REPORT ON PRELIMINARY STRUCTURAL INSPECTION

VICTORIA PIER, COLWYN BAY

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09205/B02

Date 9 December 2009

REPORT ON PRELIMINARY STRUCTURAL INSPECTION OF VICTORIA PIER, COLWYN BAY

1.0 Introduction

1.1. In November 2009 Datrys were instructed by Conwy County Borough Council to undertake a preliminary condition survey of the structure of Victoria Pier, Colwyn Bay. The purpose of the inspection was to determine the form and general condition of the pier structure so that the scope of remedial works that might be required to bring to an acceptable condition for public access could be outlined.

1.2 The inspection of the fabric of the buildings and their services did not form a part of the brief.

2.0 Location

2.1. Victoria Pier extends from the Promenade at Colwyn Bay to a point some 80m from mean low water. The whole pier length is therefore exposed at low tide. The location is sheltered from the predominant winds from the west by Rhos Point but has a 165km long fetch to the north. The site is susceptible therefore to wind generated waves from this direction with a potential significant wave height of 4m ignoring local beach effects.

2.3 The beach is generally sandy although coarse gravel and cobbles are located beneath the Promenade wall. The coastline forms a shallow embayment from Rhos Point in the west to the limestone headland at Penmaen Rhos near Llysfaen in the east. The beach has been stabilised by the installation of timber groynes.

2.4 The general arrangement of the Pier is illustrated in the accompanying drawings. Its construction is described in greater detail below but may be summarised as comprising of timber decking on timber joists supported on longitudinal steel lattice girders. The girders span approximately 12m onto braced cast iron columns fixed into cast iron piles embedded in the beach.

2.5 The Pier supports two areas of buildings. The retail area dating from the 1970's which links with the Main Entrance; these occupy the first 3 bays of the Pier. The buildings are single storey and of recent steel construction. The Pavilion is a much larger and more elaborate structure constructed in the 1930's.

2.6 The Pier may be divided into 3 distinct areas (all dimensions are approximate):

- The Promenade End of 3 bays measuring 40 x 15m.

- The widened Pavilion Area of 8 bays length and 9 bays width measuring 52 x 47m.
- The Seaward End of 14 bays length measuring 128 x 10m.

The structural form of each area comprises the same basic construction as described above with local strengthening beneath the buildings.

3.0 History

3.1 The Pier was opened in 1900 and from historic photographs and written descriptions appears originally to have extended only as far ar grid line 12 as shown on the appended drawings being approximately half its present length. The widened Pavilion area was an original feature although it may have been 1 bay narrower and shorter than at present. The seaward area was constructed from 1903 and photographic evidence indicated that this reached as far as grid line 22 some 40m short of the present Pier Head. A 600 seat theatre was then constructed at the Pier Head in 1917 extending the Pier to its present length. It is possible that the Pavilion area was widened at this time to its present dimensions.

3.2 The Pier suffered from a several fires during its lifetime which caused the loss of the original Pavilion and its replacement building. The present Pavilion is the third structure and was opened in 1934. The theatre at the Pier Head was destroyed by fire in 1933 and was never replaced.

3.3 From 1968 and into the 1970's the buildings at the Promenade End were built as part of a modernisation programme of the Pier by its then owner, a subsidiary of Trust House Forte. Finally, the Promenade End was widened around 1980 by the subsequent owners.

3.4 The Seaward End of the Pier was closed to the public on safety grounds in 1987 and the whole Pier was closed in 2008.

4.0 Survey work

4.1. The survey was carried out on a visual basis only. No sampling, testing or uncovering was carried out.

4.2. The initial survey was undertaken on 12 November 2009 with members of the Council Engineering and Design Department, the Pier owner and agent. All areas of the decking were accessed with the exception of the worst affected Seaward End which was deemed unsafe. The Pavilion building could not be accessed and its inspection was therefore limited to the external elevations only. The roof was not inspected. The Entrance Building was accessible for at hand inspection.

