

**BEFORE THE INDEPENDENT HEARINGS PANEL**

**UNDER**

the Resource Management Act 1991

**AND**

**IN THE MATTER OF**

the submissions of B & A Stokes on  
the Waimakariri Proposed District  
Plan (#214) and Variation 1 (#29)

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**PRIMARY EVIDENCE OF NEIL  
JAMES CHARTERS  
ON BEHALF OF B AND A STOKES  
(Geotechnical Engineering)**

4 March 2024

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## **1 EXECUTIVE SUMMARY**

- 1.1 ENGEO undertook a geotechnical investigation of the site at 81 Gressons and 1375 Main North Road, Waikuku (the **Site**) in November 2021. The purpose of the investigation was to inform an assessment of the Site's suitability to be rezoned from a mixture of Large Lot Residential Zone (**LLRZ**), Rural Lifestyle Zone (**RLZ**) and Large Lot Residential Zone Overlay (**LLRZO**) (as notified) to General Residential / Medium Density Residential Zoning under the proposed Waimakariri District Plan, as sought by the current landowners (the **Proposal**).
- 1.2 Historically and currently, the Site has been used for agricultural purposes alongside some existing dwellings.
- 1.3 Based on the investigation undertaken by ENGEO, the Site's soil classification for seismic design purposes is most likely to be 'Class D – Deep or soft soil sites' under the NZS 1170.5:2004.
- 1.4 The Site was found to be generally consistent with the low to medium liquefaction vulnerability category (broadly TC1 and TC2 equivalent), with localised areas consistent with the high liquefaction vulnerability category (broadly TC3 equivalent).
- 1.5 Consolidation analysis calculates that large areas of the Site may be susceptible to consolidation settlement of the soft cohesive material identified in many of the Cone Penetration Tests (**CPT**). More than 25 mm of settlement is predicted over an assumed 50-year design life of a standard residential structure for large parts of the centre and north of the Site, whilst over 50 mm is predicted for an area in the south of the Site and a small section in the centre of the Site.
- 1.6 Based on our observations and analyses, I consider the primary geohazards to be surface deformation due to liquefaction and long-term consolidation settlement of soft cohesive or organic material across areas of the Site. Excavations may also be subject to inflow of artesian water, depending upon their depth.
- 1.7 The risks presented by these hazards can be mitigated through earthworks and ground improvement. I therefore do not consider that these hazards should preclude the Site from being rezoned for

residential purposes. However, additional work will be required during any future subdivision consent phase to refine the geological ground model and more accurately define the boundaries of these areas and the options available to remediate them.

- 1.8 Further geotechnical assessment works will be required to support any subdivision consent which may include: additional geotechnical testing to better characterise soil conditions, installing several piezometers to better understand artesian water pressures (these have been installed and are being monitored fortnightly), and soil sampling for laboratory testing (i.e. consolidation testing and fines content).

## **2 QUALIFICATIONS AND EXPERTISE**

- 2.1 My name is Neil Charters. I am a Principal Geotechnical Engineer at ENGEO. I have the following qualifications and experience relevant to the evidence I shall give:

- (a) I have a Master of Engineering (Dist.), Geotechnical Engineering, from the University of Canterbury, and Bachelors in Science (Hons), Engineering Geology, University of Canterbury and University of Otago.
- (b) I am a CPEng Chartered Professional Engineer (Number 1006195) and a member of the New Zealand Geotechnical Society.
- (c) I have more than 20 years' experience working with ENGEO and other geotechnical firms. My work has had a particular focus on:
  - (i) Deep Foundations;
  - (ii) Earth Retaining Structures;
  - (iii) Foundation Design;
  - (iv) Geologic Hazard Evaluation;
  - (v) Landslide Investigations and Repairs;
  - (vi) Liquefaction Analyses; and
  - (vii) Slope Stability.

- 2.2 I was not involved with ENGEO's earlier geotechnical investigation but have reviewed it as part of preparing this evidence.

### 3 CODE OF CONDUCT

- 3.1 While this is not an Environment Court proceeding, I confirm that I have read the Code of Conduct for Expert Witnesses set out in the Environment Court Practice Note 2023. I have complied with the Code of Conduct in preparing this evidence and will continue to comply with it while giving oral evidence. Except where I state that I am relying on the evidence of another person, this written evidence is within my area of expertise. I have not omitted to consider material facts known to me that might alter or detract from the opinions expressed in this evidence.

### 4 SCOPE OF EVIDENCE

- 4.1 This evidence addresses geotechnical hazards affecting the Site and presents findings from a ground investigation and geotechnical study.
- 4.2 In preparing this evidence, I have reviewed the following reports (attached as **Appendix 1** and **Appendix 2** respectively):
- (a) Geotechnical Report 81 Gressons Road and 1375 Main North Road, Waikuku (Eliot Sinclair 350494 27/11/2020) (**Eliot Sinclair Report**); and
  - (b) Geotechnical Investigation 81 Gressons & 1375 Main North Road, Waikuku (ENGEO 19640.000.001\_02 24/11/2021) (**ENGEO 2021 Report**).

#### **Previous reporting summary**

- 4.3 The Eliot Sinclair Report addresses the northern part of the Site on the corner of Gressons Road and Main North Road.
- 4.4 As part of that Report, Eliot Sinclair completed 11 cone penetrometer tests (**CPTs**)<sup>1</sup> (shown in Appendix D and E of that report)<sup>2</sup> across that northern part of the Site to inform their report. Eliot Sinclair considered that the most relevant hazards to the Site included potential surface deformation due to liquefaction and potential inundation due to flooding

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<sup>1</sup> The cone penetrometer test (CPT) is a method used to determine the geotechnical engineering properties of soils and delineating soil stratigraphy.

<sup>2</sup> Eliot Sinclair *Geotechnical Report 81 Gressons Road and 1375 Main North Road, Waikuku* 350494, 27 November 2020, Appendix D: CPTu Test Location Plan; and Appendix E: CPTu Test Results.

of the Ashley River. It was concluded that, provided these hazards are addressed, there are no significant geotechnical constraints that would prevent the re-zoning of that part of the Site for residential purposes.

- 4.5 The ENGEO 2021 Report addressed the geotechnical conditions relevant to rezoning of the Site (including the northern area assessed by Eliot Sinclair). The ENGEO 2021 Report incorporated the data from the Eliot Sinclair Report. In addition, 40 CPTs were completed at the approximate location shown on the test location plan in Figure 5 of the ENGEO 2021 Report.<sup>3</sup> Thirteen tests were pushed to a target depth of 15 m, three were pushed until they met practical refusal and the remaining 24 were pushed to a target depth of 10 m.
- 4.6 The findings of that Report are described in further detail below.

## **5 SITE DESCRIPTION AND BACKGROUND**

- 5.1 The Site is currently rural farmland with an area of approximately 144 hectares. The landform is generally flat with drainage channels through areas of the Site. Waikuku Stream runs past the northern extent of the Site within 60 m of the boundary and Stokes Drain runs through the centre of the Site.

## **6 DESKTOP REVIEW RESULTS**

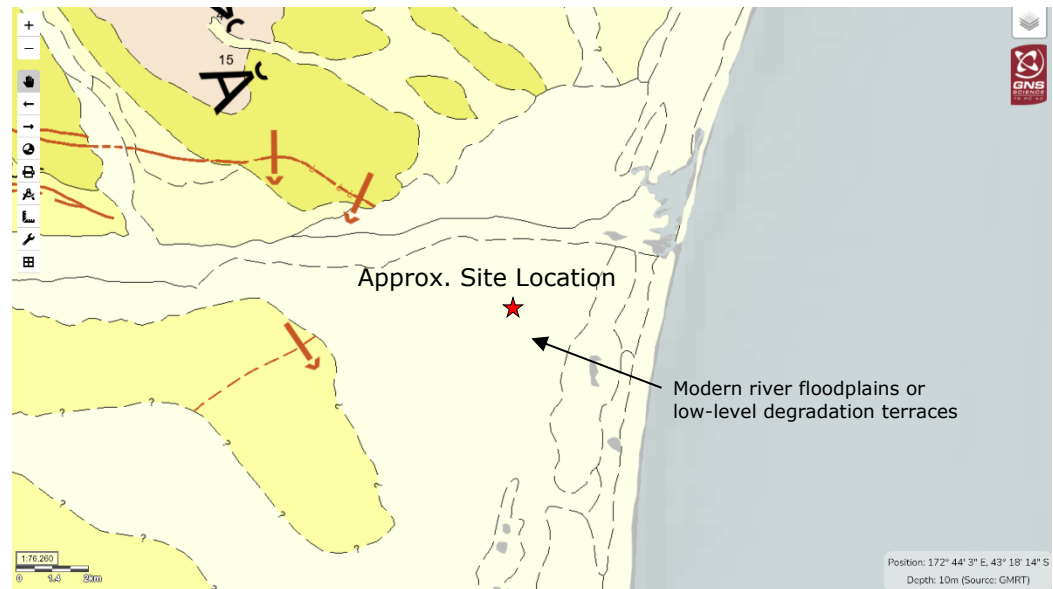
### **Regional geology**

- 6.1 Regional mapping indicates that the Site is underlain by unweathered, variably sorted gravel, sand silt and clay of modern river floodplains or low-level degradation terraces (refer **Figure 1**).

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<sup>3</sup> ENGEO *Geotechnical Investigation - 81 Gressons Road and 1375 Main North Road, Waikuku* Project Number 19640.000.001, 24 November 2021, Figure 5: Investigation Location Plan.

Figure 1. 1:250k geologic map from GNS (2024).



## Geohazards

### Seismicity

- 6.2 The nearest faults to the Site are the Loburn and Ashley faults (part of the Ashley Fault Zone), which have been mapped approximately 4.5 km northwest and 11 km west of the Site respectively. The Site is mapped outside of the Ashley Fault Awareness Zone.
- 6.3 Despite being further away, the Porters Pass-Amberley Fault Zone, Hope fault, and Alpine Fault pose a significant seismic threat to North Canterbury due to their potential to produce large earthquakes.
- 6.4 O'Rourke et al (2012) developed a contour map of the conditional median peak ground accelerations interpolated from data measured at various recording stations during the 2010/2011 Canterbury Earthquake Sequence.<sup>4</sup> The nearest monitoring stations to the Site are at Kaiapoi North School and Ashley School.
- 6.5 This mapping indicates that the Site experienced peak ground motions of approximately 0.21g during the September 2010 Darfield earthquake. The Site is therefore likely to have experienced seismic accelerations in

<sup>4</sup> O'Rourke, T., Jeon, S.-S., Toprak, S., Cubrinovski, M., & Jung, J. K. (2012). *Underground lifeline system performance during the Canterbury earthquake sequence*. Proceedings of the 15th World Conference on Earthquake Engineering, Lisbon, Portugal.

excess of Serviceability Limit State.<sup>5</sup> Contour mapping is not available for the February, June or December 2011 earthquakes, but the ground accelerations are expected to have been substantially less than that experienced in September 2010.

#### *Liquefaction*

- 6.6 The Site has been mapped by the Waimakariri District Council as being within an area where 'Liquefaction damage is possible' and further assessment is needed.
- 6.7 Sand boil formations to the south, west and northeast of the Site were mapped by GNS following the September 2010 and February 2011 earthquakes. No liquefaction ejecta was recorded on Site, however, this mapping was largely based off area wide aerial photography rather than Site specific observations. As a result, there is uncertainty regarding whether liquefaction ejecta did occur on the Site during the Canterbury earthquake sequence. To better understand the liquefaction vulnerability of the Site, CPT investigations have been undertaken and the results are discussed in Section 7 below.

#### *Flooding*

- 6.8 Mapping on the Waimakariri District Council GIS database indicates that parts of the Site may be subject to a medium flood hazard during a 1 in 200-year flood event. This will be addressed in the infrastructure evidence of Mr Hall. Assessing the risk from tsunami is outside of our scope, however, I note the Site is located outside of any tsunami evacuation zones as mapped in the proposed Waimakariri District Plan. Additionally, the Site is located 3 km inland from the coast and is approximately 6 m to 12 m above sea level.

#### **Historical aerial photography**

- 6.9 Aerial photographs from Canterbury Maps dating from 1940 to present have been reviewed. All photos portrayed historical pastoral and agricultural activities over time, with irrigation and the addition of residential dwellings in the 1990s. Paleo-channels running in a west to

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<sup>5</sup> The serviceability limit state represents a level of stress or strain within a structure below which there is a high expectation the structure can continue to be used as originally intended without repair.

east direction were identified across the Site from the 1940 aerial photograph. A significant inferred paleo-channel can be seen in the 1940 historical aerial photograph to the south of the Site. Many of these paleo-channels appear to have been filled in the next available photograph, taken in 1960.

## **7 SITE INVESTIGATION AND RESULTS**

### **Cone Penetration Test (CPT) investigations**

- 7.1 As noted above, ENGEO completed a ground investigation comprising 40 CPTs on 8 November 2021.
- 7.2 The density of testing was guided by table 2.1 of the MBIE (2021) Earthquake Geotechnical Engineering Practice, Module 2 (Recommended Minimum Deep Geotechnical Investigation Intensity for Plan Change or Subdivision Consent Applications).<sup>6</sup> The CPTs were then spread generally evenly across the Site to assess geologic variability and build a geologic model. Thirteen of the CPT investigations were pushed to a target depth of 15 m bgl, three were pushed until they met practical refusal, and the remaining 24 were pushed to a target depth of 10 m bgl.

### **Groundwater**

- 7.3 CPT holes were dipped on the completion of each test. The groundwater levels varied between 0 m to 2.6 m across the Site. CPTs 7, 8, 10, 11, 21, 22, 28, 29 and 30 encountered artesian conditions where water was flowing at the surface once the CPT rods had been removed from the hole (or encountered very shallow in the CPT hole). Based on a high level review of the CPT data it appears that there may be a confined layer of water bearing sand approximately 3.5 to 4 m bgl - it is possible that the artesian pressure is occurring from this layer.
- 7.4 **Appendix 3** outlines the inferred subsurface channel where artesian water pressures have been observed.

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<sup>6</sup> Ministry of Business, Innovation and Employment (MBIE), & New Zealand Geotechnical Society (NZGS). (2021). Earthquake geotechnical engineering practice—Module 2: Geotechnical investigations for earthquake engineering. <https://www.building.govt.nz/assets/Uploads/building-code-compliance/b-stability/b1-structure/geotechnical-guidelines/module-2-geotech-investigations-earthquake-engineering-version-1.pdf>



### **Inferred geologic profile**

- 7.5 The CPTs in the west and southeast areas of the Site generally met practical refusal on an inferred shallow gravel or dense gravelly sand layer. CPTs through the centre of the Site did not intercept this layer and generally met target depth.
- 7.6 The testing to date indicates that the composition of the subsurface soils is highly variable across the Site. Generally, shallow gravels were encountered in the east, cohesive soils in the centre, and fine-grained soils in the west of the Site. This is consistent with the alluvial depositional environment where rivers have avulsed across the landscape over time, creating a layered subsurface profile comprising loose silts, sands, peat, sensitive fine-grained soils and gravel layers. Given the proximity of the Site to the coastline, marginal marine deposits may also be present, which are likely to be susceptible to liquefaction.

## **8 GEOTECHNICAL ASSESSMENT**

- 8.1 Based on our review of mapped land damage in the area surrounding the Site and the ground conditions encountered in our investigations, I consider surface deformation due to liquefaction and consolidation settlement of the soft compressible material encountered in our geotechnical investigation to be the primary geotechnical considerations for the Site. As such, I have carried out assessments of the liquefaction potential and a preliminary assessment of the long-term consolidation settlement potential of the Site using on-site CPT data. Results and my analysis are outlined in the following sections.

### **Seismic subsoil class**

- 8.2 For the purpose of seismic design, I consider the soil classification in line with NZS 1170.5:2004 to most likely be 'Class D – Deep or soft soil sites'.

### **Liquefaction assessment**

- 8.3 I have undertaken a liquefaction assessment using the on-site and CPT data and liquefaction procedures described in the following sections. I

have included both the Eliot Sinclair CPTs and the CPTs completed as part of our geotechnical investigation.

- 8.4 The Site was found to be generally consistent with the low to medium liquefaction vulnerability category as defined by the Planning and engineering guidance for potentially liquefaction-prone land (MBIE, 2017) document, with localised areas consistent with the high liquefaction vulnerability category (refer **Appendix 4**).
- 8.5 Appendix 4 presents a map showing liquefaction vulnerability across the Site. Also included are areas of uncertainty of the deeper geological profile where the CPTs met shallow refusal. I have reviewed nearby borehole investigations (north and south of the Site) on the New Zealand Geotechnical Database. A gravel layer was present within these boreholes ranging from 0.8 m to 6.45 m thick and the top of gravel ranging 0.85 to 12.4 m depth. I have inferred that a shallow gravel layer is present where the CPTs met shallow refusal. The gravel layer is poorly constrained on the Site; however, the nearby borehole investigations indicate the gravels are likely four to five metres thick. These gravels pinch off to the west where the fine grained granular and soft cohesive soils were encountered in our CPT investigation.
- 8.6 The areas where the CPTs refused on inferred shallow gravel will require further investigation (using machine boreholes), however, I do not consider this needs to be completed until the subdivision consent stage. While the analysis indicated that some areas of the Site may be in line with the low liquefaction vulnerability category, I consider that these areas should be classified as medium liquefaction vulnerability due to the significant variation of the geological profile across the Site and the possibility that the gravel layer may be thinner on the Site than in nearby boreholes. This could be further refined through a more detailed testing regime to assess boundaries between the inferred liquefaction vulnerability categories across the Site.
- 8.7 In addition to assessing the liquefaction hazard, as described in MBIE (2017)<sup>7</sup>, I have also considered the 150 year event as required by the

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<sup>7</sup> Environment Canterbury (Ministry of Business, Innovation and Employment (MBIE). (2017). *Planning and engineering guidance for potentially liquefaction-prone land* <https://www.building.govt.nz/assets/Uploads/building-code-compliance/b-stability/b1-structure/planning-engineering-liquefaction.pdf>

WDC rule found in Yetton & McCahon (2009) Table 32.3: Liquefaction Mitigation Design Standards.<sup>8</sup> The vast majority of the CPT locations show settlement of less than 100 mm in this event, which is compliant with the requirements of the rule (refer **Appendix 5**). Two locations predict settlement greater than this, but both are within the high liquefaction vulnerability zone already defined in Appendix 4.

- 8.8 The liquefaction vulnerability zones across the Site are variable, and as such must be mitigated during subdivision design and consenting. I do not however consider that these matters should preclude rezoning of the Site for residential purposes.

