Auckland Harbour Bridge Alliance

Principal Structural Inspection
Concrete Piers Above Water (Boat)

2020/2021

NZ TRANSPORT AGENCY WAKA KOTAHI

Auckland Harbour Bridge
PART OF THE AUCKLAND MOTORWAY ALLIANCE

Auckland Harbour Bridge Alliance

Principal Structural Inspection

Concrete Piers Above Water (Boat) – 2020/2021

Inspection Details	
Inspector	Date of Inspection
s 9(2)(a)	22/04/21
	22/04/21

Quality Assurance Statement	
Report Prepared by:	s 9(2)(a)
Report Reviewed by:	s 9(2)(a) (05/05/2021), s 9(2)(a) (27/08/2021)
Approved for issue by:	s 9(2)(a) (1/9/2021)
Issued to:	s 9(2)(a) (02/09/2021)

Revision Schedule					
Rev. No	Date	Description	Prepared by	Reviewed by	Approved by

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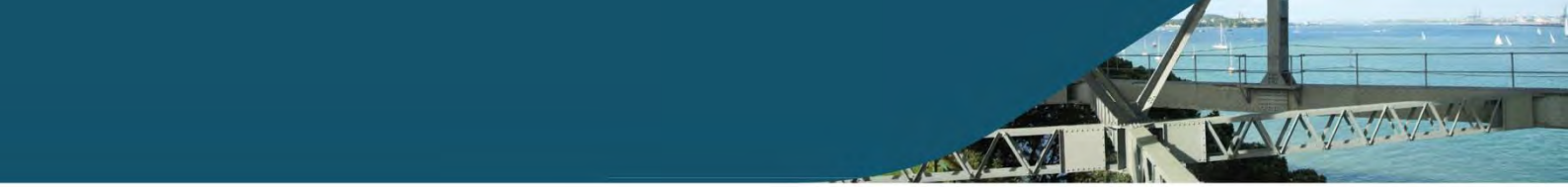
1 Scope

A Concrete Piers Above Water (Boat) Inspection was undertaken in April 2021 as part of the 2020-2021 Structural Inspection Programme. The scope of the inspection included the areas of the piers that had not already been inspected as part of the structural inspection 6 year programme. Table 1 outlines the scope of the inspections.

Report	Scope
Pier Bracket Interface Principal Inspection 2018-19	Piers 1, 2 and 3. All concrete added for the installation of the pier brackets. Including concrete joins on the north and south faces, concrete corbel area underneath the pier bracket via abseil inspection.
Concrete Piers Principal (piers 4-6) 2019-2020	All areas of the concrete piers 4, 5 and 6. Including outside and inside faces via abseil inspection. Tidal zone was not included.
Concrete Piers Above Water (Boat) Principal Inspection 2020-2021	Tidal zone of all piers 1-6. North and south faces of piers 1, 2 and 3 (not included in the 2018-2019 inspection).

The inspection was carried out between 7:30 and 11:00 am on the 22nd of April 2021 at low tide where the water level was between 1.0 – 1.5m above lowest astronomical tide (LAT). This allowed for inspection of parts of the tidal zone of the piers.

Figure 1 shows the areas where close up visual inspection and hammer tapping was conducted.



The inspection primarily focussed on locating any signs of concrete deterioration and reinforcement corrosion such as spalling and/or rust staining in the chloride affected areas of the tidal zones. Visual inspection and hammer tapping of these areas was undertaken.

Large areas of oyster and muscle shellfish growth prevented thorough inspection of the bottom half of the tidal zone on the piers from approximately 1.0m below MHWS (Mean High Water Springs) to the water level. However small areas of growth were removed and the concrete underneath was inspected.

Appendix B shows a map of the defects found during this inspection. Each pier has a numbering system based on each recess in the concrete. Numbered from top to bottom.

2 Condition Rating

The condition of the areas covered in this inspection as per the description above can be described as good. The tidal zone area is in good condition. There was one crack found in the tidal zone on the north face of pier 1. Small areas of oyster growth were removed on each pier, with the underlying concrete proving to be in good condition.

Concrete cracking was found on piers 1, 2 and 3. Cracks were identified through the use of binoculars and by eye from the boat. Any cracks that were visible from the boat without the use of binoculars were noted as large (over 0.25mm), and cracks that were only visible by binoculars were noted as small (less than 0.25mm). See Appendix B Defect map for crack locations.

There were areas of spalling found on piers 1, 2, 3 and 4. However the likely cause was via impact damage/abrasions from boats. No rust staining was present at any of the spall locations.

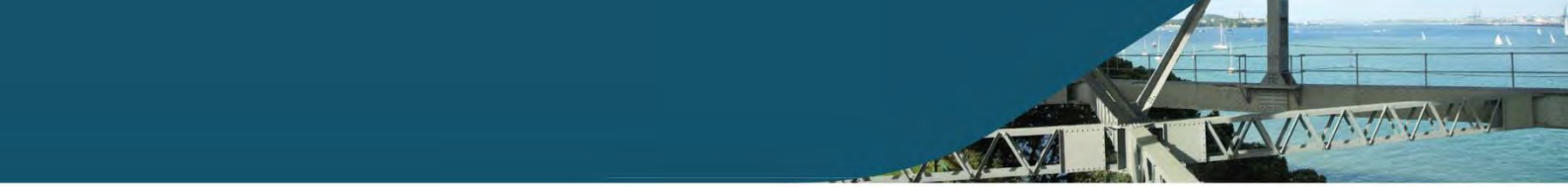
Hammer tapping of the tidal zone provided no evidence to suggest any delamination of this area. However one area of rust staining was found on the south face of pier 2 at the MHWS level. Another area of rust staining was found on the north side of pier 2 at the western pier bracket connection. Rusting of old fixings were also found on the piers.