4.3. The underside of the Pier was viewed from the beach only and at-hand inspection of the steel girders and bracing was not therefore possible. The comments given below regarding the condition of the steelwork that was viewed at some distance is therefore necessarily subjective and should be confirmed by closer inspection and evaluation.

5.0 Observations

Promenade End

5.1 The flat roof of the Entrance Building between grid lines 1 & 2 consists of rockwool slabs supported on metesec lattice beams spanning onto universal steel beams supported on SHS posts. The posts coincide approximately with the positions of the piles of the Pier structure. The structure is generally sound and would require only minor maintenance. The floor structure was not examined.

5.2 The building between grid lines 2 and 4 is again single storey with a nodal space frame roof supported on its edges by SHS posts. The form of the roof with its many valleys will lead to maintenance difficulties and problems of water ingress. The means of achieving lateral stability of the building was not apparent and may derive from the racking effect of the external timber frame cladding. The floor structure was not examined.

5.3 Most of the Pier steelwork in this area is of a condition that could be refurbished. Some relatively recent repairs are apparent and the bracing to the piles on grid lines 2 and 3 are significantly different from the remainder of the Pier structure and are more recent. Some of the detailing of the new components will however lead to water entrapment and future maintenance problems suggesting that their replacement might prove more effective.

5.4 No particular problems were noted with respect to the piles in this area.

Pavilion Area

5.5 Access into the Pavilion Building was not possible. From the inspection of its perimeter it is of a steel construction clad in rendered expanded metal cladding. In many areas the galvanised cladding has corroded and the render has significant cracks which will allow water entry. In areas the render has become detached revealing both the metal cladding and the steel structure. The roof structure is hipped with a pagoda form and its geometry is somewhat complex which could lead to problems of water ingress. It appears to be clad with an asbestos-cement sheet the condition of which is doubtful with cracked sheets apparent whilst some were missing.

5.6 The decking in this area showed some signs of decay and extensive moss growth. It is probable that a significant proportion will need to be replaced or at least refixed. The condition of the supporting soft wood joists could not be determined as they were generally obscured from view but again extensive replacement will probably be needed. In some areas such as the corner cantilever the timber structure is clearly unsafe and is close to collapse.

5.7 The decorative handrail was found to be in place for most of this area. The detailing is poor however and leads to water entrapment and decay of the timber kerb to which the standards are fixed. In most areas the kerb showed decay and the whole length will need to be refixed or replaced with a suitable new detail.

5.8 The Pier structure in this area is in a varied condition. There are instances of bracing failures near grid lines 12 and 13 whilst the degree of corrosion of the girders varies considerably. Beneath the building there are lines of deep riveted plate girders in place of the usual light lattices. The steelwork of the plate girders appeared to be sound but their rivets could not be assessed. Many of the tie bars in this area would need to be replaced and many turnbuckles had spilt longitudinally. Whilst much of the lower steelwork was heavily encrusted in marine growth the horizontal struts to the piles and the piles themselves appeared to be sound.

Seaward End

5.9 The Pier structure in this area is in the worst condition. Much of the decking has either been dislodged or is decayed. The steel girders exhibit general corrosion and elements of the column head bracing have, in instances, corroded through. Many of the column bracing ties have failed.

5.10 A length of approximately 45m of the decorative hand railing had failed along the Pier Head and east side. Elsewhere the timber kerb to which the standards are fixed was noted to be decayed.

6.0 Discussion

Promenade End

6.1 Repairs and alterations were carried out in this area in the 1970's and the structural components reflect the commercially available and popular structural systems of that period. The structural form of the buildings between grids 1 and 2 is considered to be appropriate subject to consideration of lateral stability and only localised repair and maintenance would probably be required.

6.2 The nodal space frame whilst popular at the time of its construction is now unusual and the ease with which it could be easily maintained for a long period is doubtful. The form of the roof should be simplified to minimise the risk of rain penetration. The means of providing lateral stability to this building should be established as it may be dependant on the racking resistance of the timber cladding whose condition will deteriorate.