### **Lateral spread**

- 8.9 Given the civil/landscaping design of the Site wide landform has not yet been developed I have not specifically addressed lateral spread. This should be assessed during the subdivision consent stage.
- 8.10 Should bulk earthworks form areas of sloped land (such as adjacent to water courses or stormwater basins), the detailed design will need to appropriately manage the risk of lateral spread and could include the need to install retaining walls depending on slope steepness and the proximity of buildings and roads. Any services crossing slopes at risk of lateral spread will need to be designed accordingly.

### **Preliminary consolidation analysis**

- 8.11 Weak cohesive material identified in the CPTs can be susceptible to consolidation over time. The consolidation rate can be increased when additional load is placed on the Site due to the dwellings which would be enabled if the Proposal is accepted. To estimate the consolidation potential on this Site, I have completed a preliminary settlement calculation using the geotechnical software CPet-IT. While I have not completed any consolidation or lab testing of the subsurface materials, I consider this is appropriate as a “first-pass” to indicate the likely consolidation potential (i.e. to inform re-zoning rather than resource consent).

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<sup>8</sup> Yetton, M. D., & McCahon, I. F. (2009). *Earthquake hazard assessment for Waimakariri District* (1869379616;9781869379612;). Environment Canterbury. <https://go.exlibris.link/8R4798Ww>

### **Consolidation analysis results**

- 8.12 The analysis calculates that large areas of the Site may be susceptible to consolidation settlement of the soft cohesive material identified in many of the CPTs. Consolidation settlements have been split into three categories: <25 mm, 25 - 50 mm, and >50 mm. <25 mm is considered an acceptable tolerance for new structures whereas 25 – 50 mm and >50 mm will likely require remedial works to mitigate settlement. More than 25 mm is predicted over the assumed 50-year design life for large parts of the centre and north of the Site, whilst over 50 mm is predicted for an area in the south of the Site and a small section in the centre of the Site (refer **Appendix 6**). The area of highly compressible material in the south of the Site appears to correlate with an infilled paleo-channel. Also mapped in Appendix 6 are areas of large uncertainty, due to shallow CPT refusal.
- 8.13 These settlements are outside of the acceptable tolerance for a residential structure, and as such will be required to be mitigated during subdivision design and consenting. I do not however consider that these matters should preclude rezoning of the Site for residential purposes. Proven solutions to address consolidation and liquefaction risks present at the Site are well understood and are commonly incorporated into subdivision design and consenting processes to ensure the risks are appropriately managed.

## **9 SUITABILITY OF THE SITE FOR THE PROPOSAL**

- 9.1 Based on our observations and analyses outlined above, I consider the primary geohazards to be surface deformation due to liquefaction and long-term consolidation settlement of soft cohesive or organic material across areas of the Site (refer **Appendices 4, 5, and 6** for our hazard maps – specifically areas mapped as high liquefaction vulnerability or over 50 mm of long-term consolidation settlement). Ground improvement will likely be required in areas classified as high liquefaction vulnerability.
- 9.2 Overall, the Site's complex geology results in differential performance of the ground with areas on the Site having either high surface deformations, long-term consolidation settlement, or both.

- 9.3 The risks presented by these hazards can be mitigated through earthworks and ground improvement. I therefore do not consider that these hazards should preclude this Site from being rezoned for residential purposes under the proposed Waimakariri District Plan; however, additional work will be required during the subdivision consent phase to refine the geological ground model to more accurately define the boundaries of these areas and the options available to remediate them.
- 9.4 I also recommend that the flooding hazard is considered during civil engineering subdivision design. Assessment of the effects of tsunami is outside of our scope, however, a brief review of the Waimakariri District Natural Hazards Interactive Viewer shows the evacuation zones terminating on the eastern side of State Highway 1 (i.e. outside of the Site boundary).

### **Recommendations**

- 9.5 Further geotechnical assessment works will be required to inform subdivision design and associated bulk earthworks and to support any residential development of the Site enabled through the Proposal, if approved. Works may include undertaking additional geotechnical testing across the Site to further delineate the boundaries between low, medium, and high liquefaction vulnerability type performance across the Site and the areas through which significant amounts of compressible material may be present. Further testing is also required in the areas of shallow CPT refusal, particularly in the east of the Site, to more accurately define the deeper geological profile in these areas.
- 9.6 I recommend installing several multi-stage piezometers though this area to better understand where the artesian water pressures are occurring and how they may affect the Proposal.
- 9.7 Laboratory sampling including fines content analyses to refine the liquefaction analyses may be necessary, as well as 1D Consolidation testing in the event that significant peat deposits are encountered.

## **10 CONCLUSION**

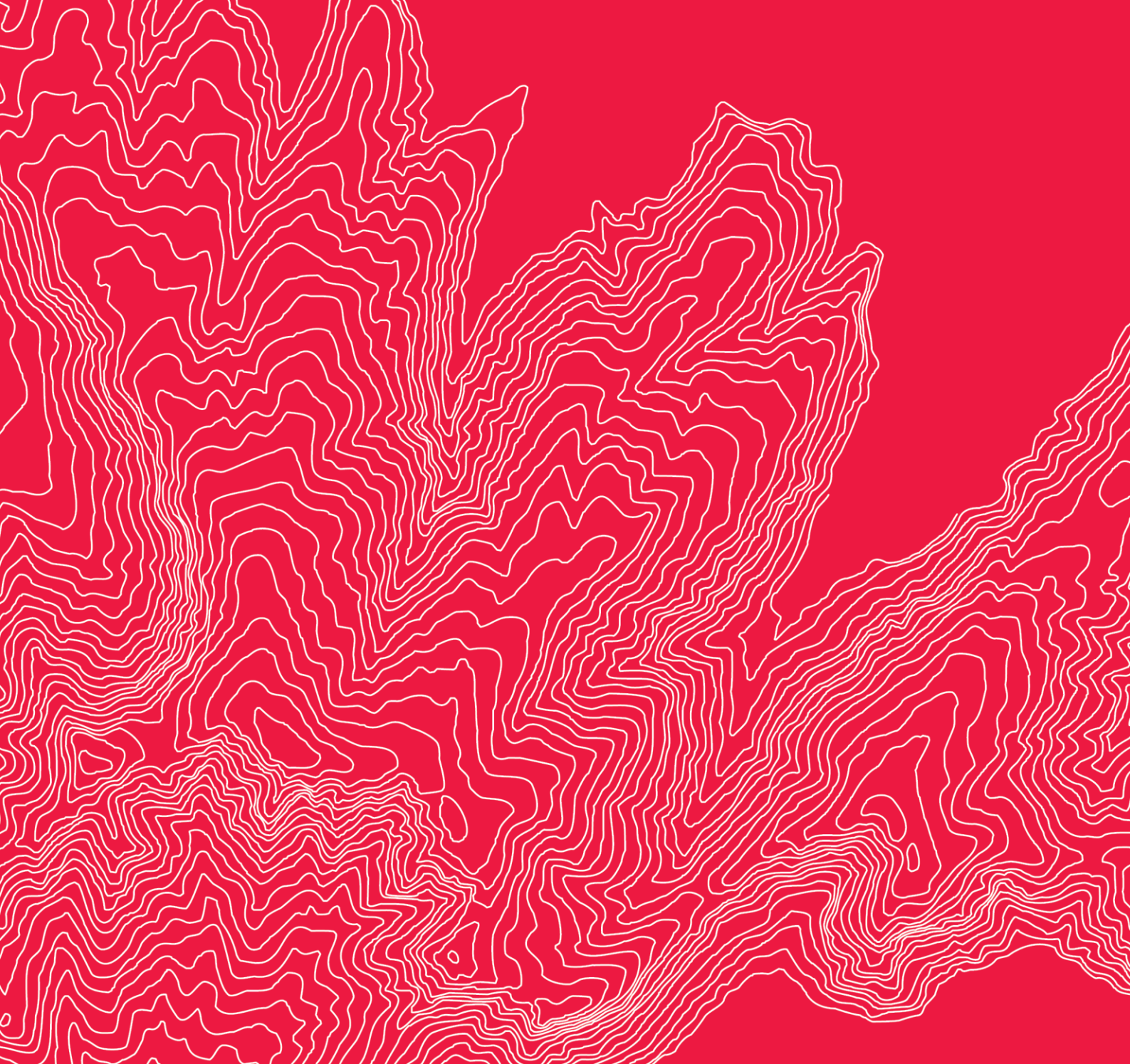
10.1 Overall, I consider that there are no geotechnical issues or hazards with this Site which would preclude it from being rezoned for residential purposes, as sought by the landowners in their submission on the proposed Waimakariri District Plan. While we have identified a number of geotechnical issues/hazards with the Site, I consider that these can be appropriately addressed at the subdivision stage, with the benefit of additional geotechnical assessment works (which can be undertaken once a subdivision design has progressed).

A handwritten signature in black ink that reads "Neil Charters". The signature is written in a cursive, slightly slanted style.

**Neil Charters**

4 March 2024

**Appendix 1**



# Geotechnical Report

**81 Gressons Road and 1375 Main North  
Road, Waikuku**

Prepared for Northside Country  
350494

**eliot  
sinclair**

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# Geotechnical Report

81 Gressons Road and 1375 Main North Road, Waikuku



Prepared for Northside Country

350494

## Quality Control Certificate

Eliot Sinclair & Partners Limited

eliotsinclair.co.nz

Action	Name	Signature	Date
<b>Prepared by:</b>	Jeffrey Fleming Geotechnical Engineering Technician NZDE Civil MEngNZ		27 November 2020
<b>Directed and approved for release by:</b>	John Aramowicz Director, Civil/Geotechnical Engineer BE(Hons), CMEngNZ, CPEng, IntPE(NZ)		27 November 2020
<b>Status:</b>	Final		
<b>Release date:</b>	27 November 2020		
<b>Reference no:</b>	350494		
<b>Distributed to:</b>	Northside Country		

### Limitations

*This report has been prepared for Northside Country according to their instructions and for the particular objectives described in this report. The information contained in this report should not be used by anyone else or for any other purposes.*

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## 1. Introduction

Eliot Sinclair have been engaged by Northside Country to undertake a geotechnical investigation and report at 81 Gressons Road and 1375 Main North Road to inform a proposed zone change from rural to rural-residential land use. The site is legally described as Lot 2 DP 428676, Lots 2-3 DP 62186, Lot 2 DP 303387, Lot 1 DP 470921 and Pt RS 3101.

Eliot Sinclair have previously completed a Geotechnical Report for the Proposed Subdivision dated 29 October 2012. We have carried out a further site visit on 10 November 2020 and reviewed the geotechnical data available for the site, and have updated our assessment of the liquefaction hazard at the site.

## 2. Scope of Work

The scope of work for this geotechnical assessment of the proposed zone change was;

- Review published geology,
- Review Environment Canterbury's database for nearby bore log data,
- Review of GNS Science's strong motion data for 4 September 2010 and 22 February 2011 earthquakes,
- Review the New Zealand Geotechnical Database,
- Reanalyse the 11 X cone penetration tests carried out in 2012 using the results of on-site groundwater monitoring records,
- Summarise the results of the geotechnical analysis, in this report and to provide geotechnical recommendations for the proposed rezoning.

## 3. Disclaimer

Comments made in this geotechnical report are based on a detailed site inspection undertaken in July 2012, a further site inspection on 10 November 2020, published geological and bore log information, CPTu testing, and assessment of the risk of liquefaction due to seismic shaking.

Whilst every care was taken during our investigation and interpretation of subsurface conditions, there may well be subsoil strata and features that were not detected. Additionally, on-going seismicity in the general area may lead to deterioration or additional ground settlement that could not have been anticipated at time of writing of this report.

The exposure of such conditions, or occurrence of additional strong seismicity, may require a review of our recommendations.

This report has been prepared for the benefit of Northside Country, and the Waimakariri District Council. No liability is accepted by this company or any employee of this company with respect to the use of this report by any other party.

## 4. Rezoning Proposal

The site is legally described as Lot 2 DP 428676, Lot 2 DP 62186, Lot 2 DP 303387, Lot 3 DP 62186, Lot 1 DP 470921 and Pt RS 3101 (paper road, 0.7852 ha) and totals approximately 34.2 hectares.

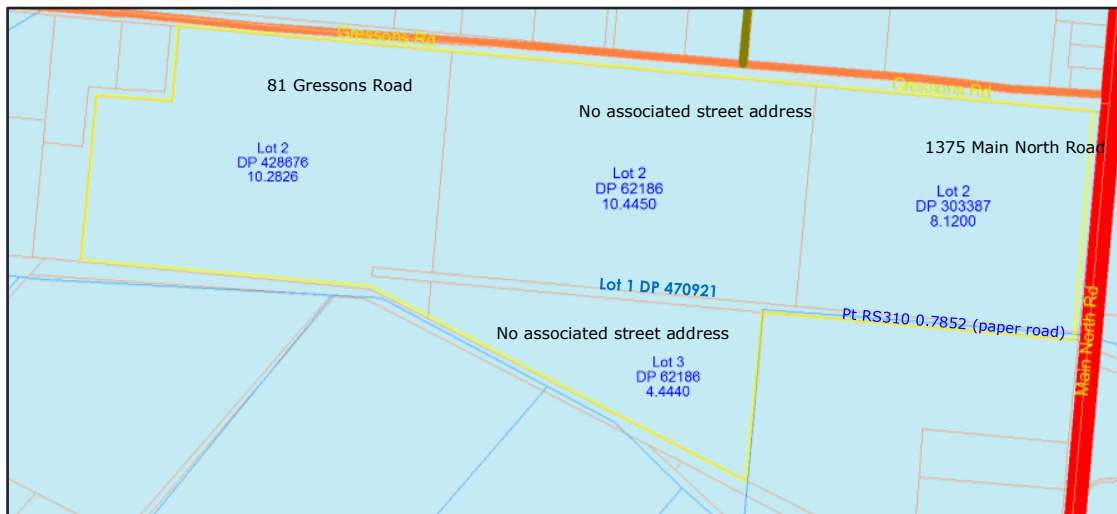


Figure 1: Site location plan (Source LINZ database)

It is proposed to rezone the site situated on the corner of Gressons Road and Main North Road, Waikuku, from rural to rural-residential land use.

Refer to Appendix A and Appendix B.

## 5. Site Description

### 5.1. Engineering Geology

GNS's geological map<sup>1</sup> notes the site being underlain by 'Grey river alluvium comprising gravel, sand and silt in active floodplains'.

*'The vast expanse of the Canterbury Plains comprises coalesced floodplains. Large parts of the plains are abandoned braided river floodplains, last occupied during the LGM (last glacial maximum)'.*

<sup>1</sup> Forsyth, P.J., Barrell, D.J.A., Jongens, R. (compilers) 2008 Geology of the Christchurch area. Scale 1:250 000. Institute of Geological & Nuclear Sciences geological map 16. 1 sheet + 67p. Lower Hutt, New Zealand. GNS Science.

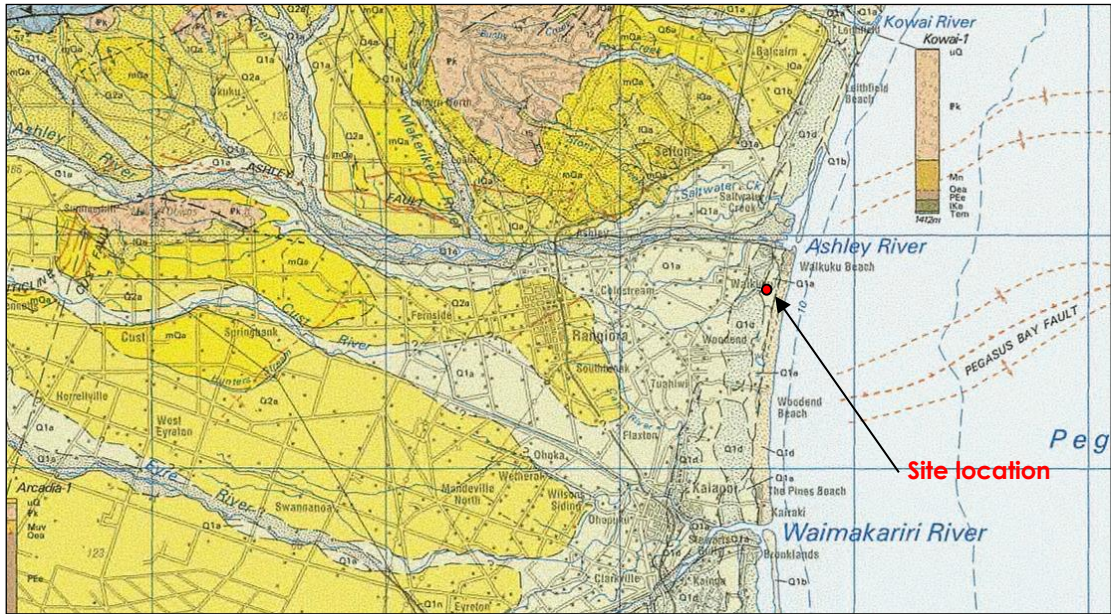


Figure 2: Geological Map of Christchurch.

## 5.2. Existing bore hole data

Bore log records from the Environment Canterbury (ECan) GIS system were reviewed to determine typical subsoil geology of the general area.

Well M35/6353, located on the western boundary of Pt Lot DP 57114 encountered 'sandy silt' to 4m, 'grey pug with some vegetation' to 12.5m, 'sand' to 15m overlying 'sandy gravel' to at least 16m depth where the well terminated.

Well M35/7340, located approximately 25m north of the site along Gressons Road, encountered 'clay' to 3m, multiple layers of 'pug' and 'gravel' to 14.3m, 'pug and sea shells' to 20m overlying gravels to at least 23m depth where the well terminated.

Well M35/7197, located approximately 355m west of Lot 1 DP 62186 encountered 'claybound' and 'sandy gravels' to 5m, 'sandy pug with gravels' to 21m, 'black clay' to 25m overlying 'gravel' to at least 41m depth below ground level.

Well M35/6176, located approximately 22m from the southern boundary along Main North Road (SH1), encountered 'clay' to 3m, 'sand & some small gravels' to 14m, 'peat' to 20m, overlying 'gravels' to at least 23m depth below ground level where the well was terminated.

### 5.3. Topography

The site is located on the corner of Gressons Road and Main North Road. The site topography is flat.



Photograph 1: The southeast corner of the site looking west, showing the flat topography across the site. (November 2020)

### 5.4. Drainage

An open drain is located along the west and south boundaries of the site, and is piped in places.