2.1 Pier 1 north face

- Cracking. Approximately 8 cracks (1 large).
- 0.5m of crack injection required.
- Two areas of spalling (small).

2.2 Pier 1 south face

- Cracking. Approximately 10 cracks (7 large).
- 6.0m of crack injection required.
- One area of spalling/impact damage to eastern corner.
- Rust staining.



2.3 Pier 2 north face

- Cracking. Approximately 3 cracks (1 large).
- 0.5m of crack injection required.
- One area of spalling/impact damage to eastern corner.
- Rust staining.

2.4 Pier 2 south face

- Cracking. Approximately 8 cracks (4 large).
- 3.0m of crack injection required.
- One Area of spalling/abrasion.
- Two old fixing holes.
- Rust staining.

2.5 Pier 3 north face

- Cracking. Approximately 4 cracks (all small).
- No crack injection required.
- Three areas of spalling.
- One old fixing hole.

2.6 Pier 3 south face

- Cracking. Approximately 13 cracks (all small).
- No crack injection required.
- Two areas of spalling to recess edge.

Mark	Priority	No. Defects
2	-	10
R	H	-
R	M	-
R	L	-
S	H	-
S	M	3
S	L	15
	Total	28

3 Defects

3.1 Pier 1

Photo ID	Marking Code	Description of Defects	Maintenance/ Repairs Recommendations	Maintenance/ Repairs Priority & Timeframe
P1-1.	N			
		Pier 1 North Face. General view.	N/A	N/A

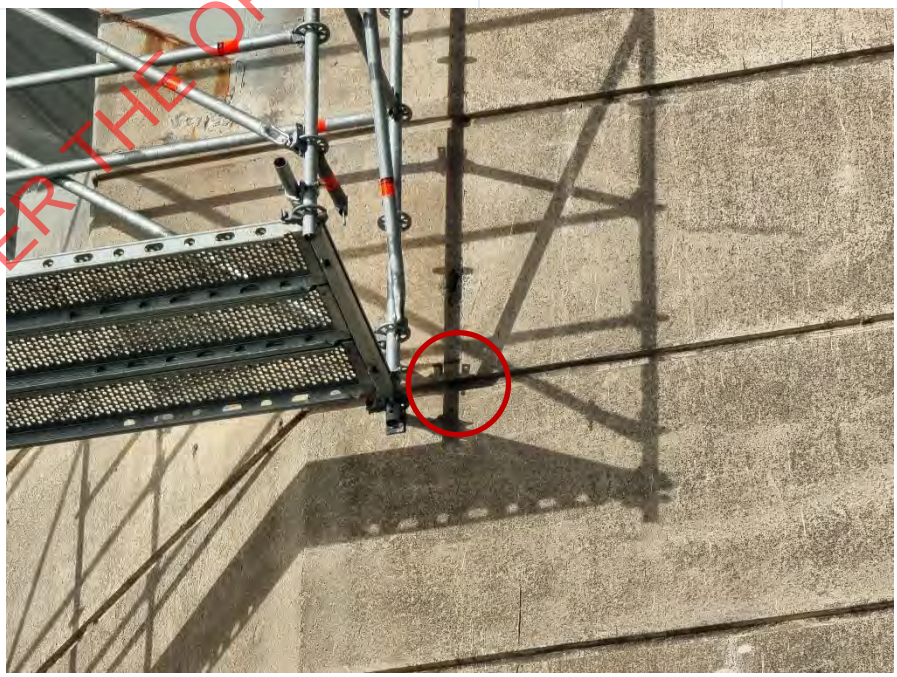
Photo ID	Marking Code	Description of Defects	Maintenance/ Repairs Recommendations	Maintenance/ Repairs Priority & Timeframe
P1-2.	S			
		Pier 1. North face. Section 1. Spalling approximately 100x100mm. Depth unknown.	Concrete repair	L 2+ Years
P1-3.	S			
		Pier 1. North face. Section 8. Spalling with rebar exposed.	Concrete repair.	M 1-2 Years

Photo ID	Marking Code	Description of Defects	Maintenance/ Repairs Recommendations	Maintenance/ Repairs Priority & Timeframe
P1-4.	S			
		Pier 1. North face. Tidal zone. Section 20. Concrete crack 0.75mm width. 500mm length.	Crack injection.	L 2+ Years
P1-5.	N			
		Pier 1. South face. General view.	N/A	N/A

Photo ID	Marking Code	Description of Defects	Maintenance/ Repairs Recommendations	Maintenance/ Repairs Priority & Timeframe
P1-6.	S			
		Pier 1. South face. Sections 3-6. Concrete cracking.	Crack injection.	L 2+ Years
P1-7.	S			
		Pier 1. South face. Sections 14-17. Concrete cracking.	Crack injection.	L 2+ Years

Photo ID	Marking Code	Description of Defects	Maintenance/ Repairs Recommendations	Maintenance/ Repairs Priority & Timeframe
P1-8.	S			
		Pier 1. South face. Section 18. Spalling/impact damage 40-50mm deep. No reinforcing exposed.	Concrete repair.	L 2+ Years

3.2 Pier 2

Photo ID	Marking Code	Description of Defects	Maintenance/ Repairs Recommendations	Maintenance/ Repairs Priority & Timeframe
P2-1.	N	 Pier 2. North face. General view.	N/A	N/A
P2-2.	2	 Pier 2. North face. Section 8. Rust staining.	Monitor at next inspection.	At next inspection.

