What’s That Void?

a case study
Acknowledgements

• DR. Melissa Marot in helping proof read this presentation
• The team of 15 different company that assisted in the remediation of this property
• Lucinda Curran in her trust in me
• The Home Owner in allowing us to help them resolved the problem in their home
Pressure In Building

“Air flow in buildings is one of the major factors that governs the interaction of the building structure with the mechanical system, climate and occupants. If the air flow at any point within a building or building assembly can be determined or predicted, the temperature and moisture (*hygrothermal or psychometric) conditions can also be determined or predicted. If the hygrothermal conditions of the building or building assembly are known, the performance of materials can also be determined or predicted”

Joseph Lstiburek BSD Jan 15th 2014
Private Dwelling

• This is an “Owner Build” prior to the Baker’s purchase
• House is about 5 acre on a slope in the peninsula of Melbourne prime seaside location
• Due to Baker’s work which involved many oversea trip the house was really lived in
• 2017 Baker’s found house was flooded and subsequent mould on the lower level of the home (basement herein in called subfloor)

*Baker is not the real home owner name
History and finding

- House had total of 3 home build on the plot.
- There is no drainage in the property which reside on a slop.
- The house has a tennis court, bitumen driveway with no drain, and large garden space.
- The house is split into 3 level like a terrace style design with all water flow into the house landing into the subfloor.
- Subfloor is covered by plaster walls.
Project Scope

Initial projects scope of work:

• Provide a mould remediation scope of work and costing

But!

What the real Project scope of works finally was: - Project Manager – Building repair works, Mould remediation, Civic works and plumbing works

• Plan! ...find them...
• Engage builder
• Forensic Engineer
• Engage civil engineer
• Engage IEP
• Roof Plumbing Plan
• Gutter and drainage redesign and installation – Plumber and builder
• Building plan from council
• Engage Plumbing works
• Mould remediation works
• HVAC
• Subfloor Climate Control System design and installation
• Drainage works
• Local water ingress point civil and internal
Initial site drainage inspection

3. Site Drainage

We recommend that the site drainage is upgraded to divert any water that enters from outside the boundaries of the site directly into the storm water system. This is something that should be done even if building a new residence on the site.

4. Area adjacent to study and tennis court

The crazy paving area shows considerable signs of collapse from erosion, this area (marked in yellow) will need to be excavated and drainage installed and rebuilt. We also recommend a secondary drain (in blue) to divert any water from the tennis court directly into the storm water system. This will also need to address the storm water down pipe in this process.

Final Drainage Plan

Legend

- 1st draft drain plan
- 2nd line of water ingress defense
- 3rd line of defense
- water impact from neighbours
Water Ingress points – Subfloor

- Area with issue
- Water enter direction with no drain as yet
- Water travel point
- Suspect water enter point
- Area 2 x 1 m to dig tree to see down to see water depth
- Tennis court area 1 – 2 x tree out to dig into soil to see where water is going from crazy paver
Find Those Pipes

Equipment – Ridgid See Snake Camera
Upper Level
water ingress

• 2 x flower beds not water proofed
• Water is running to the subfloor via old foundation wall x 2 house
• Hard to identified
• Dye test proved one of our theory to be correct
• Water proof all garden bed with a state art system design by a landscaping engineer
Dye test – What this about

• Too many entry point
• Uncapped old storm water pipe etc
Final Drainage Plan
What that Void!
Well there a Roof Here!
So Does a void create pressure difference in building?

- Subfloor ventilation Fan installed
- Created a pressure difference
- HAVC this is study a lot
- Hourly average air velocities of 0.05 to 0.15 m/s (0.16 to 0.49 ft/s) were measured in the wall cavities when the windspeed was between 1 to 3 m/s (3.28 to 9.8 ft/s). Wind direction influenced the ventilation air velocity more than windspeed **Dr. Achilles Karagiozis**
Odour Tracking

Bell Lab Scope of Work (Brief)

Mould Squad engaged BELL Laboratories to help determine connections between the large cavity space and the occupied spaces using an odour tracking procedure. The procedure involved the release of a highly odorous, but non-toxic, tracer gas (cinnamaldehyde) into the subfloor cavity and observing the dissemination of the tracer within the building envelope.
### TEST METHODS

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Test Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Odour</td>
<td>VDI 3940</td>
</tr>
</tbody>
</table>

VDI = Verein Deutscher Ingenieure (Association of German Engineers)

### TEST SCHEDULE

<table>
<thead>
<tr>
<th>Location</th>
<th>Date</th>
<th>Test Parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td>East/west &amp; north/south void</td>
<td>18/12/17</td>
<td>Odour (intensity, character)</td>
</tr>
<tr>
<td>Wifi room</td>
<td>18/12/17</td>
<td>Odour (intensity, character)</td>
</tr>
<tr>
<td>Gym/ballet room</td>
<td>18/12/17</td>
<td>Odour (intensity, character)</td>
</tr>
<tr>
<td>Library</td>
<td>18/12/17</td>
<td>Odour (intensity, character)</td>
</tr>
<tr>
<td>Study</td>
<td>18/12/17</td>
<td>Odour (intensity, character)</td>
</tr>
<tr>
<td>Master bedroom</td>
<td>18/12/17</td>
<td>Odour (intensity, character)</td>
</tr>
<tr>
<td>Master ensuite</td>
<td>18/12/17</td>
<td>Odour (intensity, character)</td>
</tr>
<tr>
<td>Bedroom 1 / ensuite</td>
<td>18/12/17</td>
<td>Odour (intensity, character)</td>
</tr>
<tr>
<td>Bedroom 2 / ensuite</td>
<td>18/12/17</td>
<td>Odour (intensity, character)</td>
</tr>
<tr>
<td>Bedroom 3 / ensuite</td>
<td>18/12/17</td>
<td>Odour (intensity, character)</td>
</tr>
<tr>
<td>Main entrance</td>
<td>18/12/17</td>
<td>Odour (intensity, character)</td>
</tr>
<tr>
<td>Powder room</td>
<td>18/12/17</td>
<td>Odour (intensity, character)</td>
</tr>
<tr>
<td>Theatre</td>
<td>18/12/17</td>
<td>Odour (intensity, character)</td>
</tr>
<tr>
<td>Kitchen</td>
<td>18/12/17</td>
<td>Odour (intensity, character)</td>
</tr>
<tr>
<td>Kitchen prep area</td>
<td>18/12/17</td>
<td>Odour (intensity, character)</td>
</tr>
<tr>
<td>Dining room</td>
<td>18/12/17</td>
<td>Odour (intensity, character)</td>
</tr>
<tr>
<td>Laundry</td>
<td>18/12/17</td>
<td>Odour (intensity, character)</td>
</tr>
</tbody>
</table>
What it smells like