Photograph 2: The large drain situated on the neighbouring property, south of the site. (July 2012)

## 5.5. Vegetation

The site is vegetated in grass, with shelterbelts located in the western part of the site.



**Photograph 3: The west end of the site looking northeast. (November 2020)**

## 5.6. Buildings

There are no buildings within the area of the proposed subdivision.

A residential dwelling is located at the adjacent property at the northwest corner of the site.

## 5.7. 2010/2011 Canterbury Earthquakes

The M7.1 Darfield earthquake on 04 September 2010 occurred on a previously unknown (Greendale) fault, producing peak horizontal ground accelerations of 0.21g and 0.41g at Ashley School and Kaiapoi North School respectively. Whilst the earthquake resulted in liquefaction within the soft alluvial soils predominantly across eastern Christchurch and some areas of Kaiapoi, we understand that there was no liquefaction identified areas on or around the site.

The subsequent M6.3 aftershock on 22 February 2011, located near Lyttleton/Heathcote, produced peak horizontal ground accelerations of 0.09g at Ashley School and 0.23g at Kaiapoi North School.



**Table 1 Comparison of peak horizontal ground accelerations close to site.**

<b>PGA (horizontal)</b>	<b>SLS (1/25, M7.5)</b>	<b>ULS (1/500, M7.5)</b>	<b>04 Sept 2010<sup>2</sup> (M7.1)</b>	<b>22 Feb 2011<sup>3</sup> (M6.3)</b>
Current design pga	0.13g	0.35g		
Ashley School			0.21g	0.09g
Kaiapoi North School			0.41g	0.23g

## 5.8. Technical Land Category

This site has not been classified by CERA, as it is deemed rural /NA.

The site is located within the area of "liquefaction susceptibility" shown on the Waimakariri District Council's 'Natural Hazards Liquefaction Susceptibility Map', dated 19 May 2016.

## 6. Site Investigation

### 6.1. CPTu Testing

Eleven cone penetration tests with measurement of pore water pressure (CPTu) were undertaken across the site in 2012. Refer to Appendix E.

These test results generally indicate the presence of interbedded sand, sandy silts, and silty clays throughout the profile.

CPTu testing met practical refusal at 2.6 to 20m depth across the site, most likely on a dense sand or sandy gravel. Shallow refusal at CPTu's 1, 3, 4, 7, 8, 10 and 11 is likely to have occurred within an upper layer of gravelly sand. Refer to Appendix E.

It appears that there is a layer of sandy gravel located around 2-4m below ground level across the site, roughly in a southwest-northeast orientation. It is likely that this is an historic paleochannel, with overbank deposits to the northwest and southeast.

### 6.2. Groundwater

Pore water pressure measurements at the time of the CPTu testing indicated inferred groundwater at around 3 to 4m below ground level.

Subsequent to this, Eliot Sinclair installed 7 standpipes across the site in July 2013 and then monitored ground water levels monthly between July 2013 to September 2017. Our monitoring records indicate the highest ground water level occurs in winter and spring when the ground water level rises to between 1m to 2m below ground level across the site.

<sup>2</sup> Darfield (Canterbury) earthquake strong motion data, GNS Science, 04 September 2010.

<sup>3</sup> Christchurch earthquake strong motion data, GNS Science, 22 February 2011.

Potentially, the highest groundwater monitoring data is not accurate and there may have been water (or rainfall) infiltration into the standpipes giving a false result. It was noted that during some monitoring periods, especially after rainfall some wells indicated a groundwater near the surface while other suggested it was 1 m bgl. It is considered that the 15th and 85th percentile groundwater records should be used for groundwater depth measurements. The average annual groundwater depth across the full site is 1.10 m bgl.

### 6.3. Site investigation density

The Ministry for Business, Innovation and Employment released their 'Planning and engineering guidance for potentially liquefaction-prone land' in September 2017.

The new guidelines set out typical requirements for geotechnical investigations, assessment and reporting primarily for Plan Change and Subdivision Consent applications.

Our assessment for the site was based on a Level C detailed area-wide assessment. The guidelines suggest that between 0.1 to 4 deep ground test/investigation locations be undertaken per Ha for adequate ground characterisation for liquefaction assessments to inform planning and consenting processes. Our CPTu testing special density across the site the site is equivalent to 0.3 tests per Ha. The testing undertaken across the site included:

- Cone penetrometer testing with pore water pressure measurement at eleven (11) locations across the site, down to 2.5 to 20m depth.

We consider the results of the deep site investigation, along with supporting information from geological maps, records shown on the New Zealand Geotechnical Database, and Environment Canterbury well logs, provide sufficient evidence of the underlying ground conditions and the risk of natural hazards at this site to inform this report which is advises on the geotechnical suitability of the site for rural-residential land use.

## 7. Liquefaction Assessment

### 7.1. Methodology

Following the most recent version of MBIE's guidelines and Supplement Issue 7, the calculation of liquefaction triggering was undertaken using the method by Boulanger and Idriss (2014)<sup>4</sup> and the estimation of post-liquefaction induced settlements using the method by Zhang et al (2002)<sup>5</sup>.

The peak ground accelerations used for liquefaction assessment were  $PGA_{6.0} = 0.19g$  and  $PGA_{7.5} = 0.13g$  for the serviceability limit state (SLS) event, and  $PGA_{7.5} = 0.35g$  for an ultimate limit state (ULS) event.

For the purpose of this assessment, the depth to groundwater for liquefaction assessment was conservatively assumed to be 1m below existing ground level.

---

<sup>4</sup> Boulanger, R. W. and Idriss, I. M. (2014). CPT and SPT based liquefaction triggering procedures (Report No. UCD/CGM-14/01), University of California, Davis, CA, 134 p.

<sup>5</sup> Zhang, G., Robertson, P. K., & Brachman, R. (2002). Estimating liquefaction induced ground settlements from CPT for level ground. Canadian geotechnical journal, 39(5): 1168-1180.

## 7.2. Liquefaction-Induced 'Index' Settlement

Liquefaction-induced 'index' settlements were calculated using CLiq<sup>6</sup> software, with the results summarised in table 2. The vertical 'index' settlements were calculated using the method by Zhang et al (2002) using the four basic CPT parameters (depth, cone tip resistance, skin friction and pore water pressure). Reported settlements are 'index' values that indicate relative susceptibility to liquefaction and free-field ground surface settlement.

The analysis indicates that in an SLS earthquake event the silty sands and sands typically located between around 3 to 6m bgl would liquefy, but the near-surface clay and silty clay-like soils would generally not liquefy. In a ULS earthquake the clay silts and sands between 1m to 10m bgl are expected to liquefy at various depths.

Where CPTu testing met practical refusal at shallow depth, estimation of liquefaction risk and settlements will not have taken the presence of deeper soil layers into account.

Please refer to the CPT data, Liquefaction Analysis and the Summary of Liquefaction Hazard in Appendix E.

Test No.	Depth of CPTu test	Results of liquefaction analysis (mm)						Assessed Technical land Category
		SLS1 (M6.0, 0.19g)		SLS2 (M7.5, 0.13g)		ULS (M7.5, 0.35g)		
		Index	LSN	Index	LSN	Index	LSN	
CPTu01	3.9m*	3	1	2	1	7	4	TC1
CPTu02	14.7m	66	22	43	10	101	38	TC2
CPTu03	12.7m	55	12	42	8	76	20	TC2
CPTu04	2.4m*	3	2	1	1	10	7	TC1
CPTu05	20.0m	39	12	28	7	58	23	TC2
CPTu06	18.0m	56	17	41	10	63	21	TC2
CPTu07	4.3m*	10	6	4	2	19	11	TC1
CPTu08	3.2m	1	1	0	1	2	2	TC1
CPTu09	18.1m	79	18	67	12	94	24	TC2
CPTu10	4.0m*	5	3	3	1	13	8	TC1
CPTu11	2.6m*	6	5	1	1	26	18	TC1

**Table 2 - Liquefaction-induced 'index' settlement (mm) – Limited to the upper 10m of soils.**

<sup>6</sup> CLiq (version 2.2.0.37). (2006). Computer software. Serres, Greece: GeoLogismiki.

\*CPT testing terminated prematurely and did not reach 10m bgl, therefore these values may not completely reflect the geotechnical conditions that exist deeper down.

### 7.3. Liquefaction Severity Number (LSN)

The liquefaction severity number (LSN) is a parameter developed to reflect the more damaging effects of shallow liquefaction on residential land and shallow foundations<sup>7</sup>. Calculation of the LSN is limited to 10m bgl. The estimated LSN values are summarised in Table 3.

**Table 3: Maximum LSN**

Event	Typical Maximum LSN Assessed for CPT 1-11	Predominant performance
SLS	10 - 20	'Minor expression of liquefaction'
ULS	20 - 30	'Moderate expression of liquefaction'

#### 7.3.1. Serviceability limit state, SLS

LSN values of between 0 to 20 were calculated, which suggest only minor expression of liquefaction would occur in an SLS event. This is consistent with either TC1 or TC2 land.

#### 7.3.2. Ultimate limit state, ULS

LSN values around 20-30 were calculated for an ULS earthquake. This is consistent with TC2 land.

#### 7.3.3. Actual Damage

We did not observe any visual evidence of liquefaction or lateral spreading across the site in our July 2012 site inspection, although we note that our inspection occurred around 20 months after the September 2010 earthquake, and it is likely that any visual evidence of ground damage across the paddocks, if present, may have been obscured by grass.

There was no obvious ejection of groundwater or sediment across the site in aerial photography taken soon after the September 2010 M7.1 earthquake.

The road surface of Gressons Rd and SH1 were in relatively good condition for their age at our site visit in 2012, and we did not observe any unusual settlement, slumping or heaving of the road surface that may have indicated the occurrence of shallow liquefaction.

### 7.4. Lateral spreading

The Waikuku Stream is located around 150m north of the site. The topography of the site is flat, and there are no steep slopes or banks across the site or surrounding area. Therefore, lateral spreading in an SLS event is not likely to affect the future subdivision.

While there is an open drain along the south boundary of the site, the risk of lateral stretch to nearby building platform can be addressed by adopting TC2- type foundation systems that are designed with sufficient tensile capacity to avoid rupture if lateral spread ever occurred.

<sup>7</sup> Tonkin & Taylor's (T&T) report 'Liquefaction Vulnerability Study', February 2013, T&T Ref: 52020.0200/v1.0

## 8. Natural Hazards

### 8.1. Falling debris

The site is flat, and not close to any steep slopes, and is therefore not at risk of falling debris due to rock fall/roll.

### 8.2. Landsliding

The site is flat, and not close to any steep slopes, and therefore is not at risk of land damage due to landsliding.

### 8.3. Tsunami

The site is **not** located within a Canterbury Tsunami Evacuation Zone<sup>8</sup> *“No zone: Tsunami flooding is not expected, even in a very large tsunami”*.

### 8.4. Earthquake rupture

We have searched GNS's Active Faults database<sup>9</sup> to determine the presence of any known active faults in the general locality. The Loburn Fault is located approximately 4.5km northwest of the site. Based on available data the site is likely to be located outside the minimum 20m fault avoidance zone recommended by the Ministry for the Environment<sup>10</sup>.

While the site is not affected by active faulting, it is important to acknowledge that New Zealand is a seismically active country.

These risks are considered by various New Zealand standards, the New Zealand Building Code, various Ministry guidelines, and the Council's design standards. Providing design and construction work is undertaken in accordance with the appropriate standards and guidelines then the risk to life and property can be kept to an acceptable low level.

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<sup>8</sup> <https://ecan.maps.arcgis.com/apps/Minimalist/index.html?appid=591062afb6b542abb247cc8d15a64855>

<sup>9</sup> <https://data.gns.cri.nz/af/>

<sup>10</sup> Planning for Development of Land on or Close to Active Faults: A Guideline to Assist Resource Management Planners in New Zealand (Published July 2003).

## 8.5. Inundation from the Ashley River

There are no topographical features that concentrate stormwater onto the site.

The 'Waimakariri District flood planning hazard management strategy Ashley River floodplain'<sup>11</sup> indicates that the site is not at risk at from the Ashley River Floodplain for a 0.5% AEP (200 year return period) event.

The Waimakariri District Natural Hazards Interactive viewer shows the site is generally at very low risk of flooding for the 1 in 200 year return period. Parts of the southeast corners of the site are at low to medium risk.

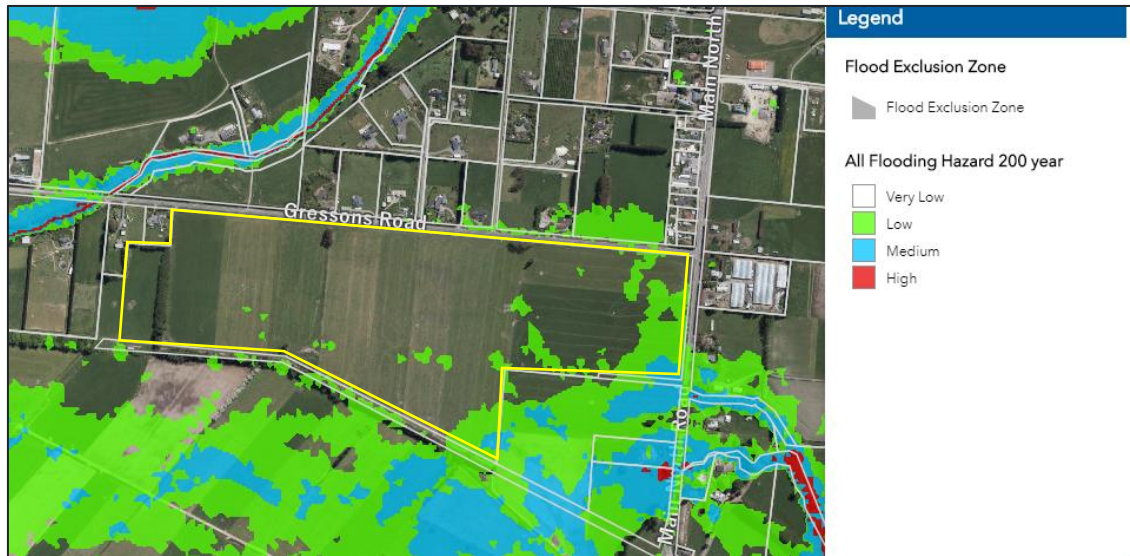


Figure 3 Waimakariri District Natural Hazards Interactive Viewer, retrieved Nov 2020.

## 8.6. Erosion

The site is flat, and there are no large watercourses or rivers close to the site. There is a small watercourse along the southern boundary, however this does not carry large flows of stormwater. Therefore, the site is not likely to be subject to erosion. Further, the site is almost entirely located outside of the area of risk of inundation from the Ashley River Floodplain, and therefore erosion is not likely.

## 8.7. Stormwater from developed site

There is no piped stormwater system along Gressons Rd or SH1.

Concentrations of roof and surface stormwater will almost certainly require onsite treatment and attenuation before discharge either to ground or an existing waterway.

We note that subdivision and future residential construction on the lots will tend to increase the rate of stormwater runoff from the site and therefore the stormwater design will need to take into account the risk of inundation to adjacent and downstream property, and provide attenuation before discharge to surface waterways.

<sup>11</sup> Waimakariri District, flood hazard Management Strategy, Ashley River Floodplain Investigation, Report No. R08/23, June 2008, Environment Canterbury.

## **8.8. Subsidence (Liquefaction)**

Geotechnical testing and analysis indicates the site is at low risk of damage to shallow building foundations in a serviceability limit state event (7.5, 0.13g), and a moderate risk of damage to building foundations in a ultimate limit state event (M7.5, 0.35g). Refer to Section 7: Liquefaction Assessment.

Based on the calculated index settlements and LSN values, with ground water at 1 m bgl, we conclude the site should be considered equivalent to TC2.

## **9. Requirements for Residential Foundations**

Based on our site assessment and review of geotechnical information for the site, future residential buildings located over undisturbed natural ground are likely to require TC2 foundations. Site-specific geotechnical investigation, assessment and foundation design will be required as part of the normal building consent requirements once the nature and location of the proposed buildings has been established.

## **10. Conclusions**

Eliot Sinclair has completed a geotechnical desktop investigation, liquefaction analysis and review of relevant geotechnical, topographic data and Council records that relate to the site and wider area.

While further assessment and consideration will need to be given to inundation and the need for site specific foundation requirements for buildings. This will be part of the standard geotechnical requirements, including Section 106 of the RMA, for future subdivision consents. There are no significant geotechnical constraints that would prevent the re-zoning of the land.

In summary, in accordance with the recommendations set out in this report, we consider the site is geotechnically suitable for residential development.