Photo ID	Marking Code	Description of Defects	Maintenance/ Repairs Recommendations	Maintenance/ Repairs Priority & Timeframe
P2-3.	S			
		Pier 2. North face. Section 10. Cracking small to large.	Crack injection	L 2+ Years
P2-4.	2			
		Pier 2. North face. Section 16. Concrete cracking (small).	Monitor at next inspection.	At next inspection.

Photo ID	Marking Code	Description of Defects	Maintenance/ Repairs Recommendations	Maintenance/ Repairs Priority & Timeframe
P2-5.	S			
		Pier 2. North face. Section 14. Rust staining to old fixings.	Remove and repair.	L 2+ Years
P2-6.	S			
		Pier 2. North face. Section 19. Rust staining to old fixings	Remove and repair.	L 2+ Years

Photo ID	Marking Code	Description of Defects	Maintenance/ Repairs Recommendations	Maintenance/ Repairs Priority & Timeframe
P2-7.	N			
		Pier 2. South face. General view.	N/A	N/A
P2-8.	S			
		Pier 2. South face. Section 6. Old fixing hole.	Concrete repair.	L 2+ Years

Photo ID	Marking Code	Description of Defects	Maintenance/ Repairs Recommendations	Maintenance/ Repairs Priority & Timeframe
P2-9.	S	 Pier 2. South face. Section 17. Cracking.	Crack injection.	L 2+ Years
P2-10.	S	 Pier 2. South face. Section 17. Cracking.	Crack injection of large cracks.	L 2+ Years

Photo ID	Marking Code	Description of Defects	Maintenance/ Repairs Recommendations	Maintenance/ Repairs Priority & Timeframe
P2-11.	2			
		Pier 2. South face. Section 18. Rust staining.	Monitor at next inspection.	At next inspection.
P2-12.	S			
		Pier 2. South face. Section 18-19. Impact damage/abrasion 30-40mm deep.	Concrete repair.	L 2+ Years

3.3 Pier 3

Photo ID	Marking Code	Description of Defects	Maintenance/ Repairs Recommendations	Maintenance/ Repairs Priority & Timeframe
P3-1.	N			
		Pier 3. North face. General view.	N/A	N/A
P3-2.	2 S			
		Pier 3. North face. Section 13. Cracking (less than 0.25mm).	Monitor at next inspection	At next inspection.
		Abrasion/construction defect to recess edge.	Concrete repair.	L 2+ Years

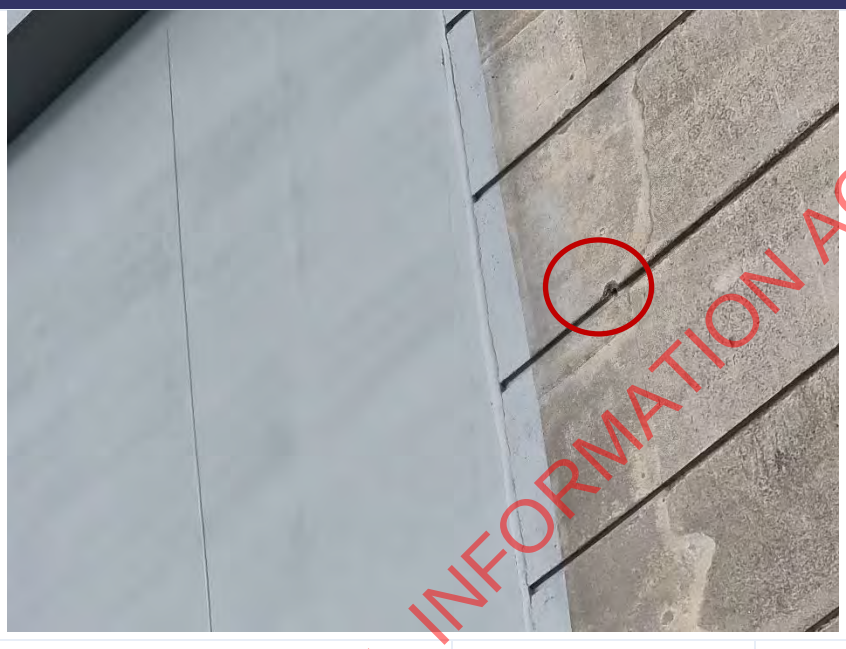
Photo ID	Marking Code	Description of Defects	Maintenance/ Repairs Recommendations	Maintenance/ Repairs Priority & Timeframe
P3-3.	S			
		Pier 3. North face. Section 4. Old fixing hole.	Concrete repair.	L 2+ Years
P3-4.	S 2			
		Pier 3. North face. Sections 13-14. Shallow spall/impact damage (20mm).	Concrete repair	L 2+ Years
		Cracking (less than 0.25mm).	Monitor at next inspection	At next inspection

Photo ID	Marking Code	Description of Defects	Maintenance/ Repairs Recommendations	Maintenance/ Repairs Priority & Timeframe
P3-5.	2			
		Pier 3. North face. Sections 12-14. Cracking (less than 0.25mm).	Monitor at next inspection.	At next inspection.
P3-6.	2			
		Pier 3. North face. Section 10. Cracking through old repair (less than 0.25mm).	Monitor at next inspection	At next inspection.

