 Existing Conditions Report. This includes the spalled exterior masonry; water damaged interior plaster, and many of the minor wall cracks.

New interior cracking was observed in finishes (plaster) at multiple locations, likely as a result of the recent earthquake. This new cracking was generally not severe enough to suggest an immediate life safety problem and appeared primarily cosmetic in nature.

A few interior locations cited in the KCE report required closer inspection to ascertain the severity of the damage, which included damage to rooms 304, 484 and 485. The cracking at room 304 was as wide as ¼” at some locations, but a probe insert into the crack hit solid resistance at about 1” of depth suggesting that the masonry backup had not cracked. *Damage at rooms 484 and 485 had already been re-plastered and painted at the time of our visit*, so review of the substrate could not be performed at that location. The exterior stone façade at all three locations showed no evidence of major damage, suggesting that the movement did not translate to the masonry at any of these locations and we conclude the damage to be limited to the interior finishes.

If the interior finishes are to be repaired in the future, consideration should be given to removing the finishes to enable inspection and documentation of the structure and substrate behind before repairing the finishes.

The attic of the Upper Main Hall was inspected and no additional deformation or movement of the trusses was observed.

On the exterior, the KCE report documented damage to the East Wing chimneys, the South Tower and a sill at the 9th floor of the Flag Tower. This damage appears to be new (relative to the 2009 EC Report) and likely a result of the 8/23 earthquake.

At the time of our visit the six East Wing chimneys had been covered by plywood and retainer straps. The KCE photos show significant movement of stone on one chimney which will require at least partial reconstruction to repair. No further photos of the pre-protection condition were available. However, we assume that damage to the other five chimneys was significant enough to require the protection, and repairs would likely include at least repointing and resetting of stone, with partial reconstruction a worst case scenario.

Exterior cracking of mortar joints and stone at the South Tower chimney was visible from the roof level on the northeast and southeast sides of the chimney. Cracking was generally less than ¼” and followed the mortar joint for most of the crack length. Repairs for this area would likely include repointing and possible resetting of some stone.

Photo 85 of the KCE report shows cracking of a window sill stone on the 9th floor (north side) of the Flag Tower. While it does not appear to be an immediate threat to below nor a threat to the integrity of the tower, long term exposure of the open crack to the elements could loosen or spall sections of the sill stone.

Recommended Repair Task List:

Damage which we recommend including in a future repair project(s) can be itemized as follows:

- 1.0 Chimneys on East Wing. Not visible during this visit but from the photos on pages 7-9 of the KCE report, cracks in at least one of these chimneys are significant and should be repaired. The other five chimneys may need to be rebuilt; others might just need to have mortar joints re-pointed depending on the severity of the damage. In the case of the particular chimney cited in the KCE report, re-pointing the mortar joints may not be sufficient and reconstruction may be necessary. Site visits to inspect each damaged chimney and determine the severity of damage for each chimney will be required. The plywood wrap would need to be removed temporarily to allow inspection. Access to inspect and document repair may require the use of a service lift. Mortar analysis will be required in order to determine the appropriate match for repair work.
- 2.0 South Tower Chimney. Cracking visible in the façade above the South Tower roof should be repaired since the mortar joints are open and if they are left as is it will enable water penetration that may cause further damage and movement. Re-pointing the mortar joints will likely be sufficient. Direct access from the roof level should be sufficient to develop documentation and perform measurements of the repair area. As with the East Wing chimneys mortar analysis will be required.
- 3.0 Flag Tower sill stone, 9th floor. Cracking of the sill stone should be repaired or at least protected from future water penetration. It may be possible to develop repair documents without the use of a service lift, however it may be prudent to perform a closer inspection of the north side of the Flag Tower from the exterior. Should a lift be used to inspect the East Wing chimneys it could also be used to access the Flag Tower. As with the East Wing chimneys mortar analysis will be required.
- 4.0 Loose and spalled exterior stone repair. Both the KCE report and the 2009 Existing Conditions Report identify locations of damaged and spalled face stone (non-earthquake). These areas should be repaired to avoid further spalling and possible falling debris. Consideration should be given to preparing and implementing a holistic masonry repair and restoration program.
- 5.0 Interior plaster repair. All of the damage to interior finishes appears to be cosmetic and is generally limited to cracks less than ¼" in width. Since none of these cracks appear to be of structural concern, they can be repaired by conventional plastering methods. Some of the more egregious plaster damage cited in the KCE report has already been repaired by SI staff. Careful treatment of the plaster repair of the ceiling of the interior of the West Tower should be considered as this is likely the original Renwick era installation.

End of Report