## Appendix A. Aerial Photo

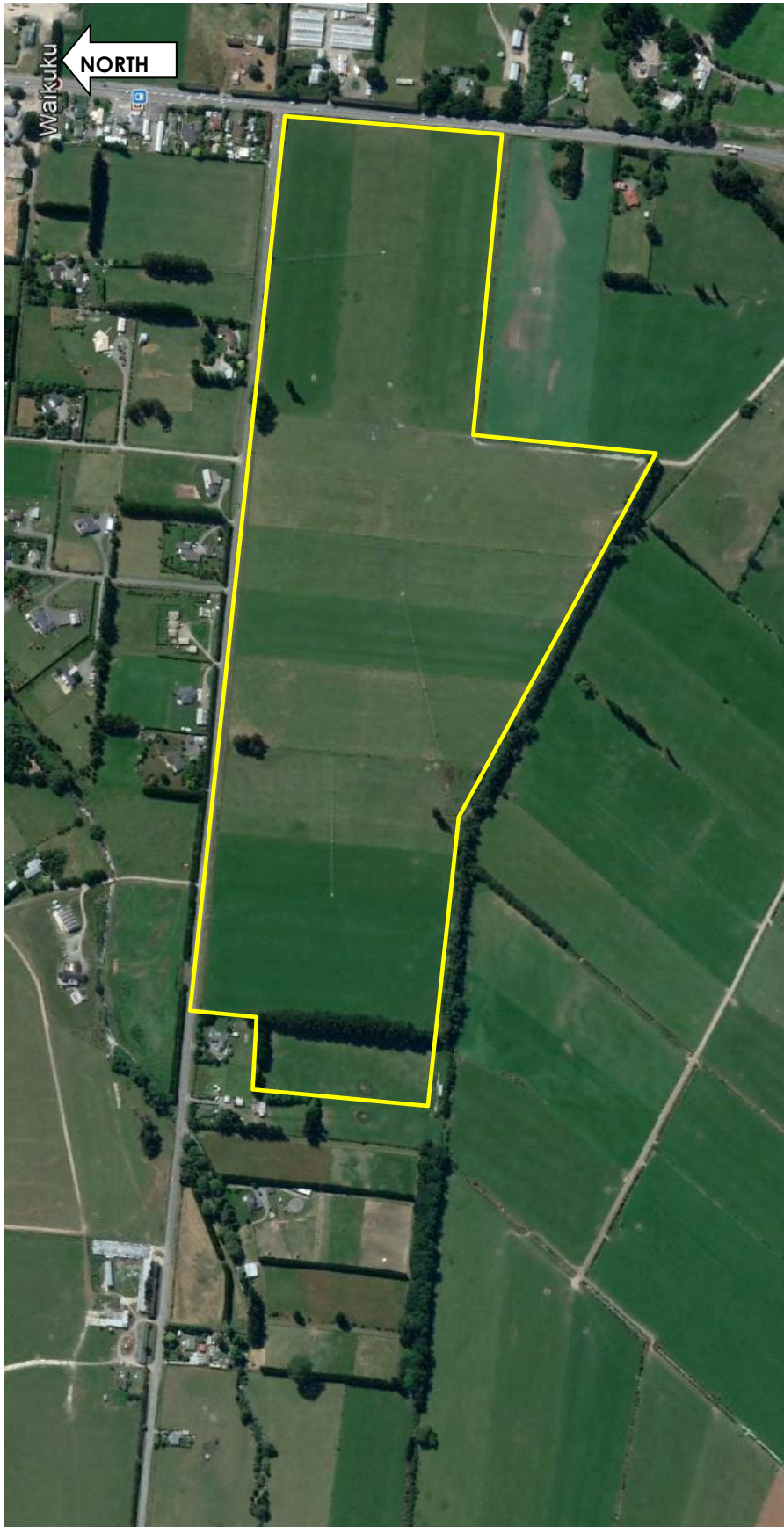
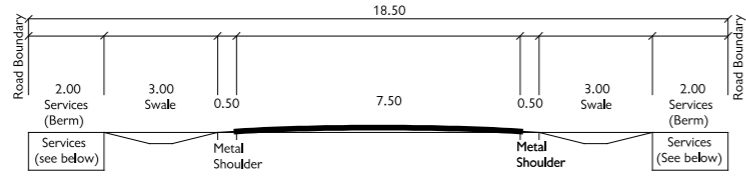


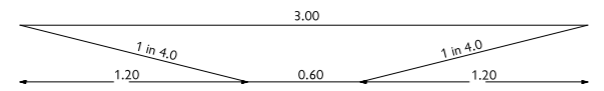
Photo 1: Aerial Photo of site and surrounding land (source: Google Earth, Image January 2019)



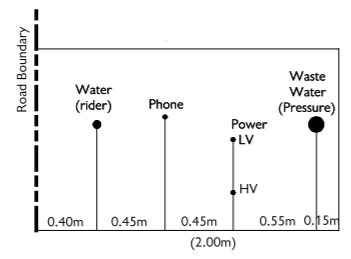
## Appendix B. Proposed Scheme Plan



TYPICAL ROAD CROSS SECTION  
Scale 1:100



TYPICAL SWALE CROSS SECTION  
Scale 1:20



SERVICES LOCATION  
Scale 1:5

NOTES  
All roads are 18.50 metres wide.  
Piped Stormwater Easements are 2 metres wide unless shown otherwise

no.	amendment	initial	date	designed	checked	surveyed	origin of levels	Projection NZGD 2000	Scale: 1:2000 (A1) 1:4000(A3)	Drawing Set	Sheet
A	Lot 61 added - pedestrian access, swale moved across, note re land in LT 470921	rsg	25.6.14	manager	checked	Bob Greening	JA 87	Circuit Mount Pleasant 2000	1:2000 (A1) 1:4000(A3)	350494 C4	1 of 1
B	Road widened to 18.5m and revised Road Cross Section added	rsg	24.7.14	manager	checked	Bruce Sinclair	Pt R S 3101				
C	Stormwater amended - two ponds - Lot 26 and Gressons, Lot 38 removed	rsg	18.8.14	drawn	checked	Bob Greening	RL 6.271				
D	Possible Future Road added to Lot 27	rsg					LINZ Dec 2013				
							datum: Lyttelton 1937 post Dec 2013				
									Date: 20/3/2014		rev D

**Eliot Sinclair**  
surveyors | engineers | planners

www.eliot-sinclair.co.nz

Proposed Subdivision of  
81 Gressons Road and 1375 Main North Road (SH1), Waikuku  
(Lot 1 LT 470921, Lots 1 and 2 DP 428676, Lots 2 and 3 DP 62186 and Lot 2 DP 303387  
for Northside Country

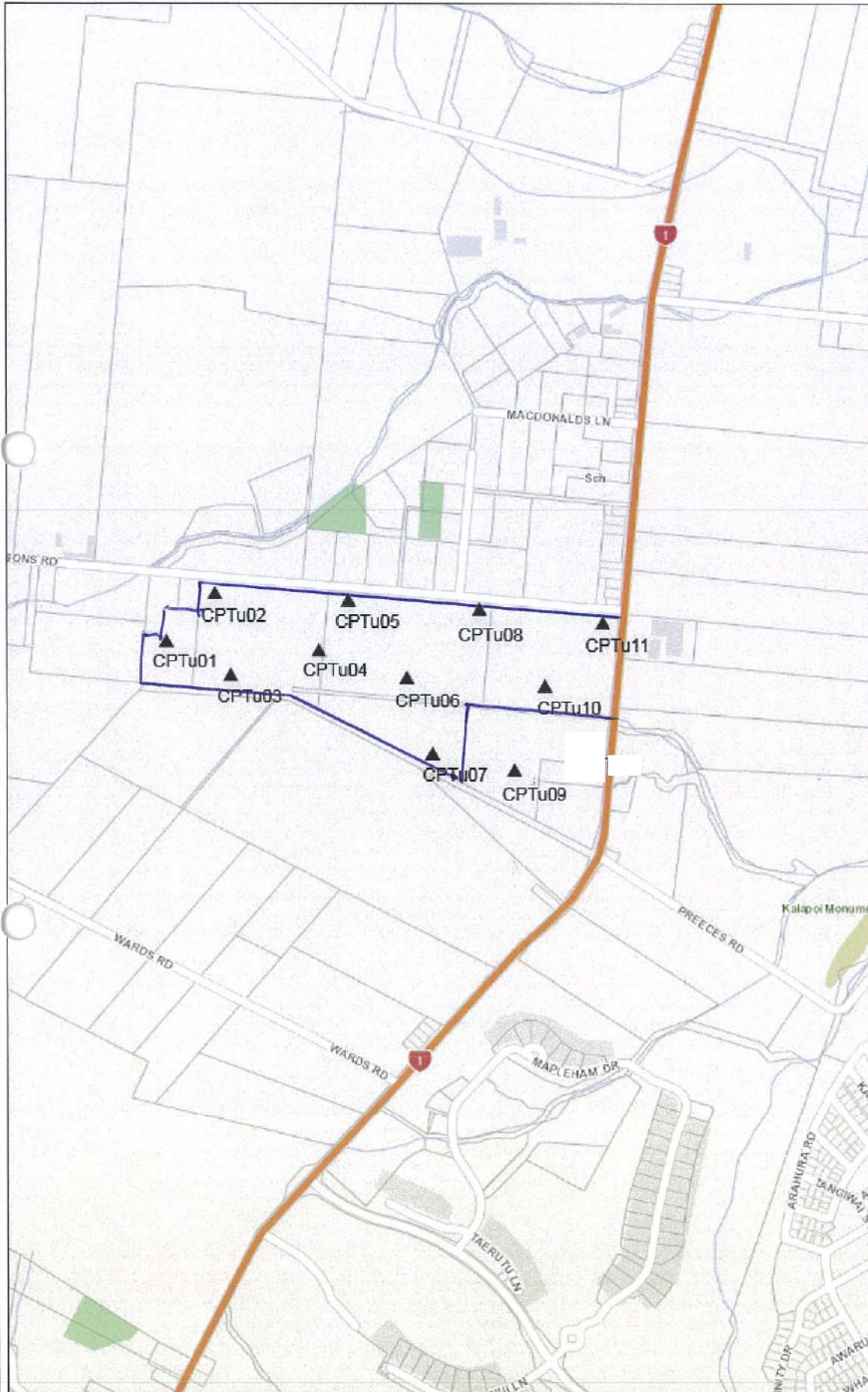
## Appendix C. Topographical Survey



## Appendix D. CPTu Test Location Plan

# CPTu Location Map

Date Printed: 22 June 2012



Legend



This map is a user generated static output from an Internet mapping site and is for reference only. Data layers that appear on this map may or may not be accurate, current, or otherwise reliable.

**THIS MAP IS NOT TO BE USED FOR NAVIGATION**

SCALE 1: 14,189

0.4 0 0.4 Miles

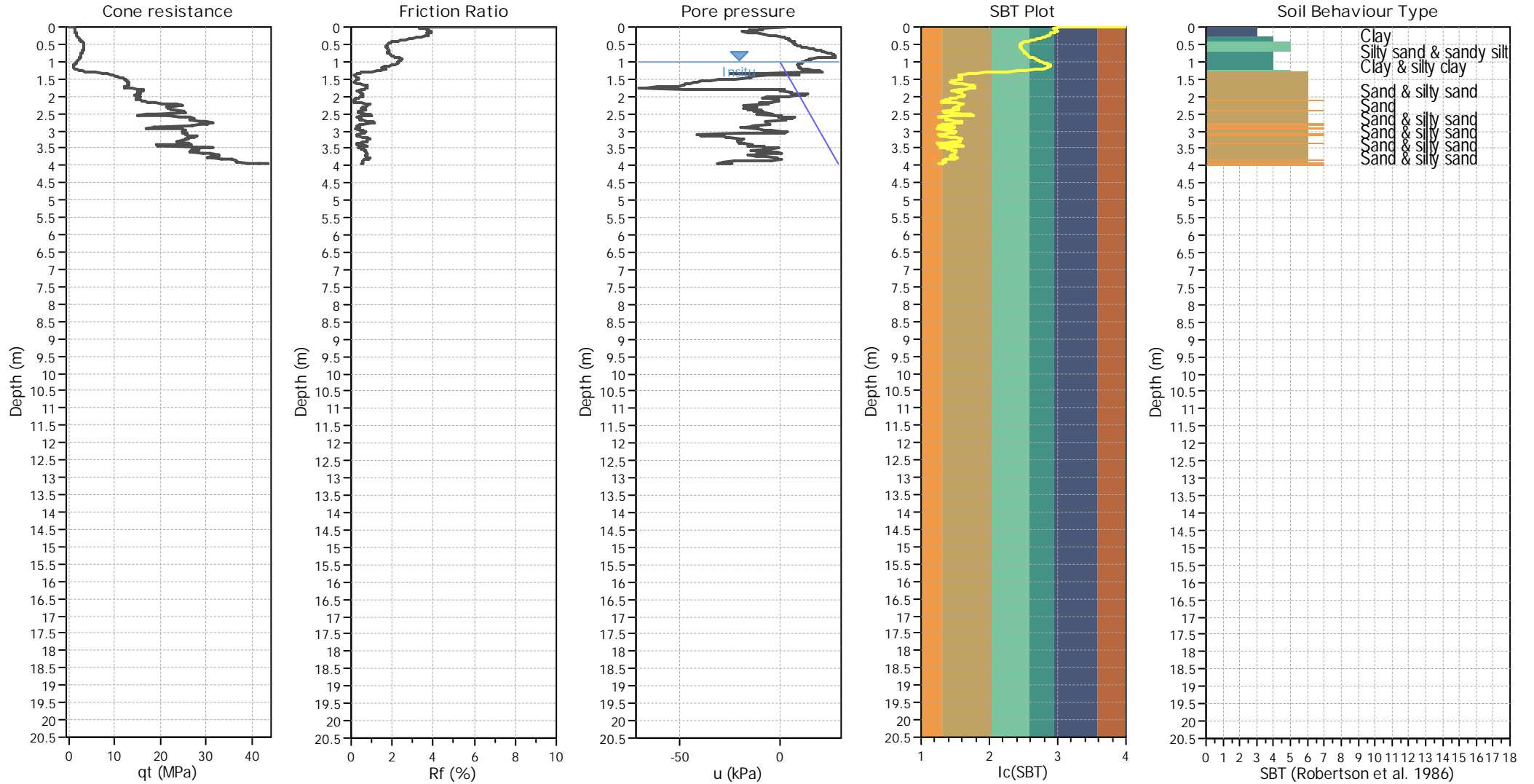
Projection: NZGD\_2000\_New\_Zealand\_Transverse\_Mercator

New Zealand Government

## Appendix E. CPTu Test Results

CPT basic Interpretation Plots

### CPT basic interpretation plots



#### Input parameters and analysis data

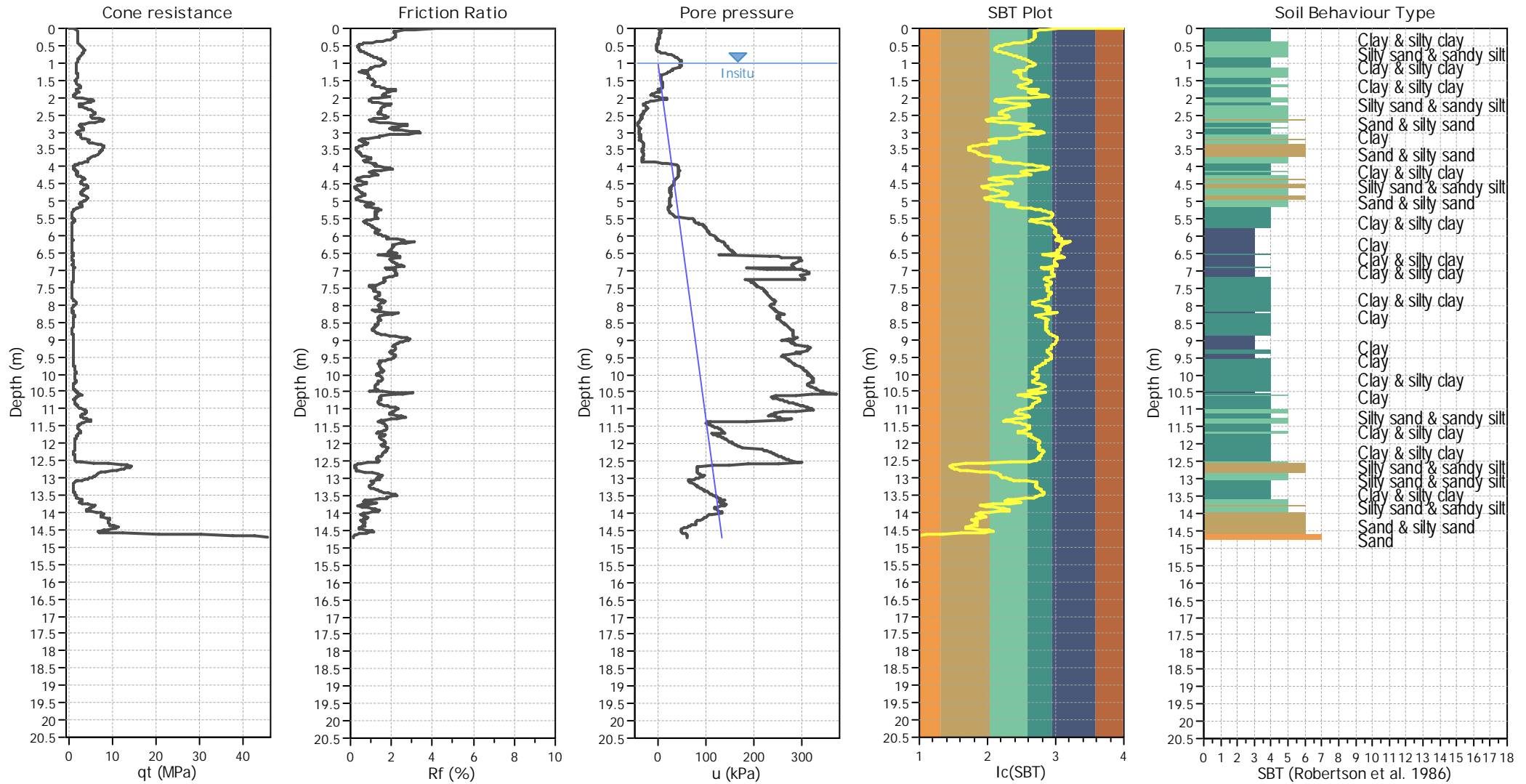
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Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_g$ applied:	Yes
Earthquake magnitude $M_w$ :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.00 m	Fill height:	N/A	Limit depth:	10.00 m

#### SBT legend

1. Sensitive fine grained	4. Clayey silt to silty	7. Gravely sand to sand
2. Organic material	5. Silty sand to sandy silt	8. Very stiff sand to
3. Clay to silty clay	6. Clean sand to silty sand	9. Very stiff fine grained