- *Odour Character (Quality)*

- The character of an odour is critical in assessing the nature or source of an odour. Odour character or quality is the property which enables us to distinguish different types of odours and is only ever descriptive. Like intensity and tone, odour character is determined directly by each assessor from undiluted sample air. Commonly, a set of standard descriptors is used, often arranged on an “odour wheel” which may include categories such as floral/fragrant, fruity, vegetable, earthy, fishy, offensive, chemical, medicinal. Each of these categories can be divided into subcategories, eg fruity (citrus, minty, melon); offensive (faecal, garbage, rotten eggs).
Conclusion

- Out the 18 area of test the outcome was there was a certain amount of leak from the void.
- Add cap to all power points
- Seal Subfloor space void
- Caulk floors

**TEST OUTCOME**

The outcome for each room or area is presented in the table below.

<table>
<thead>
<tr>
<th>No.</th>
<th>Area/Room</th>
<th>Observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>East/west &amp; north/south void</td>
<td>Tracer release point; Extremely strong, cinnamon</td>
</tr>
<tr>
<td>2</td>
<td>Wifi room</td>
<td>Distinct, cinnamon</td>
</tr>
<tr>
<td>3</td>
<td>Gym/ballet room</td>
<td>Weak, cinnamon</td>
</tr>
<tr>
<td>4</td>
<td>Library</td>
<td>Weak, cinnamon</td>
</tr>
<tr>
<td>5</td>
<td>Study</td>
<td>Weak, cinnamon; diffusing through power socket cut-out in floor</td>
</tr>
<tr>
<td>6</td>
<td>Master bedroom</td>
<td>Weak, cinnamon</td>
</tr>
<tr>
<td>7</td>
<td>Master ensuite</td>
<td>Distinct, cinnamon</td>
</tr>
<tr>
<td>8</td>
<td>Bedroom 1 / ensuite</td>
<td>Uncertain, competing wood like odours</td>
</tr>
<tr>
<td>9</td>
<td>Bedroom 2 / ensuite</td>
<td>Uncertain, competing wood like odours</td>
</tr>
<tr>
<td>10</td>
<td>Bedroom 3 / ensuite</td>
<td>Uncertain, competing wood like odours</td>
</tr>
<tr>
<td>11</td>
<td>Main entrance</td>
<td>Not detected</td>
</tr>
<tr>
<td>12</td>
<td>Powder room</td>
<td>Not detected</td>
</tr>
<tr>
<td>13</td>
<td>Theatre</td>
<td>Not detected</td>
</tr>
<tr>
<td>14</td>
<td>Kitchen</td>
<td>Not detected</td>
</tr>
<tr>
<td>15</td>
<td>Kitchen prep area</td>
<td>Not detected</td>
</tr>
<tr>
<td>16</td>
<td>Dining room</td>
<td>Not detected</td>
</tr>
<tr>
<td>17</td>
<td>Laundry</td>
<td>Not detected</td>
</tr>
<tr>
<td>18</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Mould Remediation & complexity

• Project has many complexity
• Drying using desiccated dry air and other heat drying method
• Continuous moisture ingress
• Multiple cleaning strategy i.e. Media Blasting works
• Containment setup and difficulty
Containment Setup
Cleaning
Non-Viable Sample Plan and Moisture Reading Plan - IEP
IEP – Pre- Sample and PRV Result

Figure 1: Pre-work - Total Airborne Fungal Spores
(3rd August 2017)

Figure 2: During work - Total Airborne Fungal Spores
(8th December 2017)

Figure 3: Comparison of ‘Pre’ and ‘During’ samples
(Total Airborne fungi as a percentage of average outdoor air)

[Graphs showing data and analysis related to airborne fungal spores pre- and during work]
Air Scrubber and Chamber setup
Drawing Plan
Air scrubbing? Did you say Negative pressure
Correction and adjustment needed
Climate Control IEQ Monitor Control

- Thermostat control
- Measure pressure differential with ability to turn off machine when reach above ±2 pascal
- Measure Temp/RH/Co2 and TVOC
- Unit is to assist as 3rd line of defense
- HVAC or heating unit internal
- Eliminate Infiltration when drying occurs
Water Proof – Concrete Hob

- A framework to so the framing wall can sit on without getting wet
- Stop water should there be any flood damage to go inside the house
Conclusions

The owner was able to have a out of the box approach to say million of dollars to rebuild in an area that is prone to water problem.
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Reference and definitions


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Questions?

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