Photo ID	Marking Code	Description of Defects	Maintenance/ Repairs Recommendations	Maintenance/ Repairs Priority & Timeframe
P3-7.	N			
		Pier 3. South face. General view.	N/A	N/A
P3-8.	2			
		Pier 3. South face. Section 12 recess. Cracking along recess (less than 0.25mm).	Monitor at next inspection.	At next inspection.

Photo ID	Marking Code	Description of Defects	Maintenance/ Repairs Recommendations	Maintenance/ Repairs Priority & Timeframe
P3-9.	2	 Pier 3. South face. Section 11. Cracking (less than 0.25mm). Typical of the cracking on this side of the pier.	Monitor at next inspection.	At next inspection.

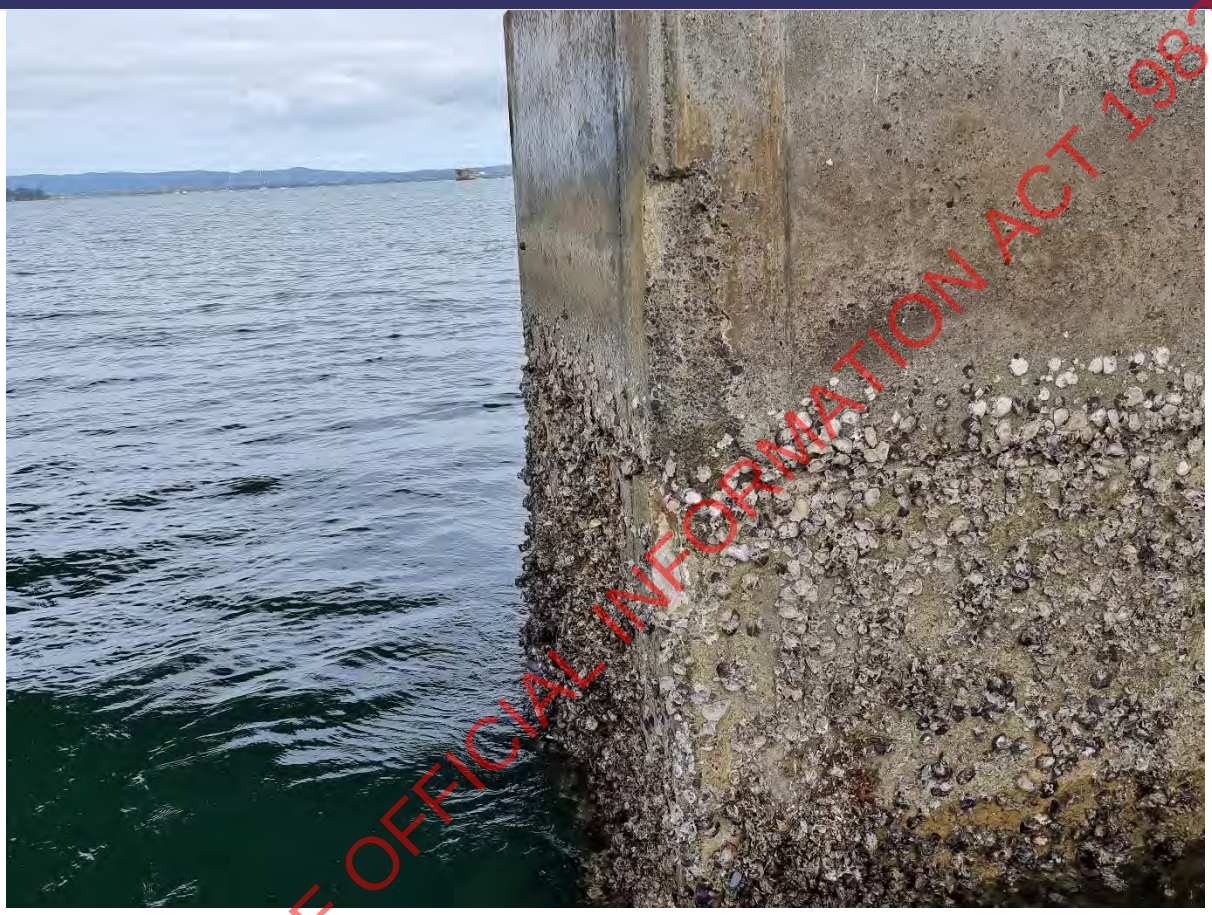
3.4 Pier 4

Photo ID	Marking Code	Description of Defects	Maintenance/ Repairs Recommendations	Maintenance/ Repairs Priority & Timeframe
P4-1.	N			
		Pier 4. South face. General view.	N/A	N/A
P4-2.	N			
		Pier 4. North face. General view.	N/A	N/A

Photo ID	Marking Code	Description of Defects	Maintenance/ Repairs Recommendations	Maintenance/ Repairs Priority & Timeframe
P4-3.	S			
		Pier 4. West corner. Spalling/impact damage.	Concrete repair.	M 1-2 Years

