



Sutton-on-sea

Follow-Up Structural Inspection Report on North Colonnade

For East Lindsey District Council

Project number: 60586167
60586167-ELDC-ACM-REP-0001

20 August 2018

Quality information

Prepared by	Checked by	Verified by	Approved by
C. Robinson Principal Engineer	Tom Howse Engineer		Brian Ward Technical Director

Revision History

Revision	Revision date	Details	Authorized	Name	Position
P1	30-8-18	First Edition		B Ward	Technical Director

Distribution List

# Hard Copies	PDF Required	Association / Company Name
	1	ELDC

Prepared for:

East Lindsey District Council

Prepared by:

C. Robinson
Principal Engineer
T: 0115 907 7015
E: Colin.robinson@AECOM.com

AECOM Infrastructure & Environment UK Limited
12 Regan Way
Chetwynd Business Park
Nottingham NG9 6RZ
United Kingdom

T: +44 (115) 907 7000
aecom.com

Prepared in association with:

SCAPE

© 2018 AECOM Infrastructure & Environment UK Limited. All Rights Reserved.

This document has been prepared by AECOM Infrastructure & Environment UK Limited ("AECOM") for sole use of our client (the "Client") in accordance with generally accepted consultancy principles, the budget for fees and the terms of reference agreed between AECOM and the Client. Any information provided by third parties and referred to herein has not been checked or verified by AECOM, unless otherwise expressly stated in the document. No third party may rely upon this document without the prior and express written agreement of AECOM.

Table of Contents

Executive Summary	5
1. Introduction	6
2. Site Inspections	6
3. Visual Observations of Concrete Defects	7
7. Recommendations and Conclusions	13
Appendix A	14
Drawings	14
Appendix B	17
Visual Observations of Concrete Defects	17



Photo no 01: North West Elevation of Colonnade

Executive Summary

AECOM was commissioned by East Lindsey District Council, on 16th August 2018, to undertake a structural inspection to the North section of the historic concrete Colonnade which is still open to the public at the Pleasure Gardens, Sutton-on-sea. The assets required to be inspected comprised a single-storey, reinforced-concrete (RC) structure whose east rear spine wall was built abutting the (landside) side of the North Sea shoreline defence structure. The first floor of the structure is at the raised promenade level and currently supports 38 traditional timber-framed, beach huts accessed by two built-in staircases. The west side of the structure faces the Pleasure Gardens and the bowling green situated at a lower ground level. The North colonnade structure also forms a covered way to the North staircase (GL B-E & 1-3) and houses kiosks for an ice-cream shop and café. The concrete beam, slab and column frames structure which span over the public access to the North staircase are showing advanced signs of degradation. The brief to AECOM excluded inspection of timber members, beach huts, ancillary equipment and services.

The aim of the follow-up structural inspection, as recommended in the Condition Report on the Concrete Colonnade by AECOM (*Ref 60578623-ELDC-ACM-REP-00010*) in June 2018 was to visually inspect and hammer test the RC structure leading to the North Staircase, to ensure that it was safe to remain open to the public for another 10 weeks, until robust remedial measures undertaken, or the structure isolated from public use. In addition, the integrity of the temporary safety propping, installed during AECOM's inspection during May 2018, was also undertaken on this first follow-up inspection

As discussed in the earlier Condition Report on the Colonnade by AECOM the ageing structure is exhibiting common defects for a reinforced concrete design constructed in the 1950s and 1960s and exposed to an aggressive marine environment. For the structure to be continued to be used for the benefit of the public, a number of defects will need to be remediated. Some of these defects are serious and are currently affecting the safe use of the structure as there is a high risk of small sections of concrete cover, to the reinforcement, being jacked off, by ferrous oxide expansion, from the high sections of the structure and falling and potentially injuring persons moving close to and/or within the structure. This safety risk is expected to increase with time unless robust remedial measures are undertaken or parts of the structure decommissioned from its present usage. Temporary safety provisions have already been implemented on site in the form of a solid barrier fence and structural props to the enclosed area under the first floor, thereby separating sections of the structure from public access. These temporary works will need to be maintained by the client until a remedial proposal is implemented.

