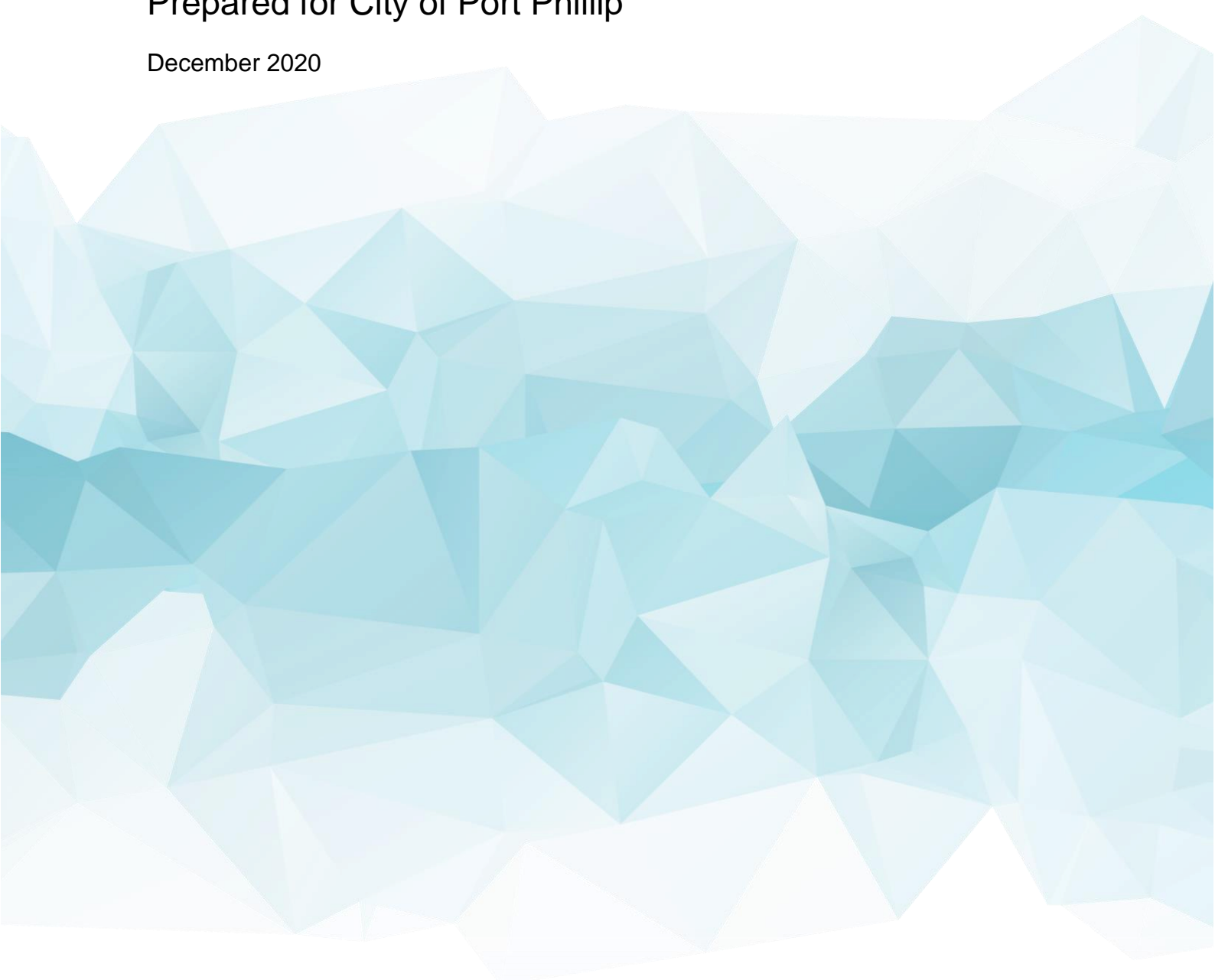


# ASSESSMENT OF TOWN HALL CLOCK TOWER

South Melbourne Town Hall

Prepared for City of Port Phillip

December 2020



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## 1 INTRODUCTION

### 1.1 Background

The South Melbourne Town Hall was built 1879/80 and is situated on Bank Street, South Melbourne, within the City of Port Phillip (CPP).

In March 2020, Infracorr Consulting Pty Ltd (Infracorr) and ASSE Consultants Pty Ltd (ASSE) undertook an inspection of the South Melbourne Town Hall for the CPP. The clock/bell tower was not accessible at that time. CPP has since engaged Working Height & Access Solutions (WHAS) and have installed a new fall arrest system to enable access up to the tower.