### CPT basic interpretation plots



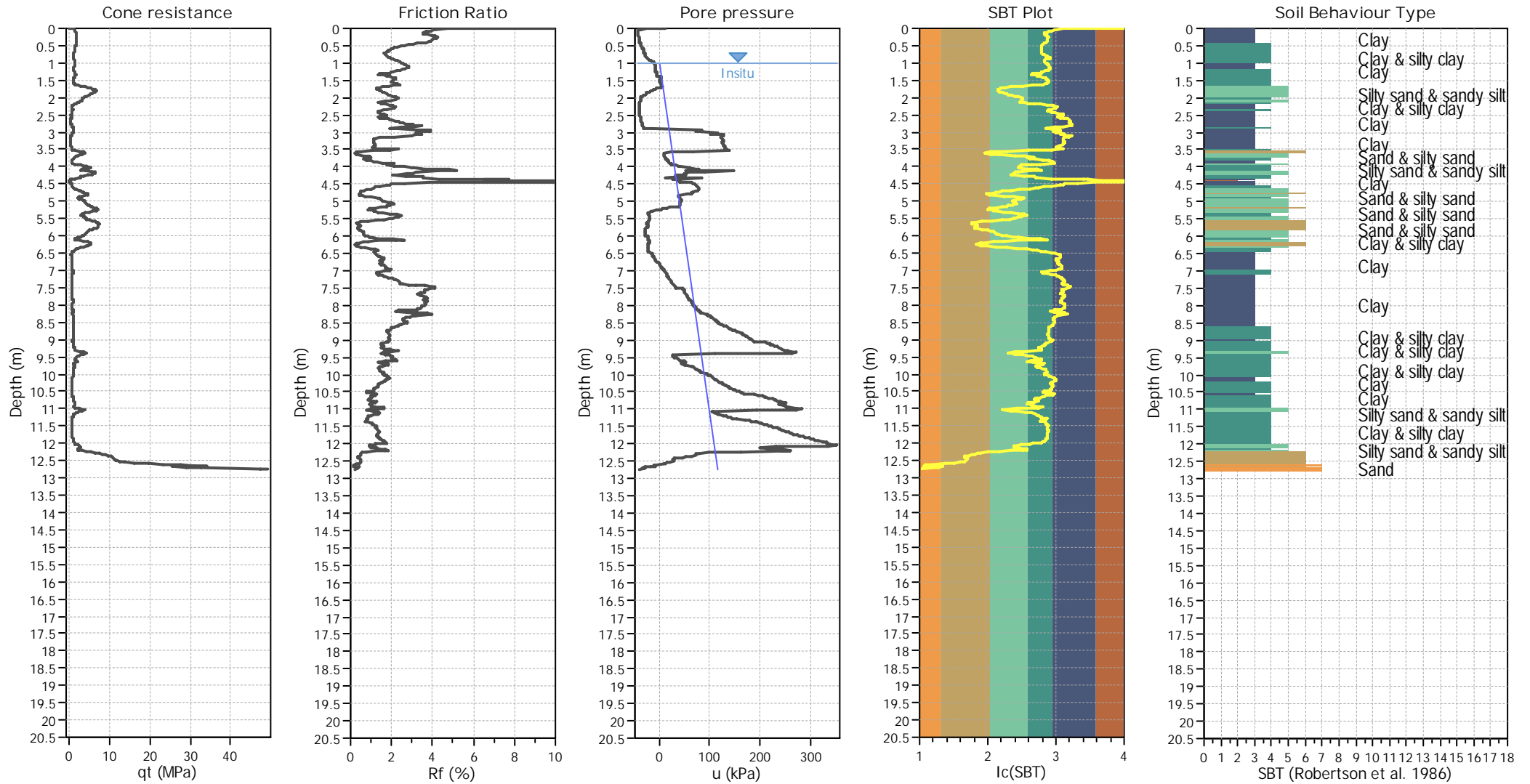
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Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_g$ applied:	Yes
Earthquake magnitude $M_w$ :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
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#### SBT legend

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2. Organic material	5. Silty sand to sandy silt	8. Very stiff sand to
3. Clay to silty clay	6. Clean sand to silty sand	9. Very stiff fine grained

### CPT basic interpretation plots



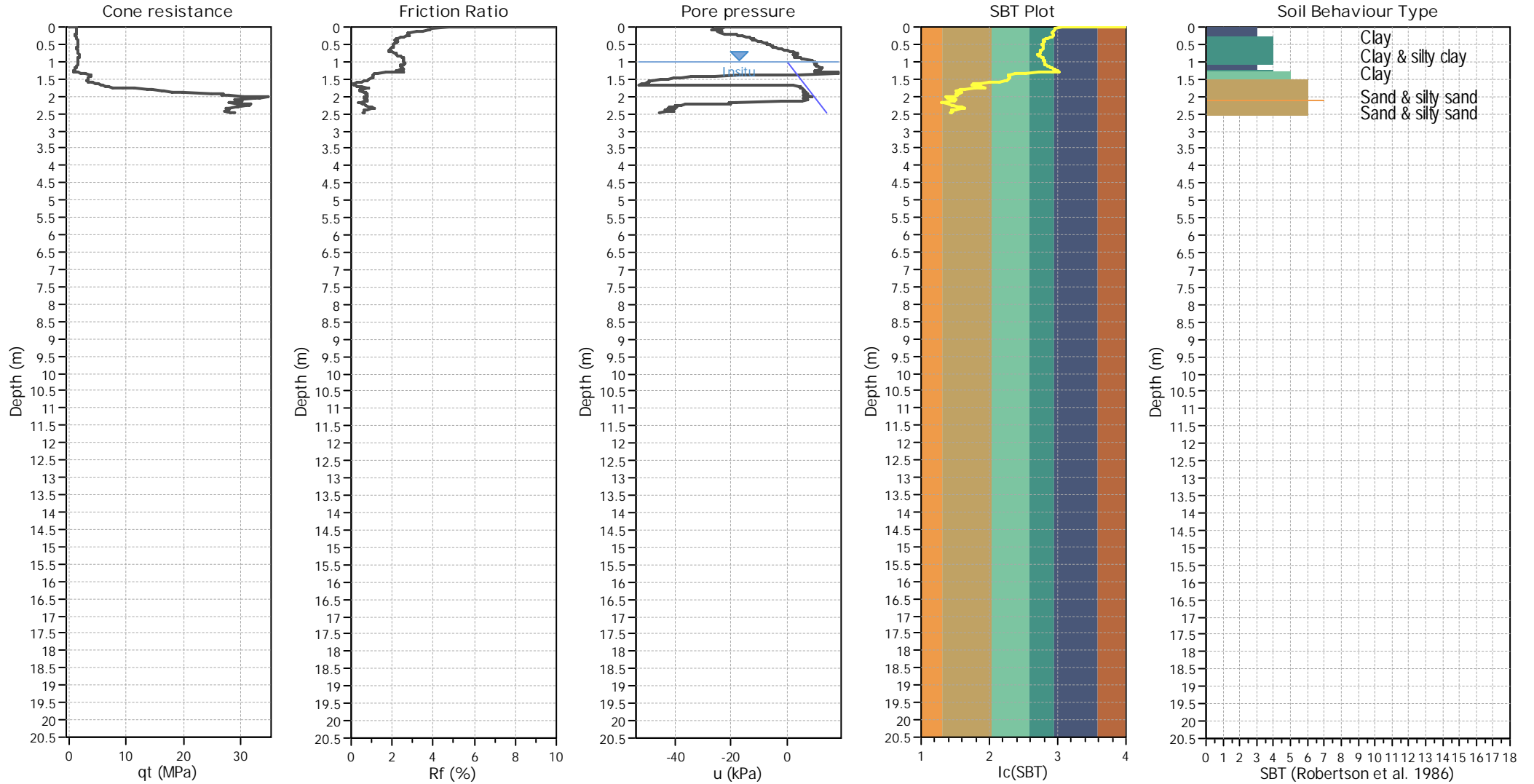
#### Input parameters and analysis data

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Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_0$ applied:	Yes
Earthquake magnitude $M_w$ :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
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#### SBT legend

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2. Organic material	5. Silty sand to sandy silt	8. Very stiff sand to
3. Clay to silty clay	6. Clean sand to silty sand	9. Very stiff fine grained

### CPT basic interpretation plots



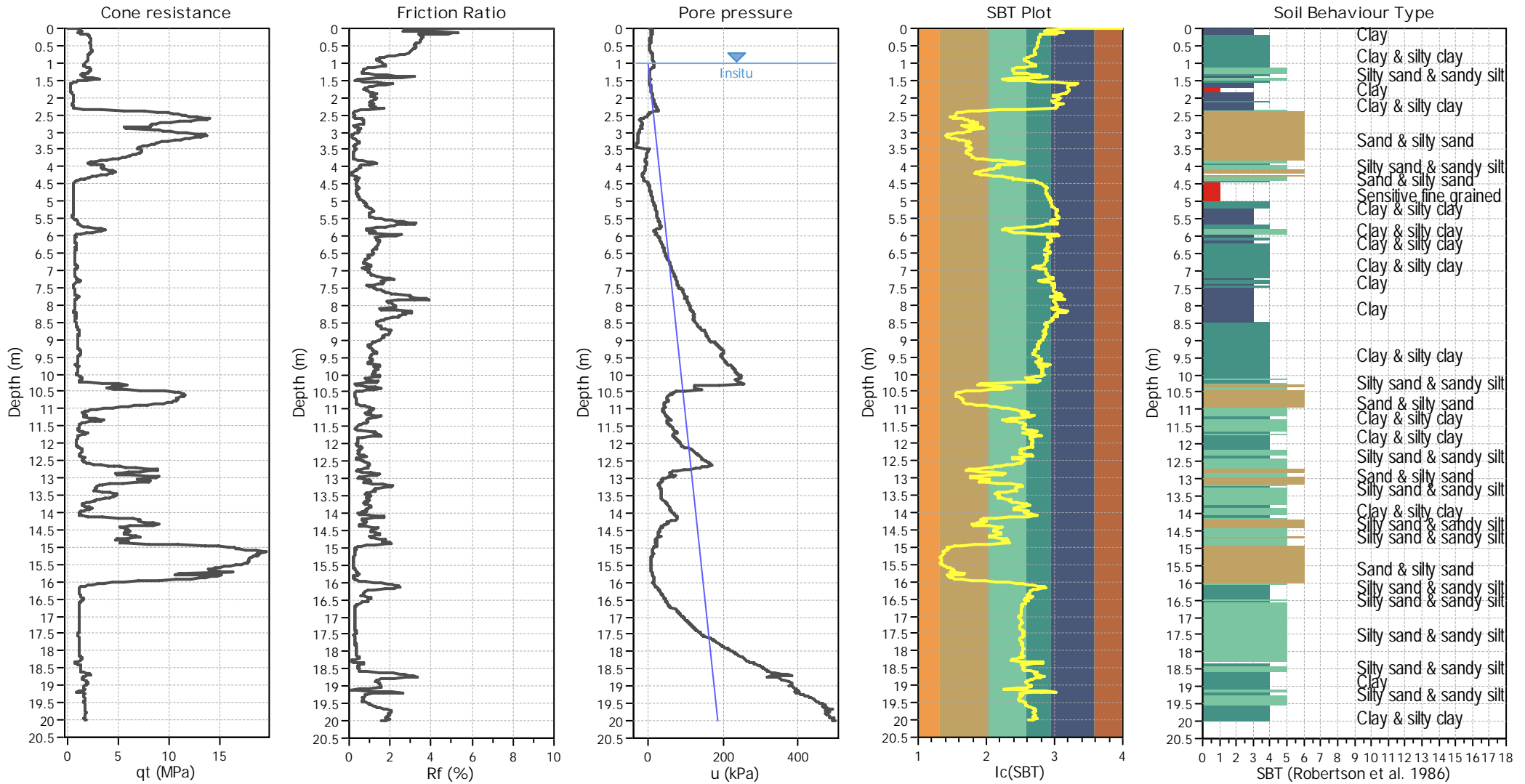
#### Input parameters and analysis data

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Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_0$ applied:	Yes
Earthquake magnitude $M_w$ :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.00 m	Fill height:	N/A	Limit depth:	10.00 m

#### SBT legend

<span style="color: red;">■</span> 1. Sensitive fine grained	<span style="color: teal;">■</span> 4. Clayey silt to silty	<span style="color: orange;">■</span> 7. Gravely sand to sand
<span style="color: brown;">■</span> 2. Organic material	<span style="color: lightgreen;">■</span> 5. Silty sand to sandy silt	<span style="color: grey;">■</span> 8. Very stiff sand to
<span style="color: blue;">■</span> 3. Clay to silty clay	<span style="color: tan;">■</span> 6. Clean sand to silty sand	<span style="color: lightgrey;">■</span> 9. Very stiff fine grained

### CPT basic interpretation plots



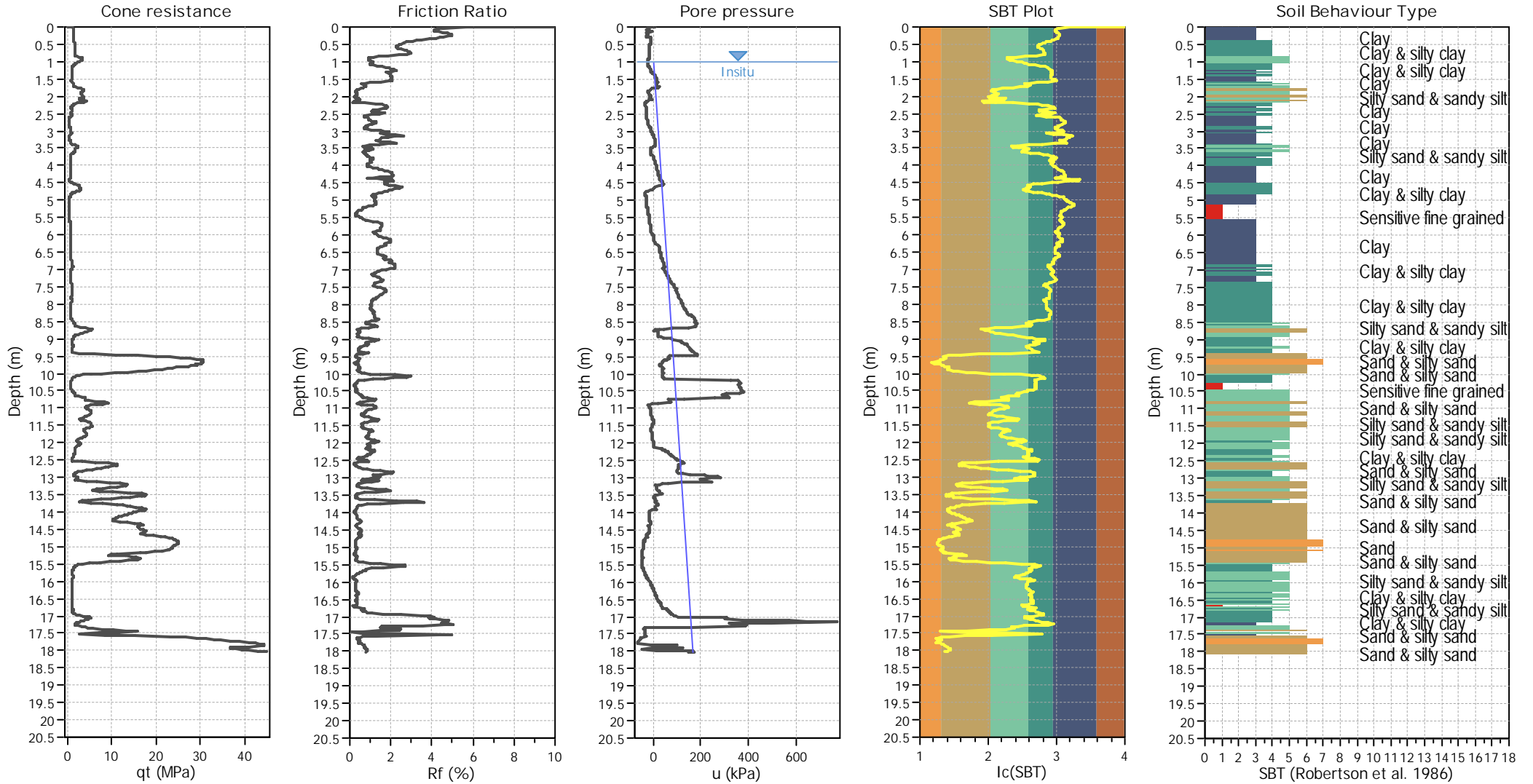
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Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_g$ applied:	Yes
Earthquake magnitude $M_w$ :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
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3. Clay to silty clay	6. Clean sand to silty sand	9. Very stiff fine grained

### CPT basic interpretation plots



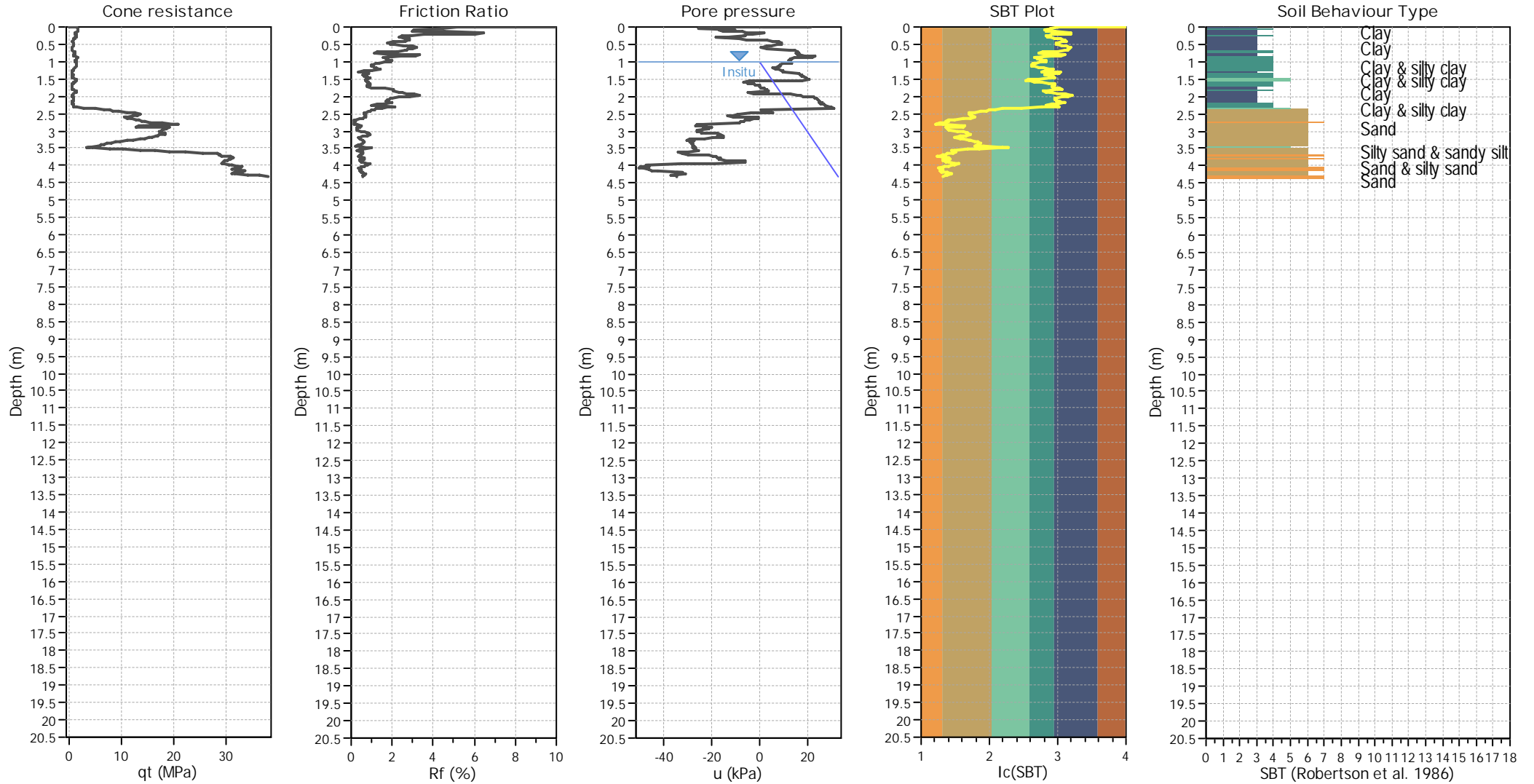
#### Input parameters and analysis data

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Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_q$ applied:	Yes
Earthquake magnitude $M_w$ :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.00 m	Fill height:	N/A	Limit depth:	10.00 m