The inspection on 20th August 2018 revealed that the condition of two small areas on the sides of the down-stand beams and six small areas on three soffit slabs had deteriorated such that there were small sections of concrete cover that could become detached and were removed for safety reasons. In addition, a corner section of column D1 in a lower position had deteriorated and was removed as a precautionary measure.

The recommendation from the inspection was that the walkway to the North stairs could remain open for public use for another 10 weeks i.e. till 29 October 2018, when another inspection is recommended.

1. Introduction

AECOM was commissioned by East Lindsey District Council, under the SCAPE consultancy framework agreement, on 16th August 2018, to undertake a structural inspection to the North section of the historic concrete Colonnade which is still open to the public, at the Pleasure Gardens, Sutton-on-sea. The assets required to be inspected comprised a single-storey, reinforced-concrete (RC) structure whose east rear (spine) wall was built abutting the (landside) side of the North Sea defence structure, which is owned by the Environment Agency. The first floor of the structure is at the raised promenade level to the North Sea and currently supports 38 traditional timber-framed, beach huts. The west side of the structure faces the Pleasure Gardens and the bowling green at a lower ground level. The North colonnade structure forms a covered way to the North staircase (GL B-E & 1-3) and to kiosks for an ice cream shop and café. It is understood that the concrete colonnade structure was built in the 1950 and 1960s. The fascia and transfer beams which span over the public access to the North staircase are showing advanced signs of degradation. The brief to AECOM excluded inspection of timber members, beach huts, ancillary equipment and services. In addition, the integrity of the temporary safety propping installed during AECOM's inspection during May 2018 was also verified.

The aim of the follow-up structural inspection, recommended in the Condition Report on the Concrete Colonnade by AECOM (Ref 60578623-ELDC-ACM-REP-00010) in June 2018 was to visually inspect and hammer test the RC structure, to ensure that it is safe to remain open to the public for another 10 weeks, until robust remedial measures undertaken, or the structure isolated from public use.

2. Site Inspections

In preparation for the follow-up site inspection, East Lindsey DC arranged for the through route, to the North staircase, to be barriered off from public access, by their framework contractor, 'Gelders'. The concessions in the kiosk and café were still trading to the public during the day of the inspection on 20th August 2018. The inspection was on a humid, overcast warm day after a period of two months of hot weather with temperatures up to 29C.

Detailed records, material samples and photographs were obtained from site and have been incorporated in the Report.

The existing structure is sub-divided into sections by movement joints which broadly divided the structure up into a Northern section, supporting rented beach huts, numbered 2 to 15 (GL B to N), Central section (GL N to Y-Z), supporting empty beach huts numbered 16 to 29, and the Southern section supporting (GL Y-Z to MM), supporting privately owned beach huts, numbered 30 to 39. A three flight public access staircase to the promenade, is incorporated into the Northern and Central sections of the structure.

A typical plan and cross-section sketch has been developed for the Northern section, and a second typical section for the central and southern sections has been developed and included in Appendix A.

The current visible concrete defects to the structural elements in the concrete structure leading to the North staircase have been added to the defect sketches included in AECOM's earlier Condition Report and a copy included in Appendix B.

To help assess the integrity of the structure, hammer acoustic tests on the concrete surfaces were undertaken during the inspection.

The safety of the structure post inspection was a prime concern given the advanced degree of degradation that the RC structure had suffered, over its 60 to 70 year life in the aggressive coastal marine environment. The safety precautions adopted during the works was to prop the more severely degraded concrete beams and slabs with steel adjustable props. The critical beams propped during the inspection included fascia beam GL 1, G to H, either side of a half lap joint; the beam across the stair access GL 2, Z-AA and longitudinal beam GL 1 to 2, LL-MM. Owing to the risk of smaller sections of concrete being jacked from the surface due to rust formation on the steel reinforcement and falling onto the public, it was noted that the temporary 'Heras' fencing had been replaced by a more permanent solid barrier of timber boarding along GL 1 to separate the structure from the public until the structure is remediated, or sections taken out of service. Whether any further safety precautions like closing certain beach huts to public use, is still to be undertaken.

During the inspection the temporary structural props were inspected and found to be secured from unauthorised person interference.



Photo no 2. Temporary props at GL 1H structural joint, secured to floor.