City of Port Phillip (CPP) have subsequently engaged Infracorr and ASSE to assist with an internal inspection of the clock tower. CPP also provided drawings to Infracorr and ASSE that were prepared by the surveying company Veris Australia Pty Ltd (Veris), as well as photographs and exterior drone footage of the clock tower.

### 1.2 Scope of Works

#### 1.2.1 Brief

Infracorr's scope of works was to perform a general inspection of the structural elements in the interior of the clock tower from areas accessible with the newly installed fall arrest system. This included visual inspection including assessment of timber condition and other visible defects or deterioration on the internal exposed structural elements.

Where appropriate, comment has also been provided on structural aspects of other internal features such as the bell and clapper.

#### 1.2.2 Limitations of the Inspection

On 15/10/2020 senior Infracorr engineer Andrew Czerwinski inspected the inside of the Bell Tower taking photographs for inclusion in the report and video for internal use to assist with the preparation of this report. This also included assessing the level of rot in timber elements by probing with a screwdriver.

Only items that could be visually inspected or probed from the floor at each level or from the access ladder were inspected. External structural elements were excluded from the inspection.

As this was a non-destructive inspection, any rot or deterioration in the timber members behind the face of the brickwork could not be identified.

## 2 FINDINGS

### 2.1 Overview

The findings for each area are detailed below. These are also annotated in Appendix A which is an annotated version of the Veris drawing provided by CPP.

### 2.2 Level 2 – Staircase

From the access stair, a horizontal crack was noted on all four faces of the tower at approximately 7 brick courses below the soffit of the floor joists at level 3. Plotting this location on the Veris drawings (Appendix A) indicates that the crack location closely corresponds with a change in wall thickness.



**Figure 1: Horizontal crack around full perimeter of tower.**



**Figure 2: Note crack location in relation to window and change in wall section.**

### 2.3 Level 3 – Clock Counterweight

#### 2.3.1 Floor

The soffit of the floor was inspected from the access stair. Generally, the timber appeared to be in fair condition with only one loose knot noted on the west side of the floor. Where the ends of the joists have been built into the walls, they have been grouted in. Some of the mortar, where accessible, sounded somewhat hollow.

#### 2.3.2 Brickwork

From the floor and access ladder, there was no cracking noted in the brickwork.

The sill bricks under the windows on all four sides appear to have come loose, with the bricks on the east side being in the worst condition.

## 2.4 Level 4 – Clock Face Level

### 2.4.1 Floor

Where the ends of the joists could be accessed and probed with a screwdriver, there was no rot observed. The floor appeared solid and did not deflect under the inspector's weight.

### 2.4.2 Clock attachment points

Glass in west face was heavily cracked but intact.

It appears that the clock face has been re-attached to the brick walls with through bolts. The brickwork around the bolts has come loose. The brickwork at the attachment points on the east side was in the worst condition.



Figure 3: Clock Face Fixing



Figure 4: Clock Face fixing



Figure 5: Top Clock face fixing



### 2.4.3 Masonry

There is some general cracking in the brick walls at this level, particularly vertical cracking down from the Bell Level floor in the corners.



**Figure 6: Vertical Crack in the corner**



**Figure 7: Vertical crack in the corner behind the access ladder and a diagonal crack on the left side behind the ladder.**



**Figure 8: Diagonal crack behind the ladder.**

## 2.5 Level 5 – Bell Level

### 2.5.1 Floor

One of the floor joists has been cut through and there are some cuts through the flooring itself. Some of the mortar caps around the ends of the joists are loose but in general the floor is solid.



Figure 9: Floor joist cut through

### 2.5.2 Walls

### 2.5.3 Bell support beams

There is a cross beam supporting the bell which is supported on timber bearers, which in turn are seated on timber bearing blocks built into the brickwork. The timber appears to be in fair condition and the only noticeable damage is some minor cracking in the brickwork around the ends of the bearers.

### 2.5.4 Bell support bracket

The bell itself appears to be supported by two large bolts which pass through the support beam. There is a large bearing plate on top of the beam spreading the load across the top of the beam and centralizing the support point.





**Figure 10: Bell support spreader plate**

### 2.5.5 Bell clapper support

Where the pivot pin runs through the support bracket, the bush that houses the pin has become ovalized on the west side and has cracked on the east side. The pin has slid towards the ovalized opening such that only a short section of the pin is supported on the east side. The bell clapper has become offset and no longer striking the bell square on. At some point in time, the bracket supporting the bell clapper has been strengthened by the addition of a bracket over the beam welded to the support bracket.