3.5 Pier 5

Photo ID	Marking Code	Description of Defects	Maintenance/ Repairs Recommendations	Maintenance/ Repairs Priority & Timeframe
P5-1.	N			
		Pier 5. South face. General view.	N/A	N/A
P5-2.	N			
		Pier 5. North face. General view.	N/A	N/A

Photo ID	Marking Code	Description of Defects	Maintenance/ Repairs Recommendations	Maintenance/ Repairs Priority & Timeframe
P5-3.	S			
		Pier 5. East corner. Spalling/impact damage. Old repair failure.	Concrete repair.	M 1-2 Years

3.6 Pier 6

Photo ID	Marking Code	Description of Defects	Maintenance/ Repairs Recommendations	Maintenance/ Repairs Priority & Timeframe
P6-1.	N			
		Pier 6. North face. General view.	N/A	N/A
P6-2.	N			
		Pier 6. South face. General view.	N/A	N/A

Photo ID	Marking Code	Description of Defects	Maintenance/ Repairs Recommendations	Maintenance/ Repairs Priority & Timeframe
P6-3.	2		Monitor at next inspection	At next inspection.
		Pier 6. North west corner. Hollow sounding delaminated concrete at circled area.		

Appendix A – Marking Code and Prioritisation of the Works

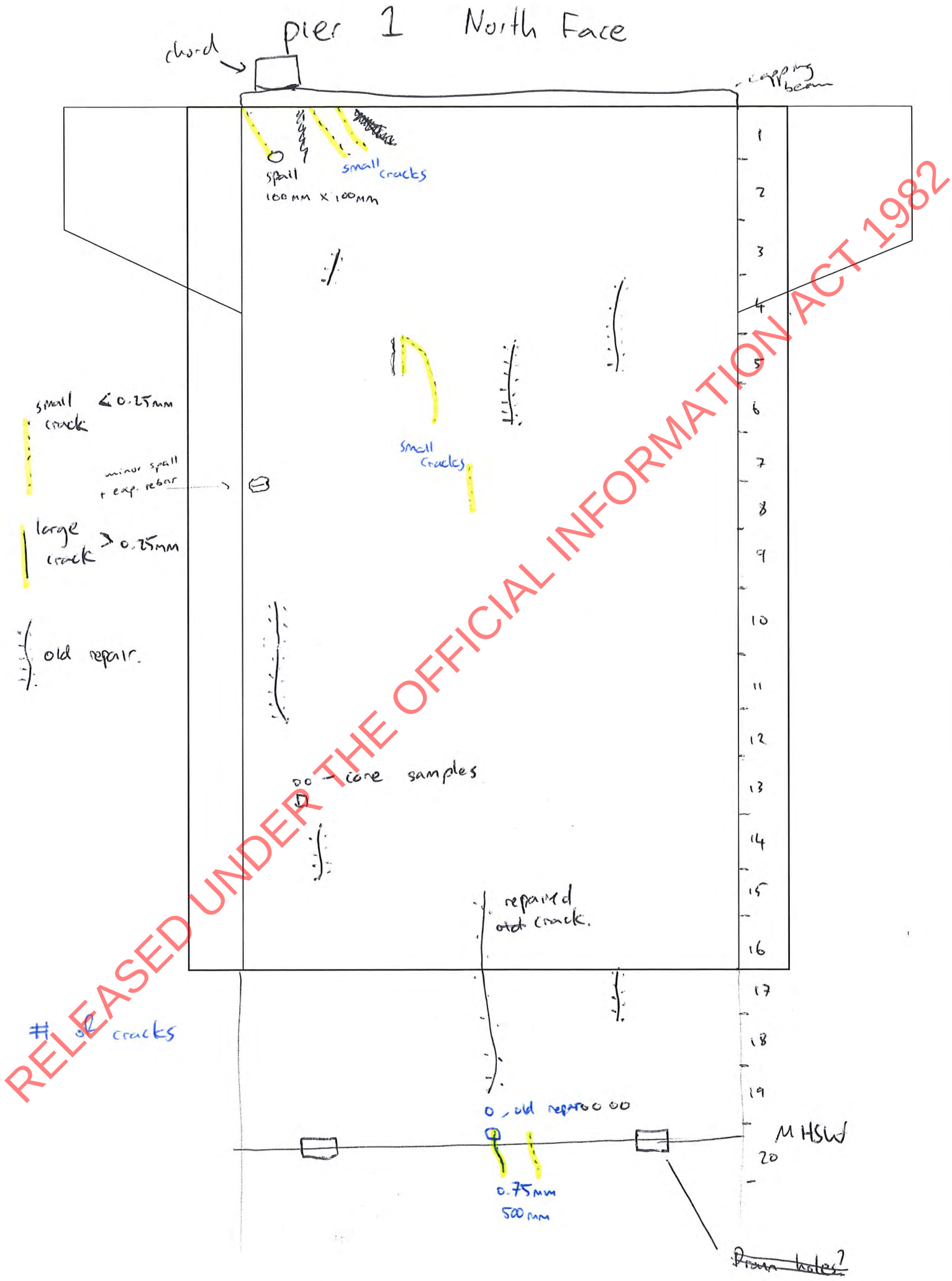
Defects are categorised by marking code, as used in NZTA S6 *Bridges and other significant highway structures inspection policy*:

0 = Not inspected
1 = Satisfactory
2 = Monitor next inspection
R = Routine maintenance
S = Structural maintenance
N = Not applicable

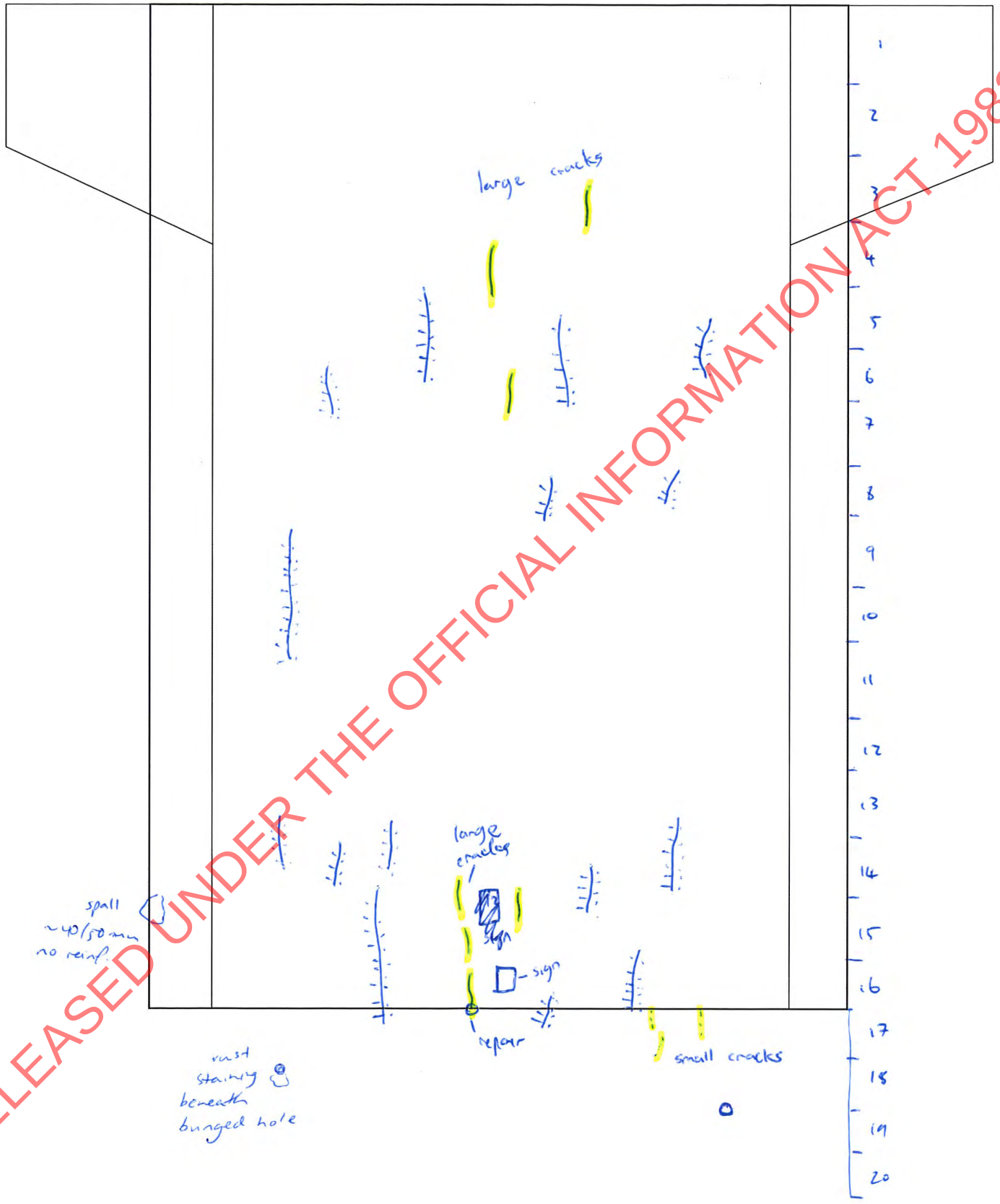
The following timeframes are used for prioritising maintenance works:

- **High** – must be done as soon as possible, within 12 months
- **Medium** – preferable to do as soon as possible, within 1-2 years
- **Low** - no work required within the next 2 years