During our inspection, we have removed all the visible loose concrete that could readily fall on the public or inspectors. The fascia beams at the Northern end of the colonnade, which are currently not separated from the public accessing the stairs and cafes, revealed that the condition of two small areas on the sides of the down-stand beams and five small areas on three soffit slabs had deteriorated such that there were small sections of concrete cover that could become detached and were removed for safety reasons. In addition, a corner section of column D1 in a lower position had deteriorated and was removed for safety reasons.

This follow-up inspection should be done by an appropriately qualified person, on a regular 10 weekly basis from the 20th June 2018, (to ensure they will not require temporary support and separation from the public) until robust remedial measures implemented.

The concrete soffits inside the ice-cream kiosk and café could not be inspected as they had food on display and the ceilings were obscured by a suspended ceiling tiles.

3. Visual Observations of Concrete Defects

The defects observed were similar to the defects found elsewhere on the structure during the condition inspection in May 2018 and were typical of an old RC structure built 50 years ago where the significance of the shallow concrete cover thicknesses specified to the embedded unprotected steel reinforcement were not generally appreciated in an aggressive marine environment. In addition, a number of different types and quality concrete patch repairs had been undertaken to earlier defects at various different times and a number of these had started to fail by becoming detached. The observed loose concrete was removed during the inspection to protect our survey team public and later inspectors whilst on site.

The RC elements inspected comprised rectangular cross-section columns supporting continuous spanning rectangular fascia beams on GL 1, simple supported cross beams spanning between columns and the vertical sea defence revetment on GL 3, one and two-way spanning slabs spanning between fascia beams, cross beams, sea defence revetment.

Visual inspection of the rectangular columns on the Northern stair through route showed a localised defects to one corner of column D1 where a previous concrete repair due to carbonation and ferrous rust oxide jacking had been undertaken.



Photo no 3. Column 1E Spalling.

Visually inspection of the arched fascia beam over the front of the café on grid line 1, E-F revealed a small area, of hollow and cracked concrete on the corner of the beam, which was removed as a precautionary measure because it was over the seating area of the café. At the spalled concrete location the reinforcement had suffered some severe rusting but no significant loss of cross section to bar diameter.



Photo no 4. Fascia beam GL 1, F-G (near café) concrete spalling.



Photo no 5. Close-up of Fascia beam GL 1 F-G concrete spall sample.

Inspection of the cross beam on GL 2, C-D revealed a small area of hollow concrete on the soffit which when tested further cracked and was removed for safety reasons.



Photo no 6. Cross beam GL 2 C-D concrete spalling.

On the edge of the first floor slab spanning across the springing of the North staircase (GL 3, C-D), a small area of concrete was tested as hollow near the base of the balustrade standard, on the North east corner. This small section of concrete cover was removed for obvious safety reasons. The cause of the cracking is considered to be associated with the close location of a balustrade anchor bolt installation, as opposed to reinforcement corrosion.



Photo no 7. Edge of slab over North staircase, concrete spalling near balustrade anchor bolt installation.

Inspection of the first floor soffit slab between GLs 1-2, C-D, four areas of hollow concrete were detected which on further hammer testing cracked and were removed as a precautionary safety measure. At the spalled concrete locations, the bar reinforcement had suffered some rusting but no significant loss of cross-section to bar diameter.



Photo no 8. Soffit of slab GL C, 1-2, hollow concrete & spalling.



Photo no 9. Soffit of slab GL 1-2, C-D hollow concrete & spalling.



Photo no 10. Soffit of slab GL 1-2, C-D hollow concrete & spalling.

Visual inspection of the first floor soffit slab between GLs 1-2, C, along a previously identified crack and previous concrete repair revealed some hollow concrete which on further investigation cracked and was removed as a precautionary safety measure. This crack appeared to be slightly damp suggesting that the repaired cracks on the upper surface may be starting to deteriorate or retained moisture from earlier leak. At the spalled concrete locations the reinforcement had suffered severe rusting but no significant loss of cross section to bar diameter.



Photo no 11. Soffit of slab at crack GL D, 1-2, concrete crack and spalling.

7. Recommendations and Conclusions

Following on from the Condition Inspection undertaken by AECOM, in May 2018, on the Concrete Colonnade at Sutton pleasure gardens, a further structural inspection of the North section of the Concrete Colonnade, near the North staircase, was undertaken on 20 August 2018, as it was still in use by the public. Following a review of the findings, we would make the following recommendations.