**Figure 11: Bell Clapper pivot pin ovalized**



**Figure 12: Bell Clapper pivot pin not visible**



Figure 13: Bell Clapper support reinforcing.



Figure 14: Bell Clapper support reinforcing top view.

## 2.6 Level 6 – Dome Level / Flagpole Restraints

### 2.6.1 Floor

This appears to be possibly a newer floor, made up of smaller timber sizes than the other floors. No rot was observed in the floor structure. The floor has been covered with a tin plate and flashed. Presumably, this forms a weather resistant floor as the top of the dome where the flagpole passes through is open to the sky.

### 2.6.2 Flagpole support beams

The flagpole support beams are located below the floor level and above the bell support beams. The beams appear to be in good condition.

### 2.6.3 Flagpole and braces

The flagpole is 200mm square and has a 200mm x 140mm stiffener bolted to the side. The braces are 100mm x 140mm and are mortised into the support beams. The tops of the braces have a beam bolted through the flagpole. One of the horizontal braces is rotted where it is bolted to the side of the flagpole. The bolts have considerable surface corrosion but do not appear to have lost much of their cross-section. It is not clear if the bolts were over-tightened or if the washers have corroded and expanded, but in either case there has been some local bearing failure under the washers. The timber braces have some splits in them, but at this stage these do not appear significant.



The function of the mid-height horizontal brace is to tie and stiffen the diagonal braces by tying them back to the flagpole. One of the braces has rotted through where bolted to the flagpole. Presumably, water has been running down the flagpole and collecting at this location leading to rot in the timber.



**Figure 15:** Rot in one of the horizontal braces where it is bolted to the side of the flagpole.



**Figure 16:** Rot in one of the horizontal braces



**Figure 17:** Bolt head pulled into the timber brace



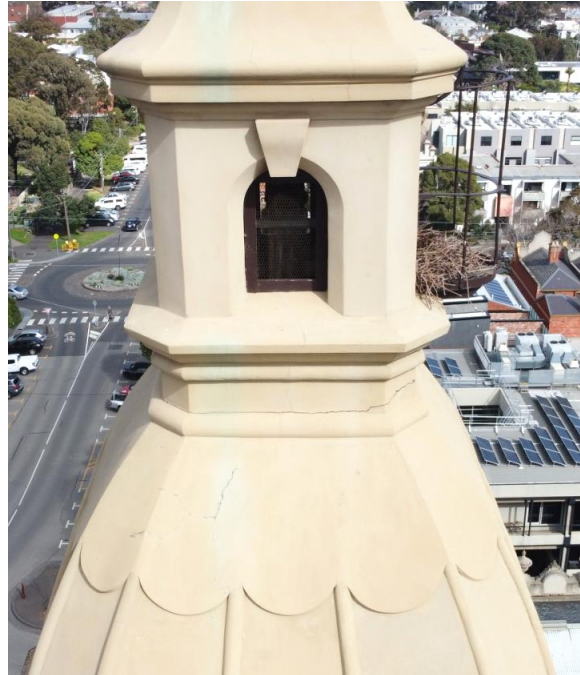
**Figure 18:** Corroded washers

#### 2.6.4 Corroded Steel at Brick Dome

The top of the brick dome is capped with stone and the bricks laid to makeup the very top of the bell tower to which the crow's nest is attached. From inside the tower there is a crack above the stonework and below the brickwork. This appears to correspond with the crack observed in the drone footage provided by CPP. There is a steel plate on top of the stonework which has corroded.



**Figure 19: Crack at the top of the dome around the perimeter of the Bell Tower. North Elevation**



**Figure 20: East Elevation**



**Figure 21: Corroded steel plate between stone capping and brickwork**

## 3 OUTCOMES

### 3.1 Discussion and Conclusion

From the areas inspected, the clock tower appears to be in fair condition.

There were no major cracks observed that raise significant structural concern with regards to the general structure of the tower. Some works will be required in the near future considering the key findings which are discussed below.