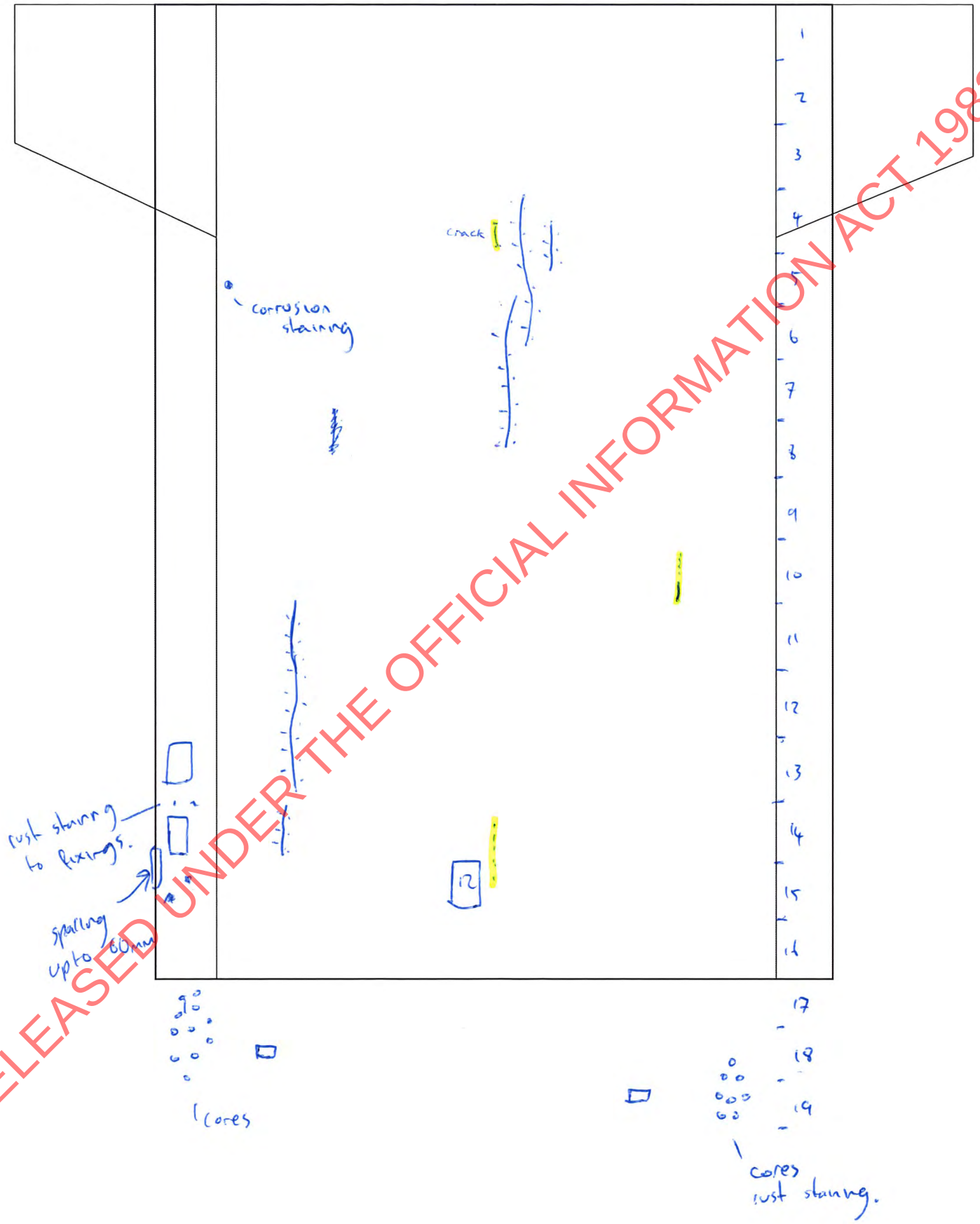
Appendix B – Piers 1-3 Defect Map



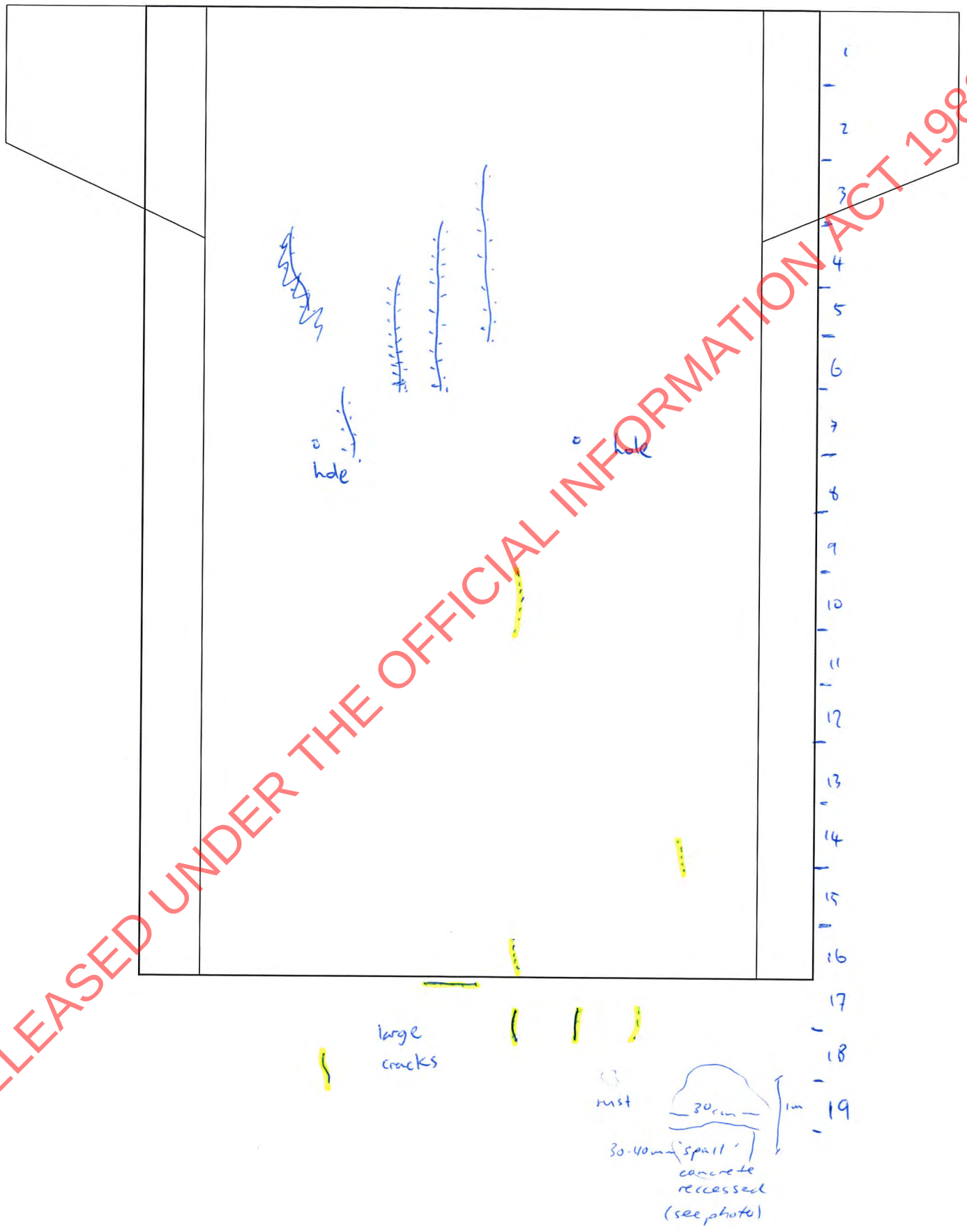