6.3 The condition of the floor decking in this area should be established in any future inspections.

6.4 The changes to the bracing system on lines 2 and 3 without doubt date to the time of the erection of the buildings. The heavier and lower sections would provide greater resistance to lateral wind loads imposed on the piles by the increased elevation of the buildings.

Pavilion Area

6.5 The large number of columns and the extensive bracing coupled with shelter offered by the structure itself have resulted in the original structure in this area being in relatively good condition.

6.6 As it was not possible to inspect the superstructure of the Pavilion it is not possible to comment meaningfully on its condition. However the loss of roof sheets and wall panels will inevitably lead to an acceleration of its deterioration. If it were to be refurbished it is probable that the building would need to be stripped back to its steel structure which would also in all probability be in need of some degree of repair and strengthening as well as general maintenance.

6.7 A detailed inspection of each bay of the Pier structure is required to properly determine the extent of repairs required to the Pier structure in this area. The piles generally appeared to be sound however cast iron is susceptibly to cracking and testing of the integrity of the piles and a check on their embedment should be carried out, initially, on a sample basis.

6.8 The condition of the column bracing systems varied. The horizontal struts appeared to be sound and would probably only require repainting. Their connection to the columns would need to be checked in detail and allowance should be made for bolt replacement. The tie bars and their turnbuckles in many instances show signs of corrosion or have failed. Allowance should be made for their replacement.

6.9 The decking is far from pristine and allowance should be made for replacing it in its entirety together with the supporting joists. This would then allow access to the girders beneath to carry out any necessary work.

6.10 The handrails will need to be removed refurbished and refixed to a new kerb detail.

Seaward End

6.11 The Pier in this area is in a very poor condition. In areas the columns are unbraced and rely on cantilever action to resist any lateral loadings.

6.12 The Pier superstructure in this area will need to be replaced. This would probably entail the dismantling of the columns and their off-site refurbishment. The adequacy of the piles would need to be confirmed prior to re-erecting the columns followed by the new superstructure.

6.13 The lost handrails would need to be replaced with a suitable replica pattern.

7.0 Conclusions

7.1 The Pier structure should be inspected in detail and its adequacy assessed in relation to the loads to which it is subjected arising from its intended use and its environment.

7.2 The condition of the Pier superstructure is varied and is particularly poor at the Seaward End. In this area the superstructure should be re-built. Elsewhere the superstructure could be repaired and refurbished.

7.3 The deck timbers and the supporting joists should be replaced.

7.4 The handrails should be removed, refurbished, supplemented as necessary and refixed to a suitable edge kerb detail. It may be necessary to raise their level to meet current standards or to seek a relaxation under the Building Regulations.

7.5 The roof and cladding of the Pavilion Building should be removed and allowance made for repair of the underlying structure.

7.6 The feasibility of retaining the nodal roof structure is questionable and consideration should be given to its replacement.

7.7 Areas of the Pier are in a state of near collapse and could present a danger to the public. The public should be excluded or at least discouraged from walking beneath these areas.

7.8 The Seaward End of the Pier is now in a condition whereby it may be lost within the next 5 years. The Pavilion Area with its high degree of redundancy could survive in an increasingly weakened state for a period of up to 10 years. The highly unpredictable nature of significant sea states should however be borne in mind when considering these timescales which could be exceeded in a single event.

8.0 Recommendations

8.1 An inspection and assessment of the pier structure should be undertaken, if necessary on a sample basis, to gain a more accurate view of its form and condition.

8.2 A Cost Plan should be prepared from the findings of the Structural Assessment.

8.3 The public should be excluded from beneath or at least warned of the dangerous nature of parts of the Pier. The unsafe areas should be secured as matter of urgency.

Costings

The following are intended as indicative costings only and are based upon unit rates derived from past pier refurbishment work and published unit rates. The figures quoted are for the first quarter 2009.