#### SBT legend

<span style="color: red;">■</span> 1. Sensitive fine grained	<span style="color: teal;">■</span> 4. Clayey silt to silty	<span style="color: orange;">■</span> 7. Gravely sand to sand
<span style="color: brown;">■</span> 2. Organic material	<span style="color: lightgreen;">■</span> 5. Silty sand to sandy silt	<span style="color: grey;">■</span> 8. Very stiff sand to
<span style="color: blue;">■</span> 3. Clay to silty clay	<span style="color: tan;">■</span> 6. Clean sand to silty sand	<span style="color: lightgrey;">■</span> 9. Very stiff fine grained

### CPT basic interpretation plots



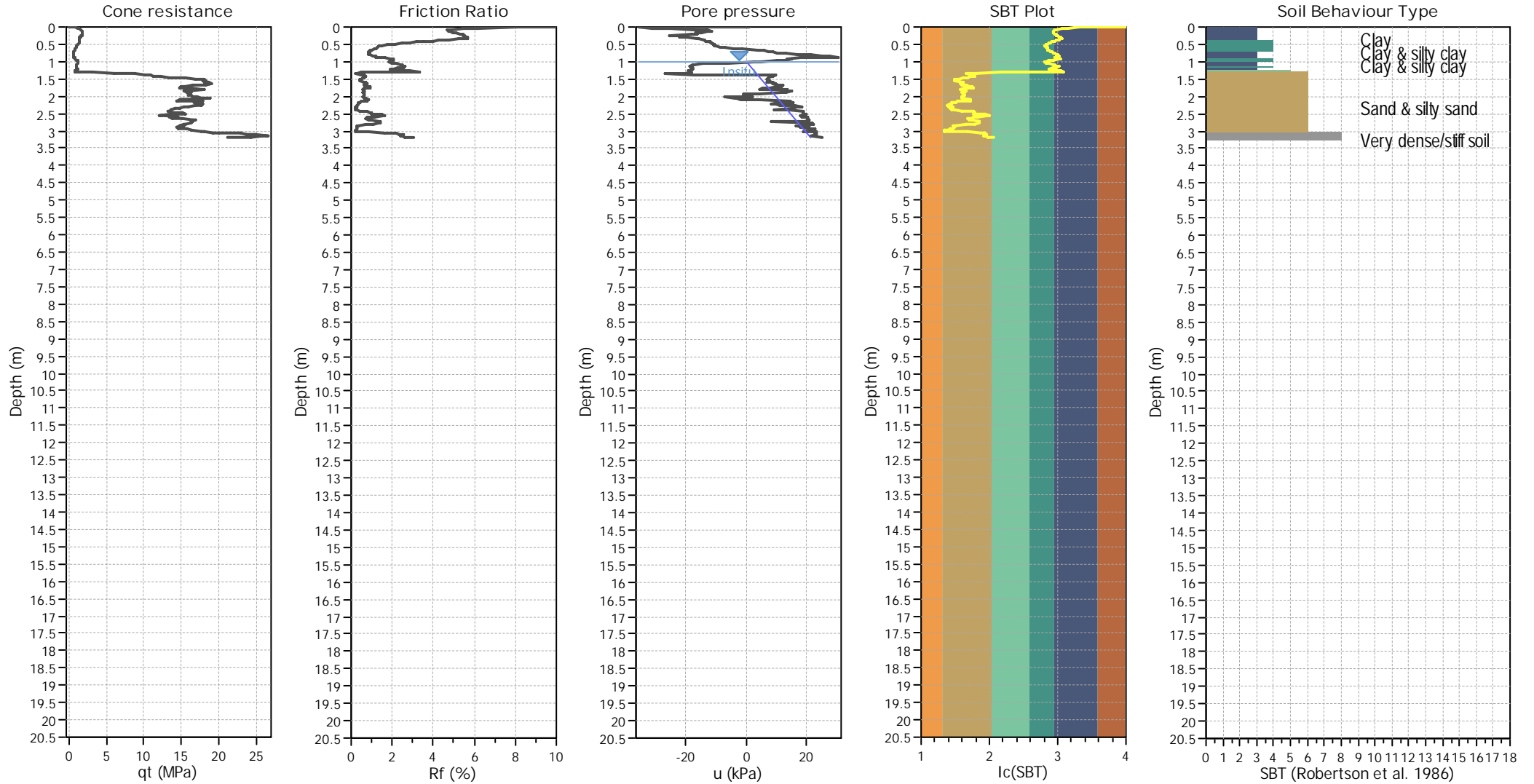
#### Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_g$ applied:	Yes
Earthquake magnitude $M_w$ :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.00 m	Fill height:	N/A	Limit depth:	10.00 m

#### SBT legend

1. Sensitive fine grained	4. Clayey silt to silty	7. Gravely sand to sand
2. Organic material	5. Silty sand to sandy silt	8. Very stiff sand to
3. Clay to silty clay	6. Clean sand to silty sand	9. Very stiff fine grained

### CPT basic interpretation plots



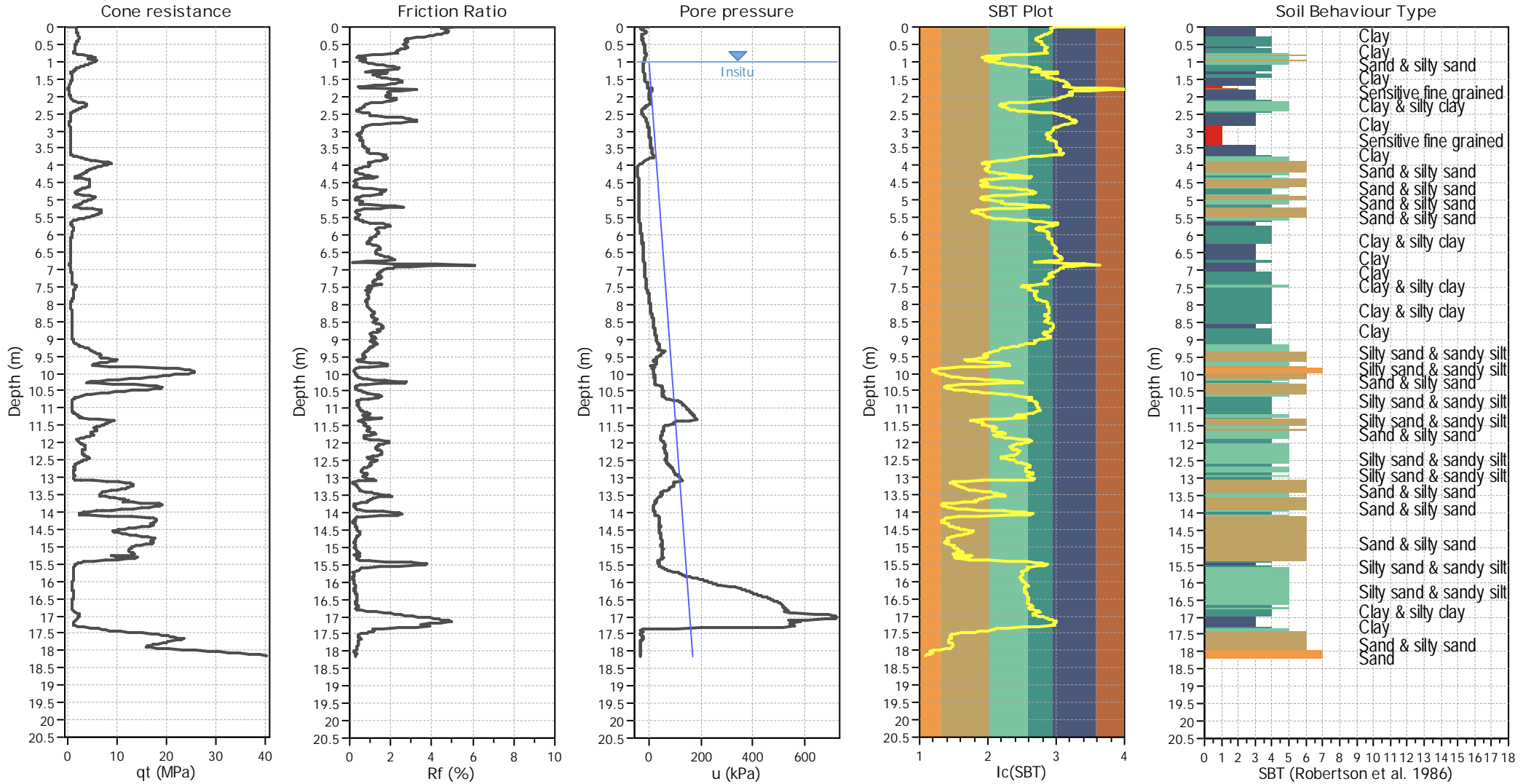
#### Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_g$ applied:	Yes
Earthquake magnitude $M_w$ :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.00 m	Fill height:	N/A	Limit depth:	10.00 m

#### SBT legend

<span style="color: red;">■</span> 1. Sensitive fine grained	<span style="color: teal;">■</span> 4. Clayey silt to silty	<span style="color: orange;">■</span> 7. Gravely sand to sand
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<span style="color: blue;">■</span> 3. Clay to silty clay	<span style="color: tan;">■</span> 6. Clean sand to silty sand	<span style="color: lightgrey;">■</span> 9. Very stiff fine grained

### CPT basic interpretation plots



#### Input parameters and analysis data

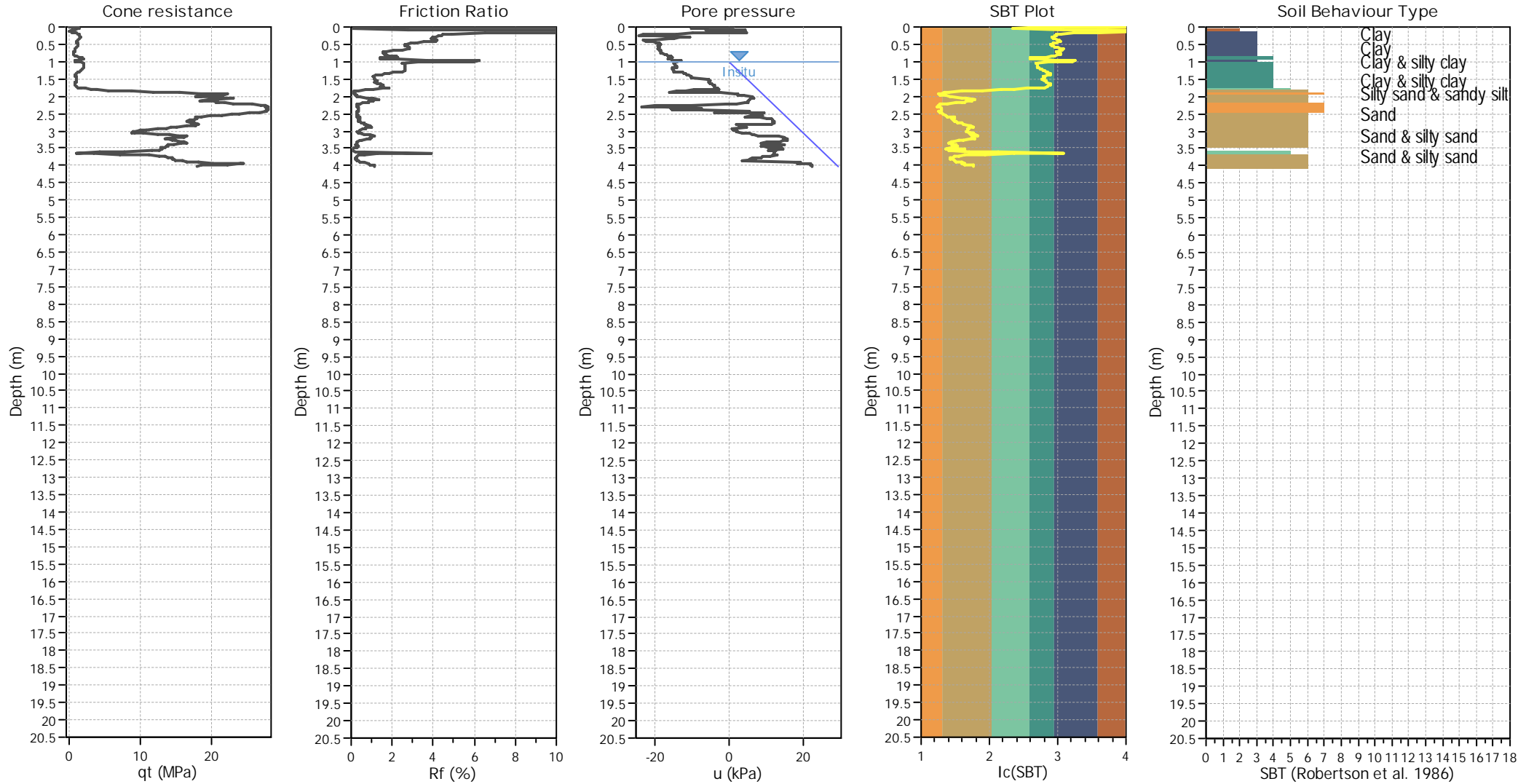
Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K <sub>q</sub> applied:	Yes
Earthquake magnitude M <sub>w</sub> :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.00 m	Fill height:	N/A	Limit depth:	10.00 m

#### SBT legend

1. Sensitive fine grained	4. Clayey silt to silty	7. Gravely sand to sand
2. Organic material	5. Silty sand to sandy silt	8. Very stiff sand to
3. Clay to silty clay	6. Clean sand to silty sand	9. Very stiff fine grained



### CPT basic interpretation plots



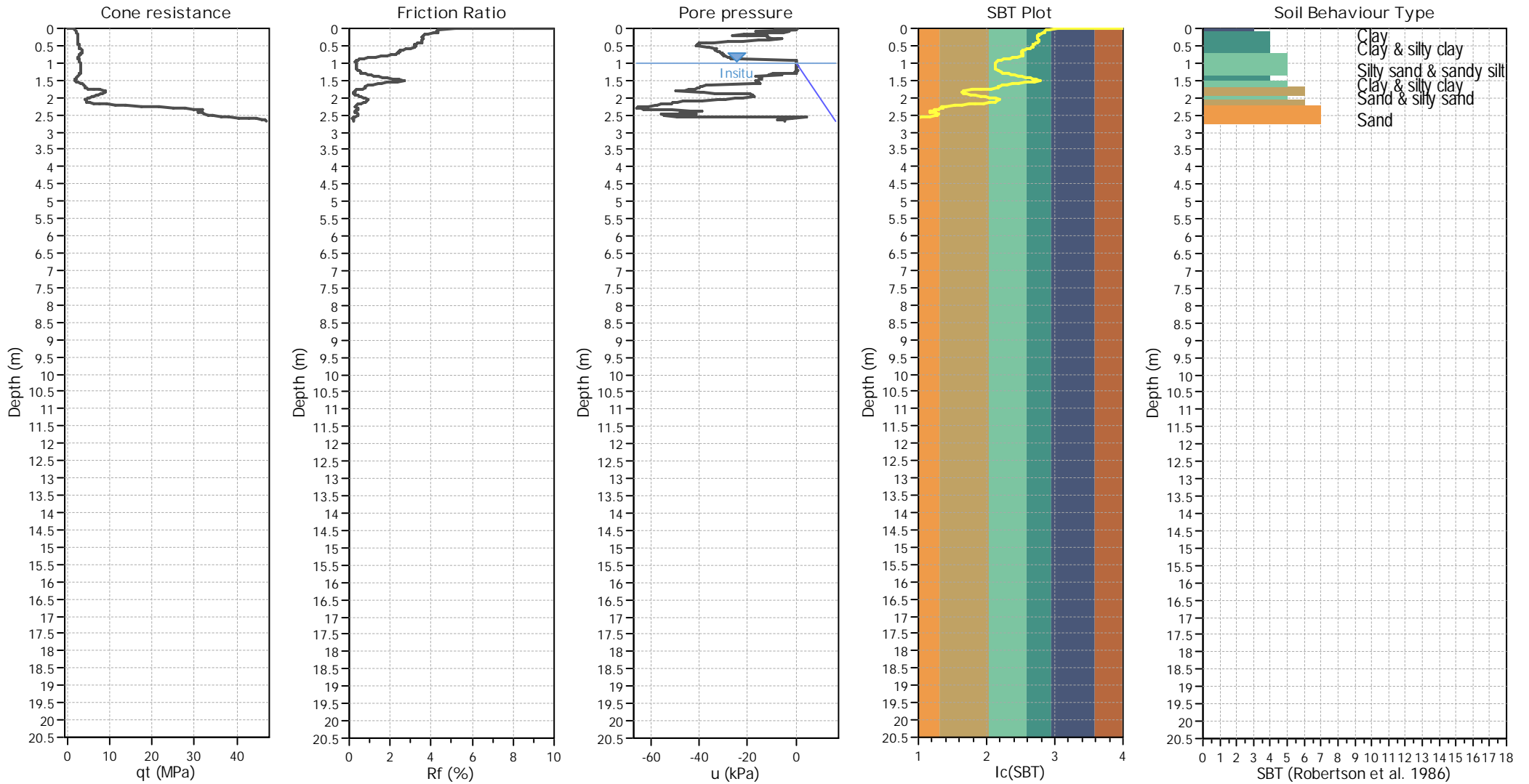
#### Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_g$ applied:	Yes
Earthquake magnitude $M_w$ :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.00 m	Fill height:	N/A	Limit depth:	10.00 m

#### SBT legend

<span style="color: red;">■</span> 1. Sensitive fine grained	<span style="color: teal;">■</span> 4. Clayey silt to silty	<span style="color: orange;">■</span> 7. Gravely sand to sand
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<span style="color: blue;">■</span> 3. Clay to silty clay	<span style="color: tan;">■</span> 6. Clean sand to silty sand	<span style="color: lightgrey;">■</span> 9. Very stiff fine grained