**Table 1: Discussion of Key Findings**

#	Item	Comment
1	Crack at Level 2 Staircase	The horizontal crack at this level extends around the perimeter of the tower and coincides with a change in thickness as shown in Appendix A. The crack may be related to movement and loading from the above tower. We are not aware of the history of this crack, but it may have been present for some time. It may be worth assessing the stability of the tower above this point, particularly if any change or growth in the crack is noted.
2	Loose Brickwork around Level 4 Clock Attachments	The brickwork around the clock attachment points has become loose. It is possible that these bricks were loosened when the bolts were drilled through the brickwork.
3	Floor of Level 5 Bell Level	The cut floor joists on this level presents a risk as the floor could become unstable.
4	Bell Clapper Support on Level 5	The bell clapper support bushings appear to have deteriorated over time. The cause of deterioration cannot be confirmed without further assessment, but it is likely due to clapper misalignment resulting in gradual, uneven wear of the components over time. There is corrosion visible on the surfaces of the components.
5	Flagpole and Braces on Level 6	One horizontal brace will need to be replaced to address the rot in the timber. The corrosion of the bolted connections does not appear severe but may be addressed as a preventative measure before further metal loss occurs.
6	Level 6 – Corroded Steel at Brick Dome	It is possible that the expansion of the steel plate at the top of the brick dome, resulting from its corrosion, has lifted the brickwork producing the crack observed from outside.  It is likely the expansion will continue until the corrosion is arrested.  To understand the extent of the corrosion, some pockets of bricks would need to be removed above the plate. This would be a difficult task due to the restricted space between the flagpole and the brickwork.



## 3.2 Recommendations

The inspection revealed several items that should be monitored, repaired, or requiring further investigation as follows.

**Table 2: Recommendations**

#	Item	Recommended Action	Relative Priority
1	Crack at Level 2 Staircase	Consider undertaking structural assessment of the stability of the tower above this level.	Low to Medium
2	Loose Brickwork around Level 4 Clock Attachments	Re-point the brickwork around the fixings for the clock face.	Medium
3	Floor of Level 5 Bell Level	Repair the cut floor joist, e.g. by lapping a length of timber beside the cut joist.	High
4	Bell Clapper Support on Level 5	Remove, inspect and make good the pivot pin support bushings for the bell clapper pivot pin. This may involve dismantling and removing the clapper assembly for inspection and repair at an engineering workshop.	High
5	Flagpole and Braces on Level 6	Replace the rotted timber bracing the flagpole.	High
6	Level 6 – Corroded Steel at Brick Dome	Investigate the cause and extent of corrosion in the steel plate around the top of the brick dome and develop a repair strategy.	High
7	General	Monitor the limited cracking in the masonry. Monitor the timber including in the flagpole. Address general corrosion and wear of the steel components (bolted joints, fixings, mechanical parts) by removing the corrosion, cleaning, and applying and maintaining suitable protective products, lubricants and/or coatings.	Low/Ongoing

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## APPENDICES

### **APPENDIX A: ANNOTATED DRAWING**





## **APPENDIX B: SITE PHOTOGRAPHS**



INFRACORR-LEVEL 2 - (1).jpg



INFRACORR-LEVEL 2 - (2).jpg



INFRACORR-LEVEL 2 - (3).jpg



INFRACORR-LEVEL 2 - (4).jpg





INFRACORR-LEVEL 2 - (5).jpg



INFRACORR-LEVEL 2 - (6).jpg



INFRACORR-LEVEL 2 - (7).jpg



INFRACORR-LEVEL 2 - (8).jpg



INFRACORR-LEVEL 3 - (1).jpg



INFRACORR-LEVEL 3 - (2).jpg



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INFRACORR-LEVEL 3 - (4).jpg





INFRACORR-LEVEL 3 - (5).jpg



INFRACORR-LEVEL 4 - (1).jpg



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INFRACORR-LEVEL 4 - (11).jpg





INFRACORR-LEVEL 4 - (12).jpg



INFRACORR-LEVEL 5 - (1).jpg



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INFRACORR-LEVEL 6 - (1).jpg





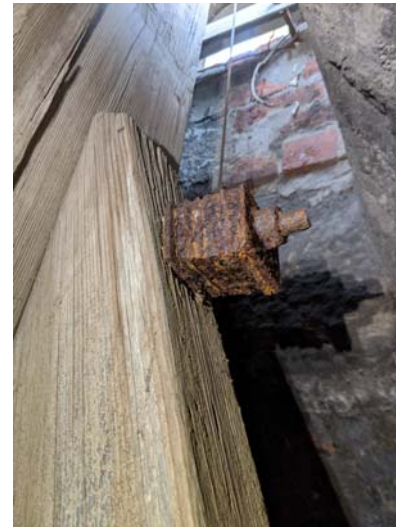
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INFRACORR-LEVEL 6 - (22).jpg