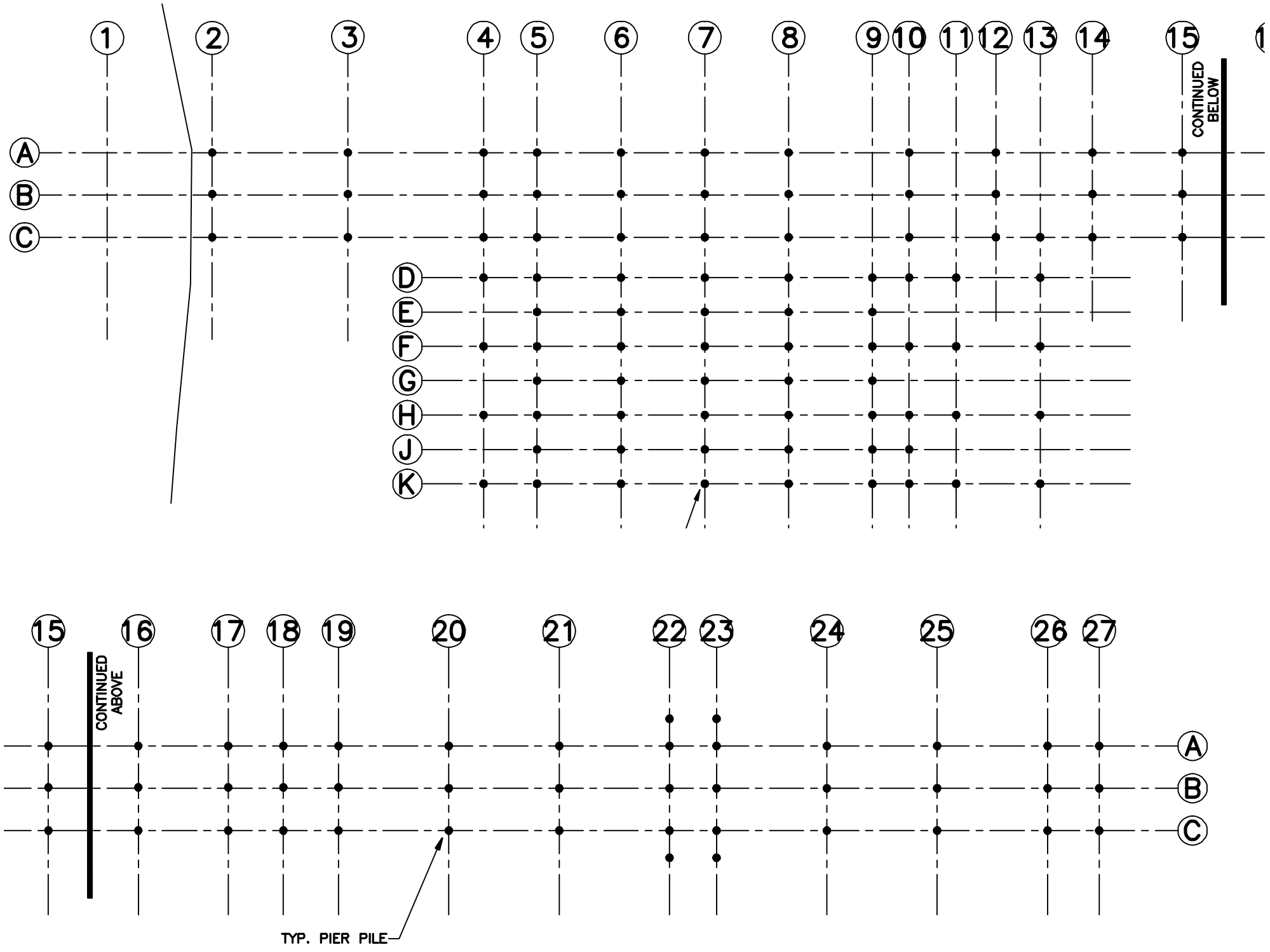
Pier Refurbishment at £450/m^2	£1.8M
Pavilion Refurbishment at £1,500/m^2	£2.1M
Shops and Entrance Refurbishment at £750/m^2	£0.375M
Contractors overheads at 15%	£0.64M
Total allowance for Construction	**£4.915M**

The above excludes fees, supervision costs and any contingency.