### CPT basic interpretation plots



#### Input parameters and analysis data

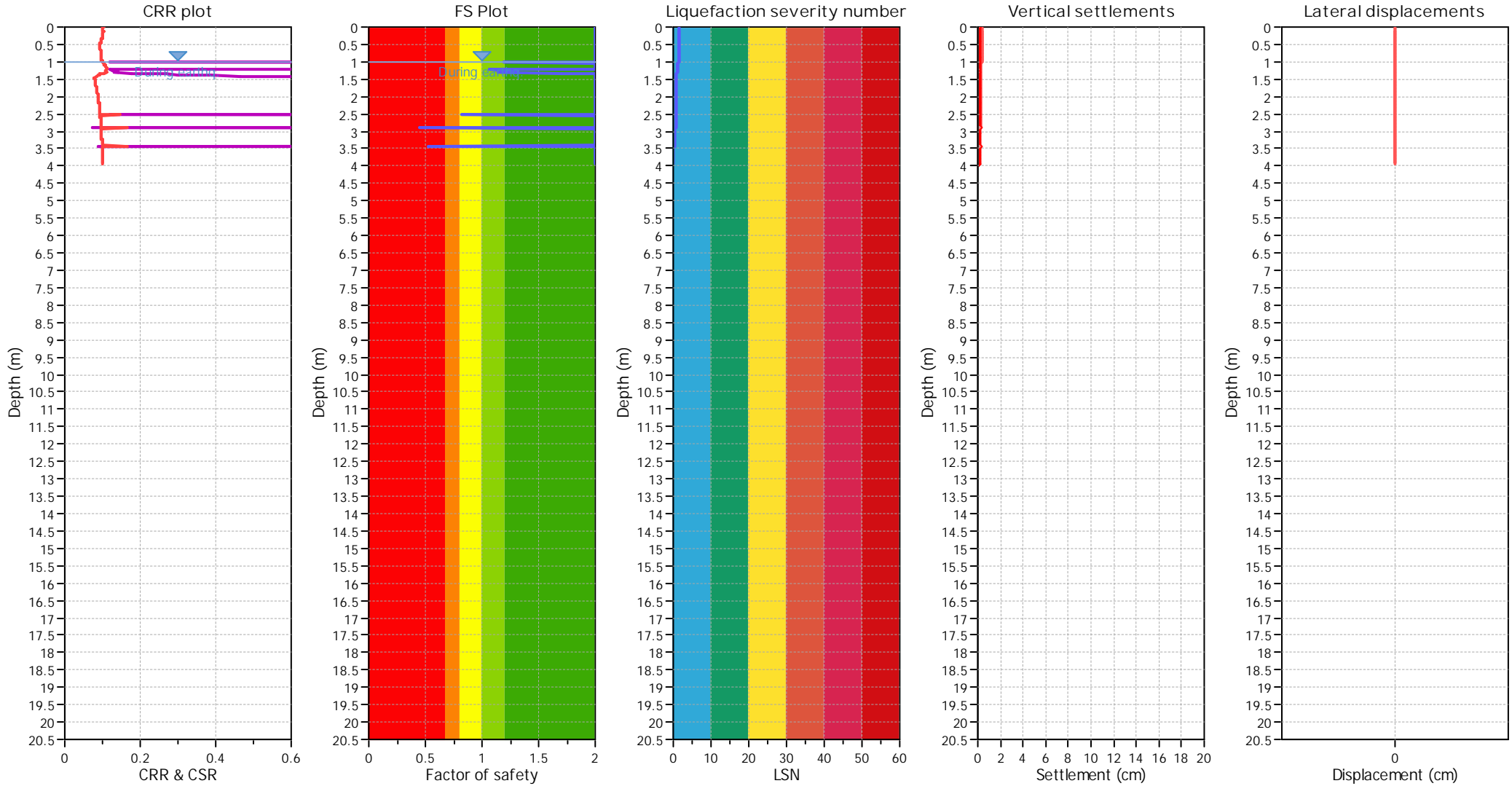
Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_g$ applied:	Yes
Earthquake magnitude $M_w$ :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.00 m	Fill height:	N/A	Limit depth:	10.00 m

#### SBT legend

<span style="color: red;">■</span> 1. Sensitive fine grained	<span style="color: teal;">■</span> 4. Clayey silt to silty	<span style="color: orange;">■</span> 7. Gravely sand to sand
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<span style="color: blue;">■</span> 3. Clay to silty clay	<span style="color: tan;">■</span> 6. Clean sand to silty sand	<span style="color: lightgrey;">■</span> 9. Very stiff fine grained

Liquefaction analysis overall plots SLS1, SLS2, ULS

### Liquefaction analysis overall plots



#### Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_q$ applied:	Yes
Earthquake magnitude $M_w$ :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.00 m	Fill height:	N/A	Limit depth:	10.00 m

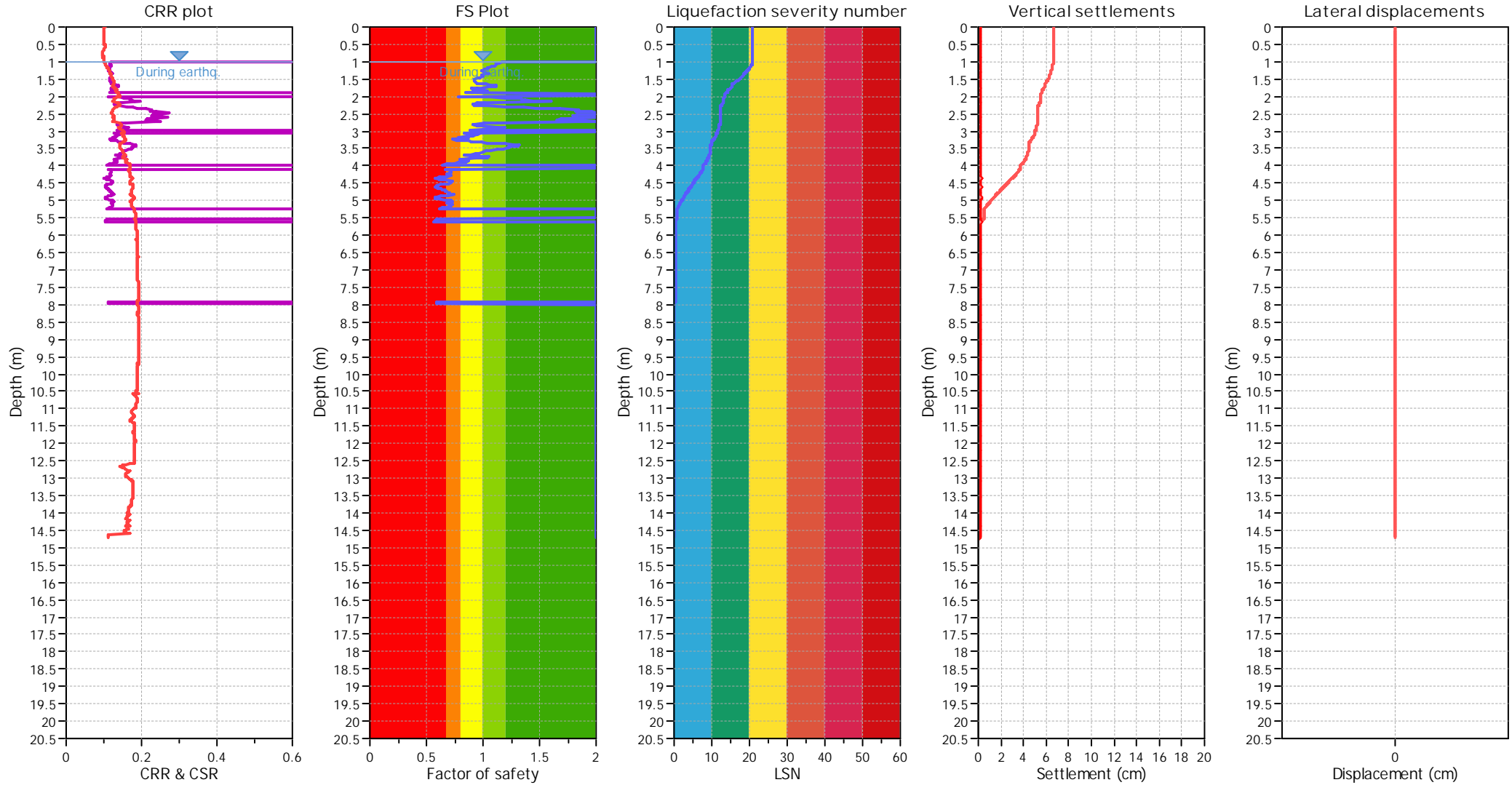
#### F.S. color scheme

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

#### LSN color scheme

- Severe damage
- Major expression of liquefaction
- Moderate to severe exp. of liquefaction
- Moderate expression of liquefaction
- Minor expression of liquefaction
- Little to no expression of liquefaction

### Liquefaction analysis overall plots



#### Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_q$ applied:	Yes
Earthquake magnitude $M_w$ :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.00 m	Fill height:	N/A	Limit depth:	10.00 m

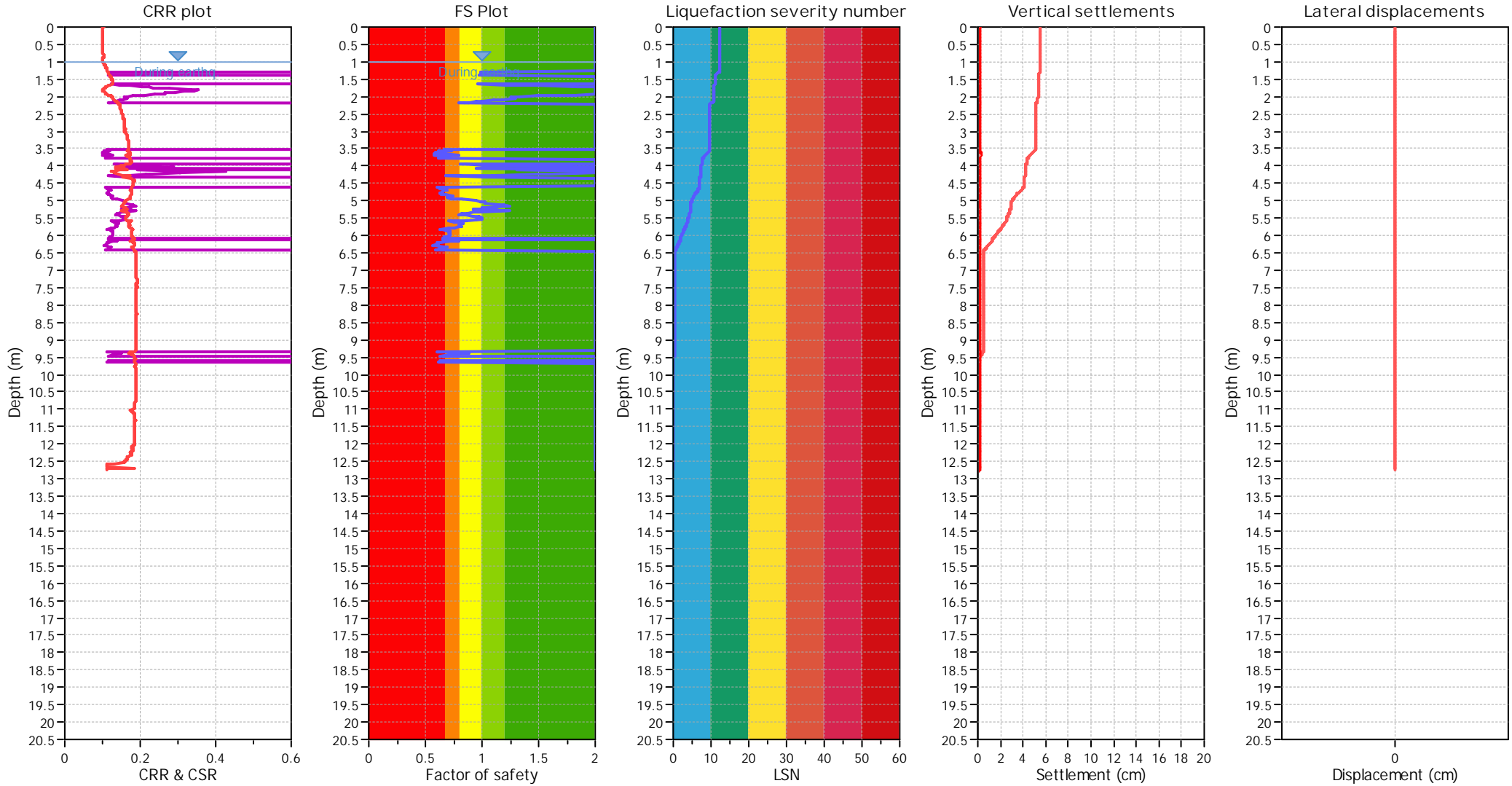
#### F.S. color scheme

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- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

#### LSN color scheme

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### Liquefaction analysis overall plots



#### Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_q$ applied:	Yes
Earthquake magnitude $M_w$ :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.00 m	Fill height:	N/A	Limit depth:	10.00 m

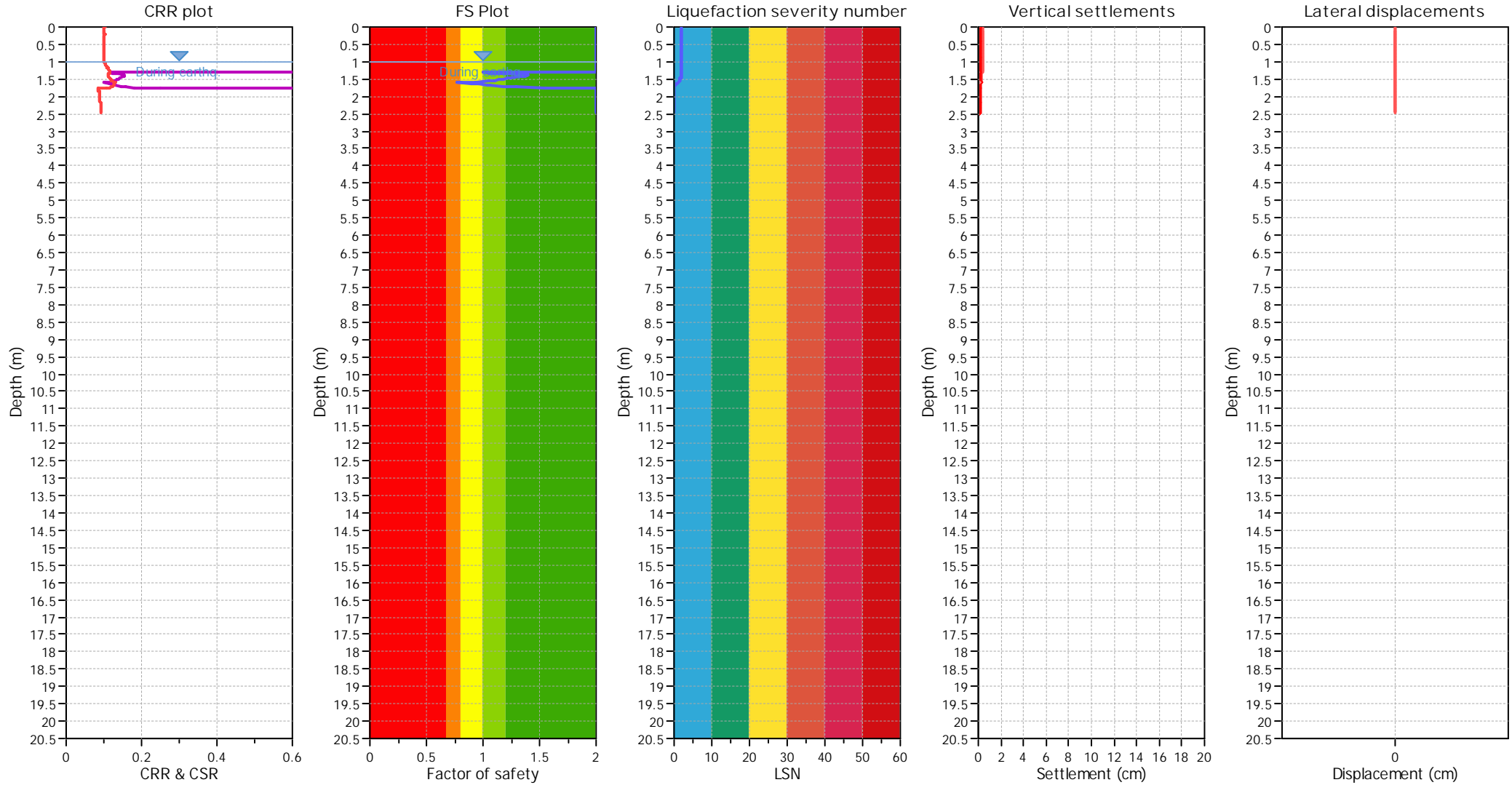
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### Liquefaction analysis overall plots



#### Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_q$ applied:	Yes
Earthquake magnitude $M_w$ :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.00 m	Fill height:	N/A	Limit depth:	10.00 m