## **APPENDIX C: PHOTOGRAPHS PROVIDED BY CLIENT**





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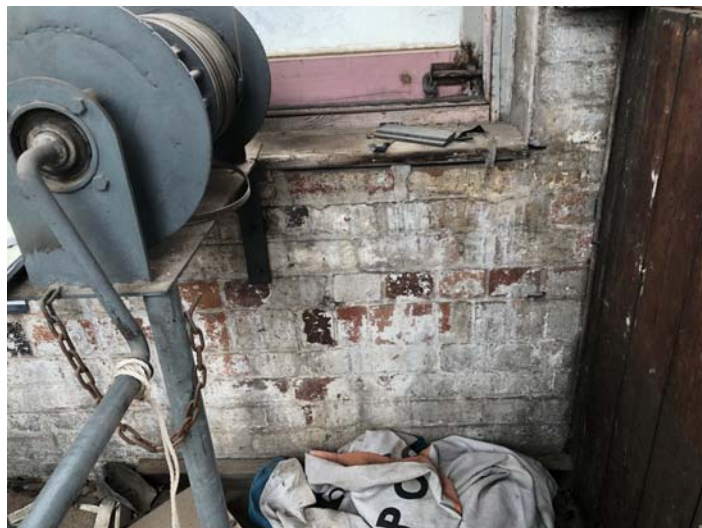




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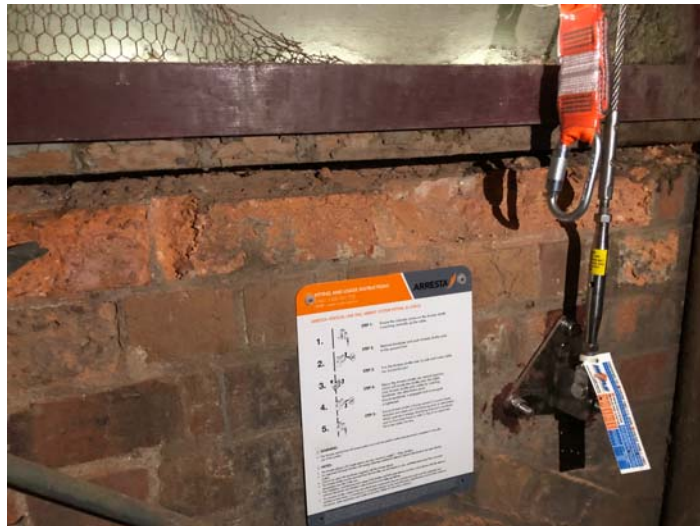
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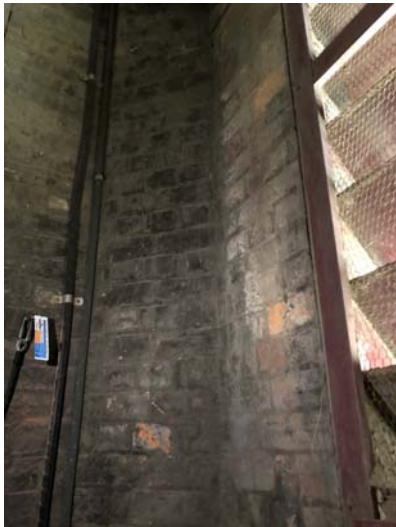
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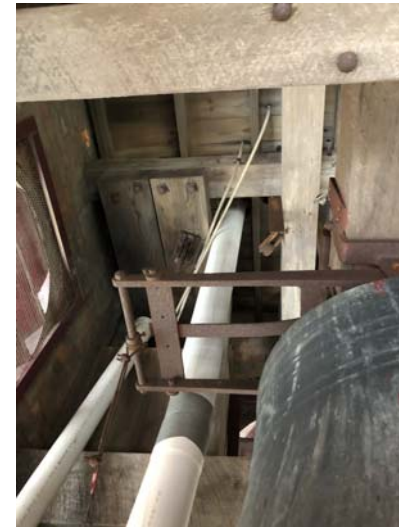
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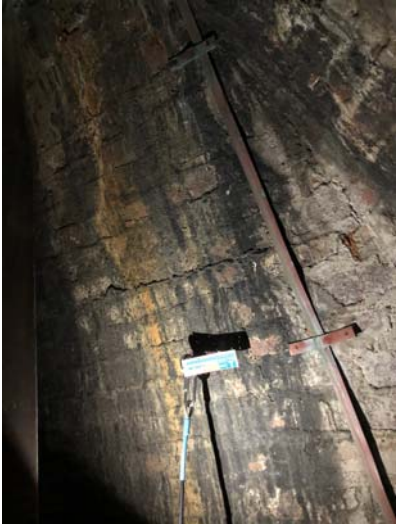
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