In order to a gather enough information on the form and condition of the structure and the extent of the repairs required a Structural Assessment should be carried out. This would include a topographic survey of the columns and deck, surveys and inspections of girders and columns on a sample basis. The information would allow a preliminary loading analysis of the Pier to be carried out to determine areas that could be repaired and those that would need to be replaced. The purpose of the Structural Assessment would be to provide information for a Cost Plan to be prepared and would need to be supplemented by further detailed surveys, testing and inspections during later stages of the design process.

Topographic survey of Pier structure	£2,000
Sample survey and inspections of Pier (allow 2 engineers 1 week on site)	£3,000
Inspection of buildings (allow 1 engineer 3 days)	£900
Assessment calculations and report	£4,500
Hire of access equipment and travel	£1,000
Total allowance for Structural Appraisal	**£11,400**

All the above costing are net of VAT



EXISTING PILE LAYOUT

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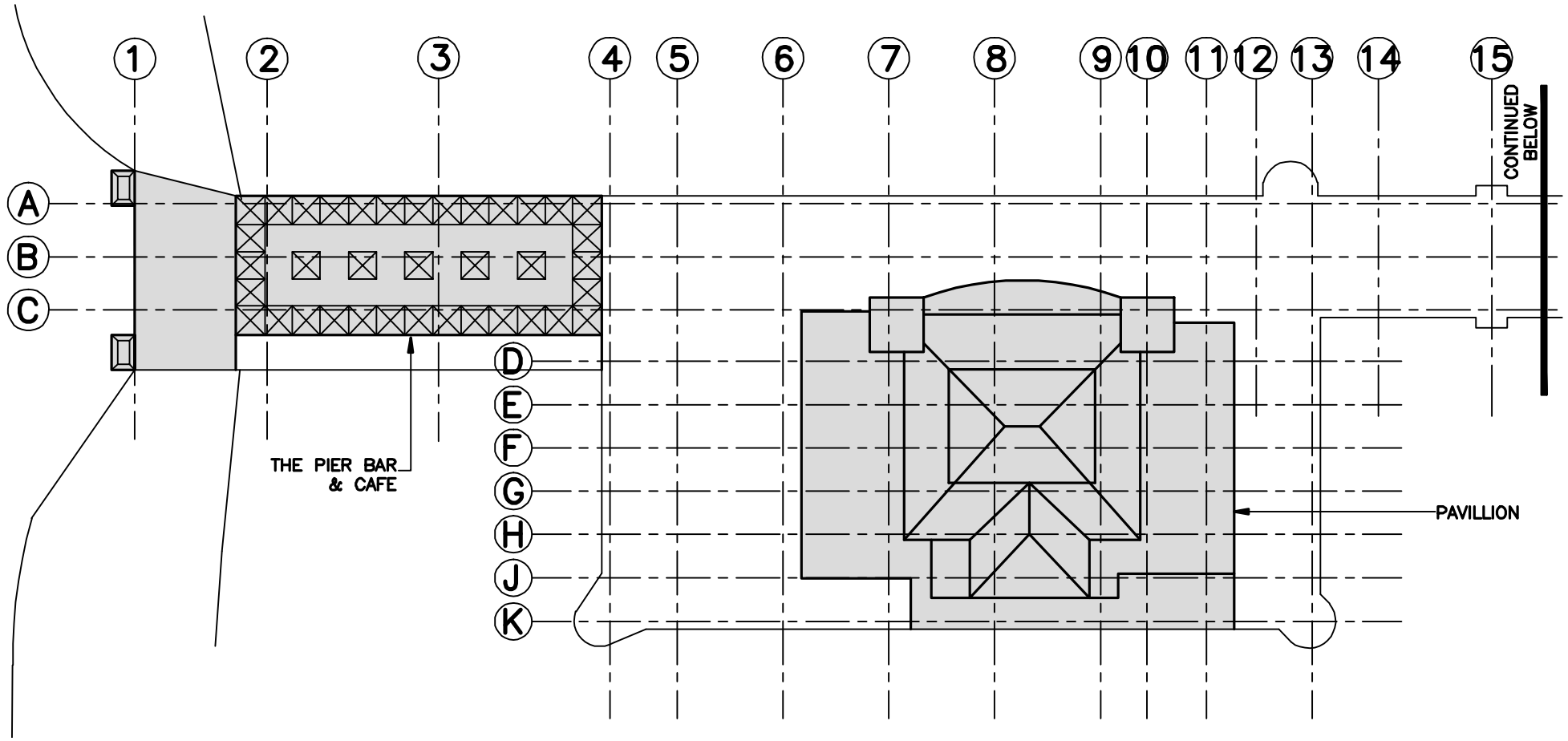