The ageing structure is exhibiting common defects for a reinforced concrete design constructed in the 1950s and 1960s and exposed to an aggressive marine environment. For the structure to be used for the benefit of the public for the next 40 to 50 years a number of defects would need to be remediated. Some of these defects are serious and currently affecting the safe use of the structure as there is a high risk of small sections of concrete cover to the embedded steel reinforcement being jacked off by ferrous oxide expansion from the high sections of the structure and falling and potentially injuring persons moving close to and/or within the structure. This safety risk is expected to increase with time unless robust remedial measures are undertaken or parts of the structure decommissioned from its present usage. The temporary safety provisions that have already been implemented on site in the form of a solid physical barrier fence and structural props to the enclosed area under the first floor, and separating sections of the structure from public access, will need to be continually inspected and maintained until a remedial proposal is implemented.

The first floor fascia beams, internal transfer beams and slabs, which span over the public access to the North staircase to the promenade, which are currently not closed off from the public, are showing advanced signs of degradation. We would therefore recommend that these are continually inspected for safety, by an engineer with appropriate structural experience, at least every 10 weeks, starting from 20th August 2018.

The inspection on 20th August 2018 revealed that the condition of two small areas on the sides of the down-stand beams and six small areas on soffit slabs had deteriorated such that there were small section of concrete cover that could become detached and were removed for safety reasons. In addition a lower corner section of column D1 had deteriorated and was removed as a precautionary measure.

The recommendation from the inspection was that the walkway to the North stairs could remain open for public use for another 10 weeks i.e. till 29 October 2018, when another structural inspection is recommended. The first floor promenade slab over this area should remain free of permanent loading and the recent planning application for a further a beach hut in this area should be reconsidered.

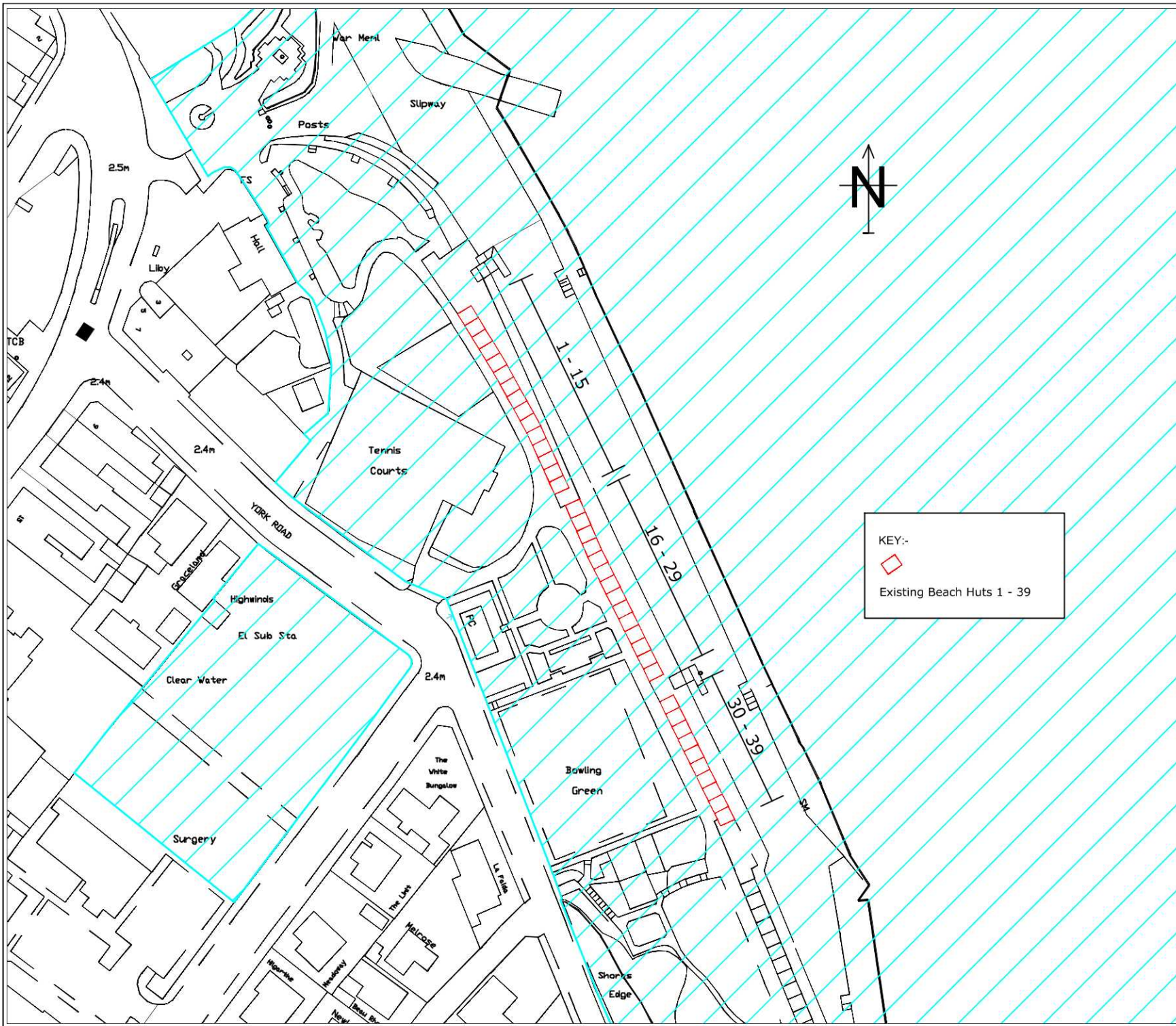
Should the Council require further additional structural design, contract management or site supervision of specific remedial measures AECOM would be pleased to offer their professional services.