pier 1 South Face



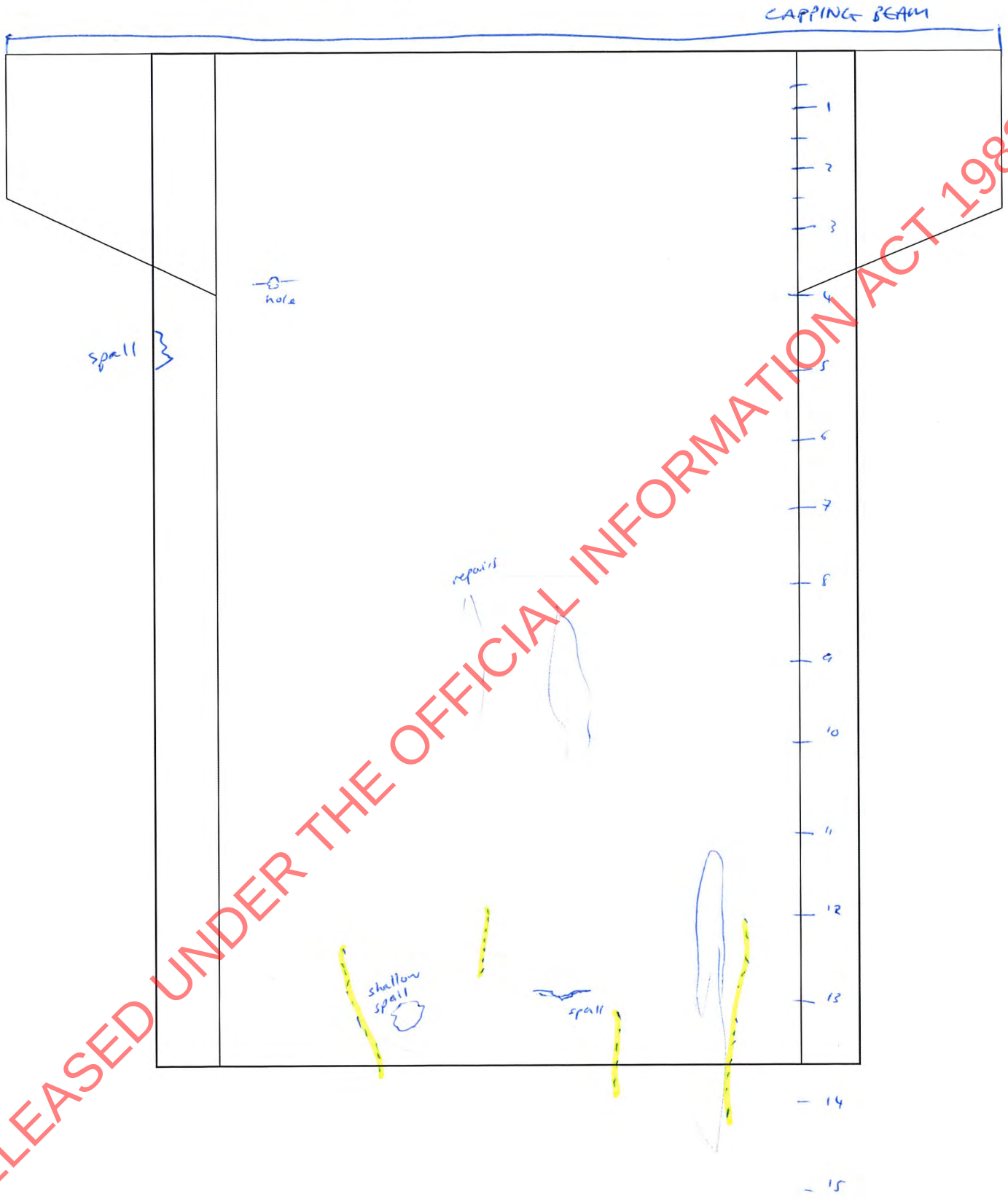
pier 2 North face



pier 2 South Face



PIER 3 North



PIER 3 SOUTH