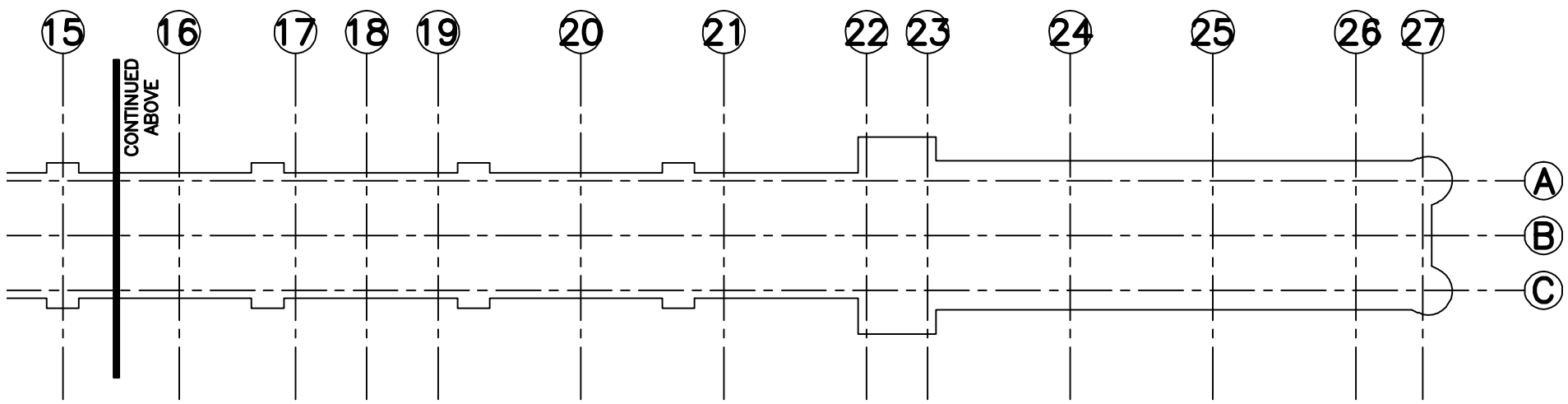

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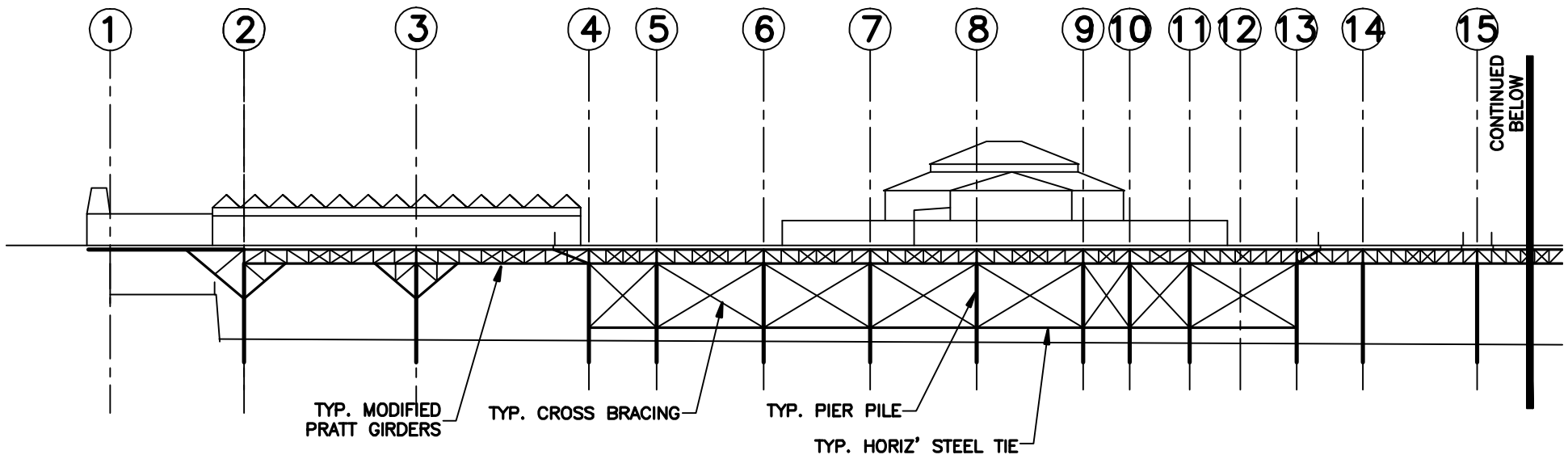