Appendix A

Drawings

Location Plan Figure 1

Typical Sections Figure 2



NOTES

Do not scale from this drawing, use figured dimensions.
All dimensions to be checked on site before work commences. All errors and omissions to be reported to the architect / supervising officer.

Reproduced from Ordnance Survey Mapping with the permission of the controller of HMSO. Crown Copyright Unauthorised Reproduction infringes Crown Copyright and may lead to prosecution or civil proceedings.
EAST LINDSEY DC LA-077879

Revisions



TEDDER HALL, MANBY PARK, LOUTH, LINCOLNSHIRE, LN11 8UP
TEL: (01507) 601111, FAX: (01507) 600206

Property and Technical Services

Project Title:

Beach Hut Redevelopment
Promenade,
Sutton on Sea

Drawing Title:

Site location plan
Beach Huts
1-15, 16-29, 30-39

Drawn by: MA

Checked by: .

Scale:

1:1250 @ A4

Date:

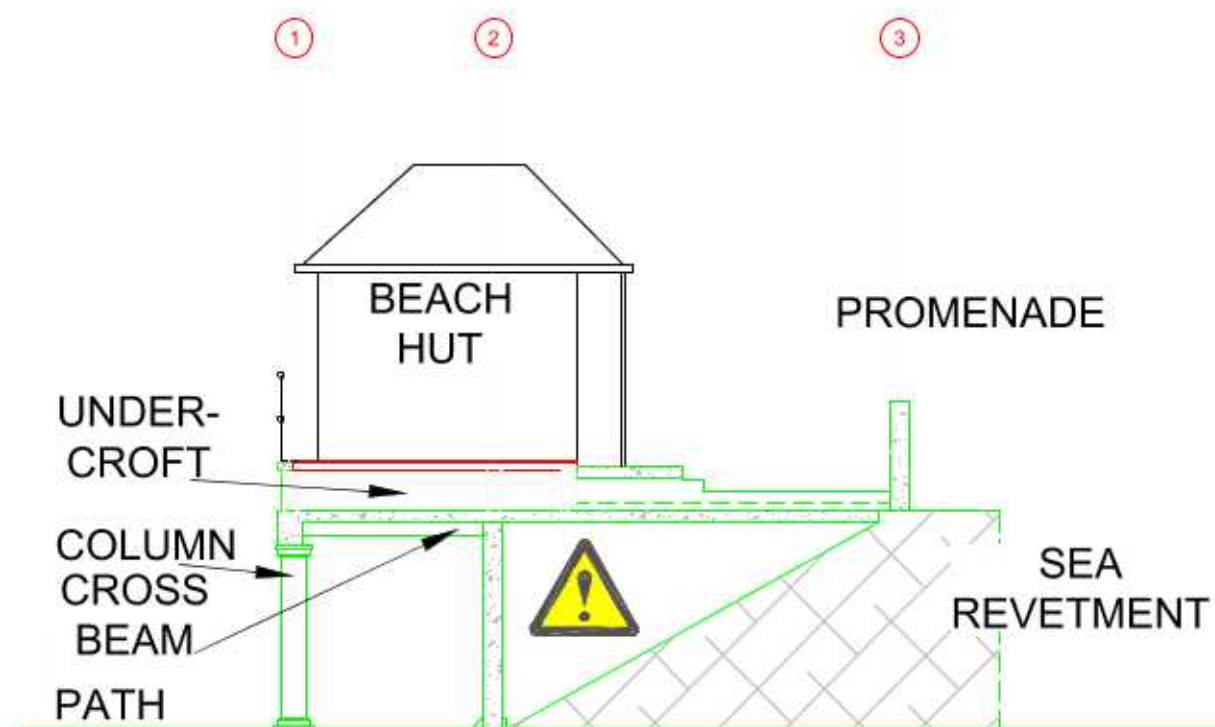
Mar 2018

Dwg No:

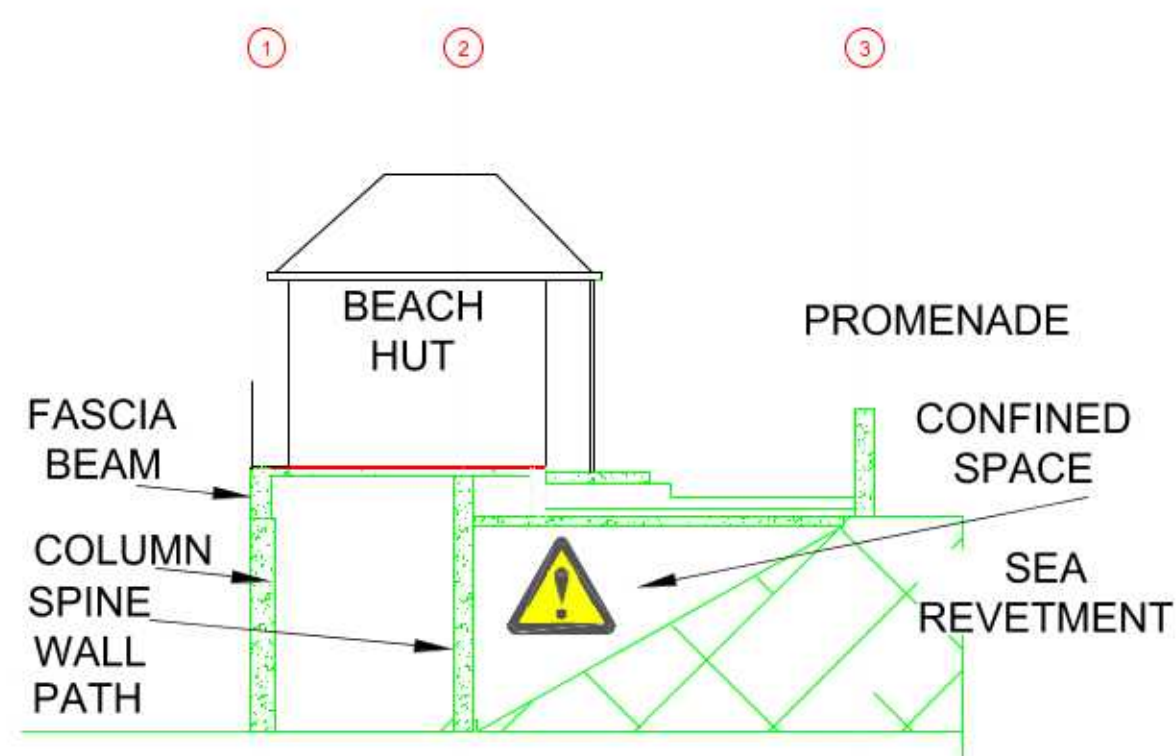
172/2025/02

Rev:

.



TYPICAL CROSS SECTION THROUGH CENTRAL & SOUTH SECTIONS



TYPICAL CROSS SECTION THROUGH NORTH SECTION

Appendix B

Visual Observations of Concrete Defects

Plan Figure 3

Elevations Figure 4