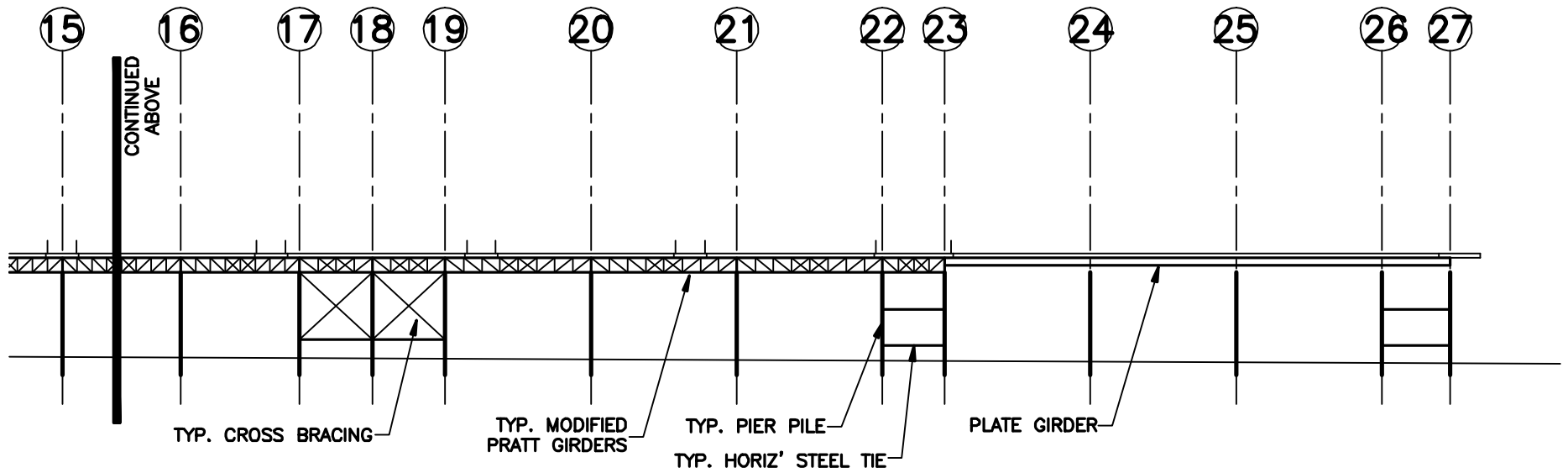

EXISTING ELEVATION

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