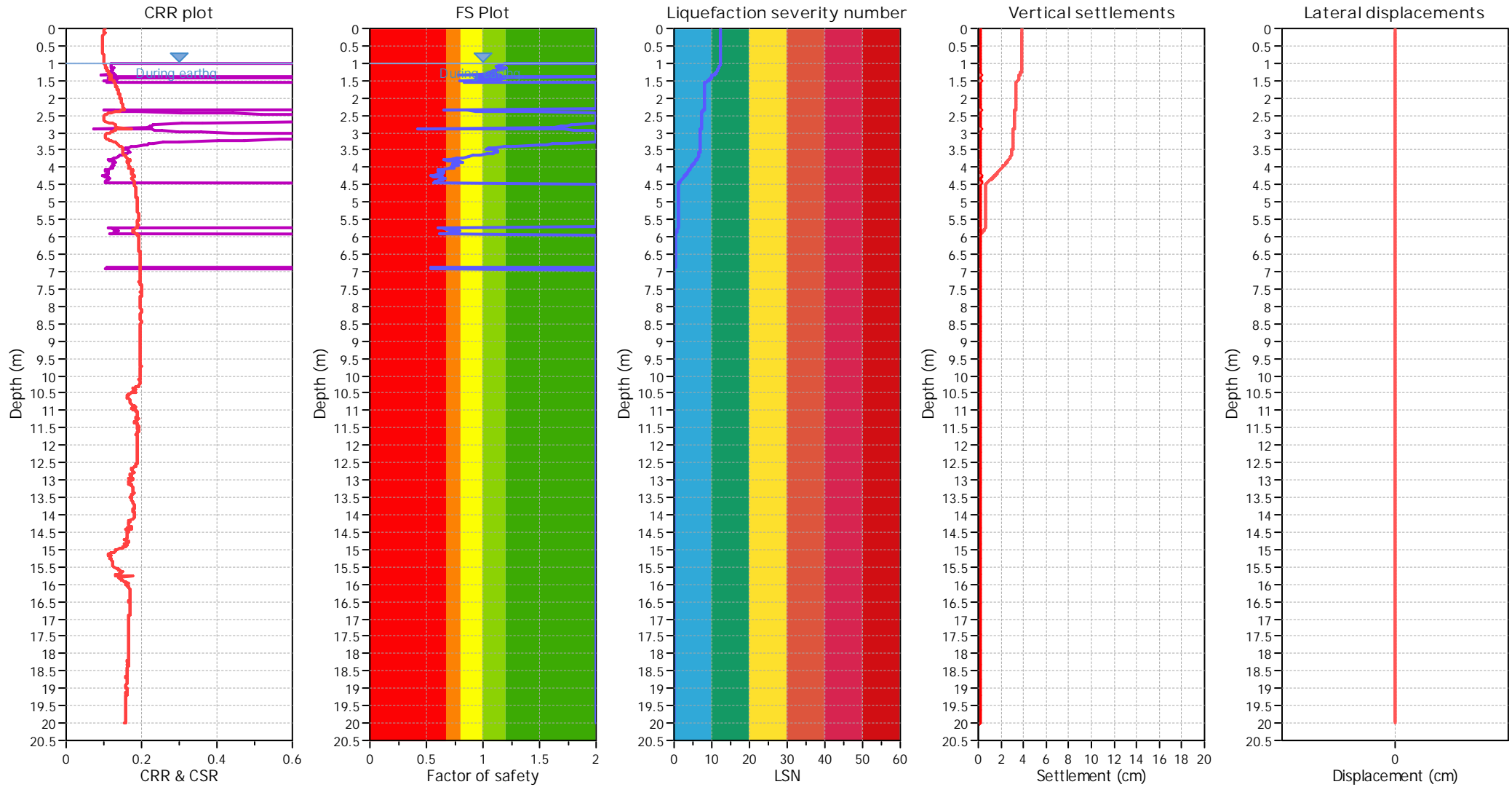
#### F.S. color scheme

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### Liquefaction analysis overall plots



#### Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_d$ applied:	Yes
Earthquake magnitude $M_w$ :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.00 m	Fill height:	N/A	Limit depth:	10.00 m

#### F.S. color scheme

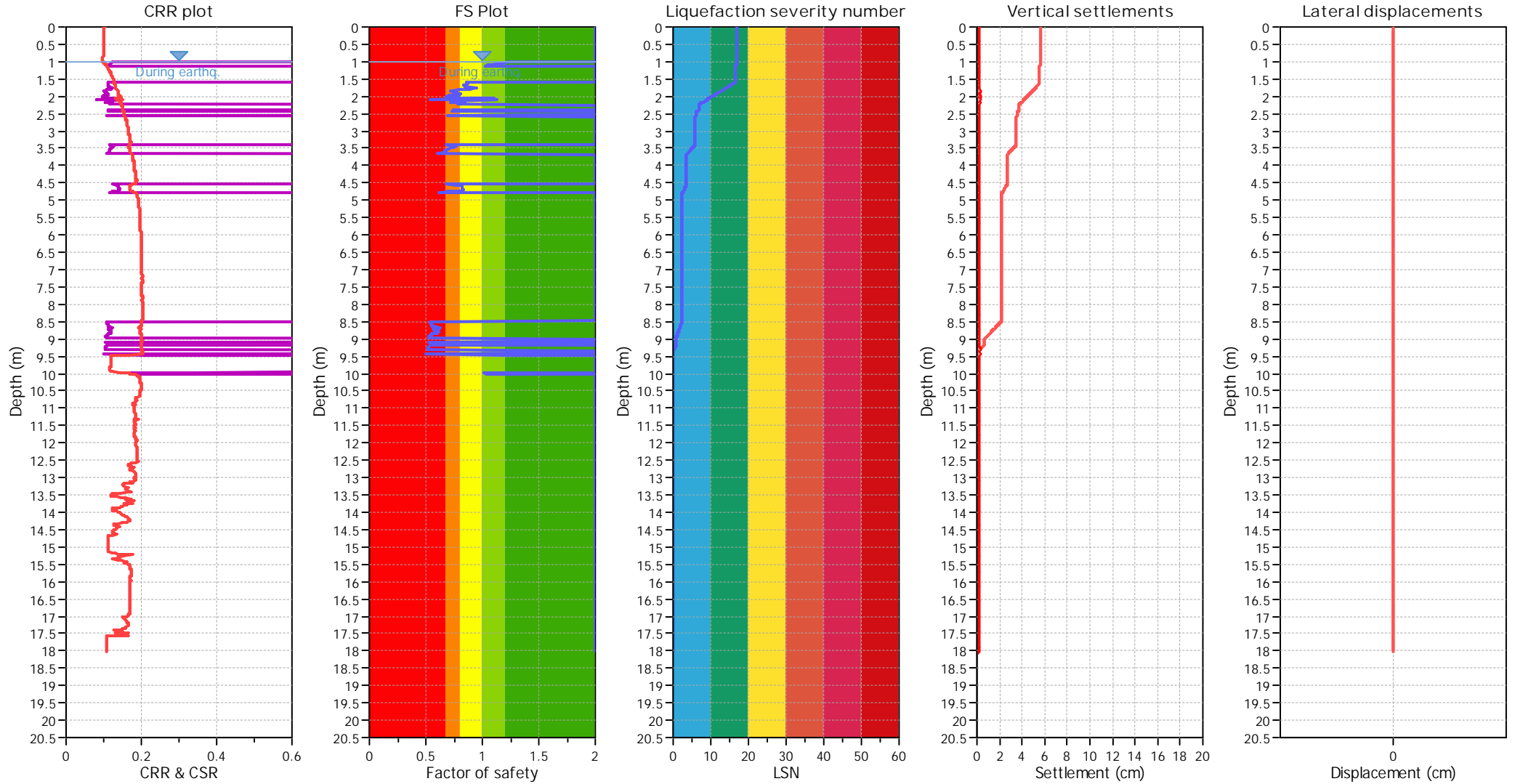
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### Liquefaction analysis overall plots



#### Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (earthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_q$ applied:	Yes
Earthquake magnitude $M_w$ :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.00 m	Fill height:	N/A	Limit depth:	10.00 m

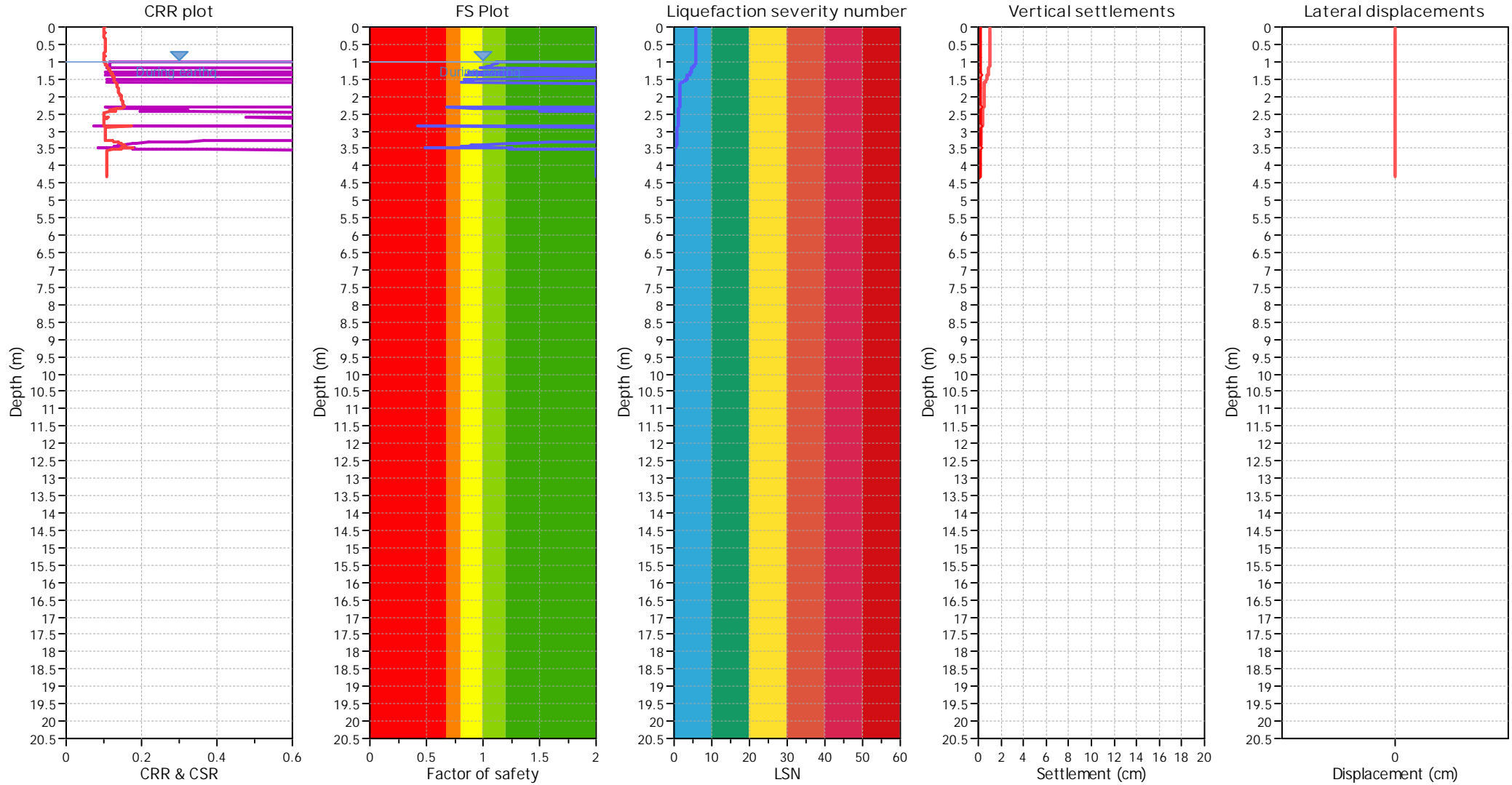
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### Liquefaction analysis overall plots



#### Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on I <sub>c</sub> value	I <sub>c</sub> cut-off value:	2.60	K <sub>σ</sub> applied:	Yes
Earthquake magnitude M <sub>w</sub> :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.00 m	Fill height:	N/A	Limit depth:	10.00 m

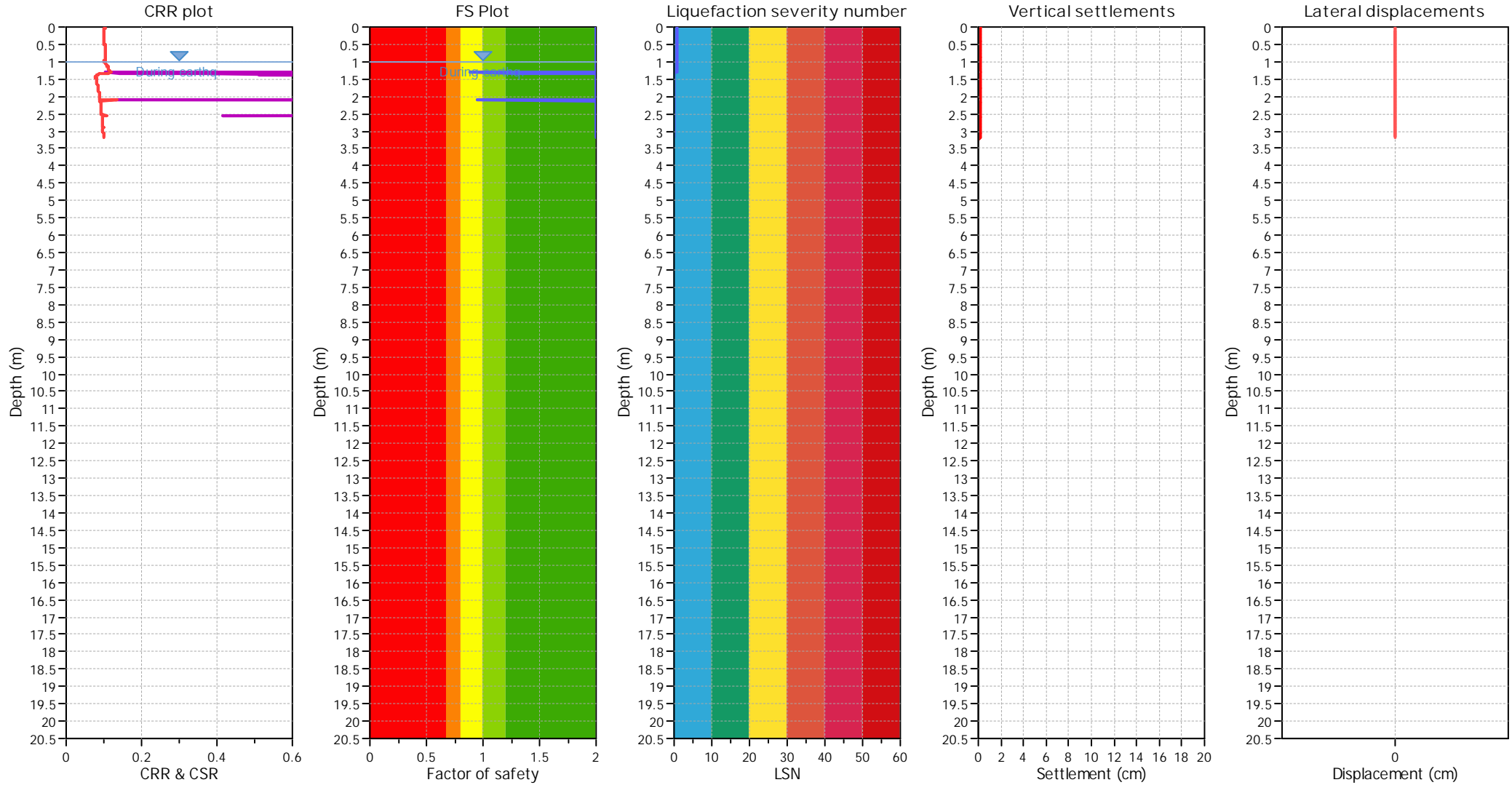
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Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_q$ applied:	Yes
Earthquake magnitude $M_w$ :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.00 m	Fill height:	N/A	Limit depth:	10.00 m

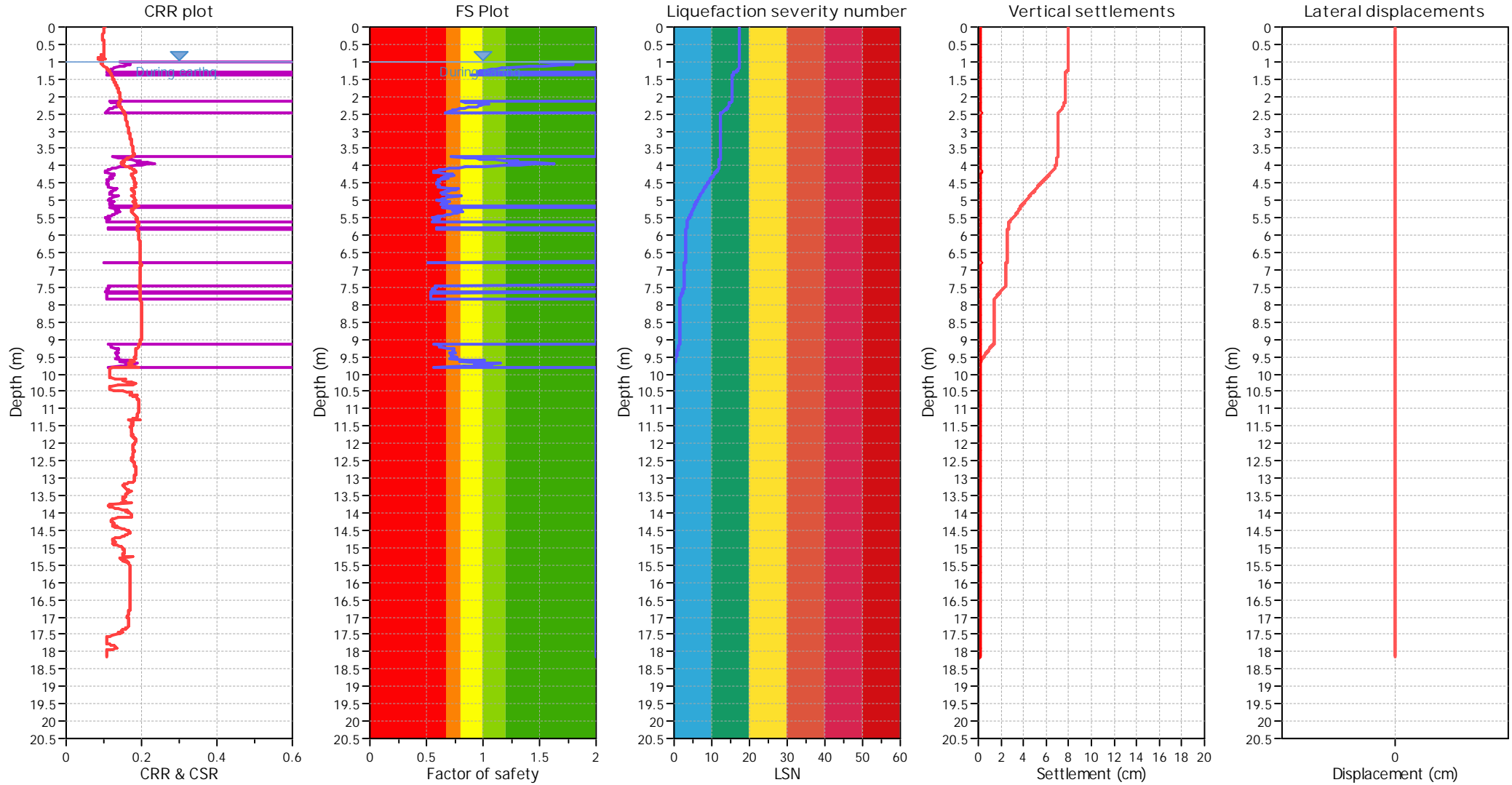
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Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_d$ applied:	Yes
Earthquake magnitude $M_w$ :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.00 m	Fill height:	N/A	Limit depth:	10.00 m

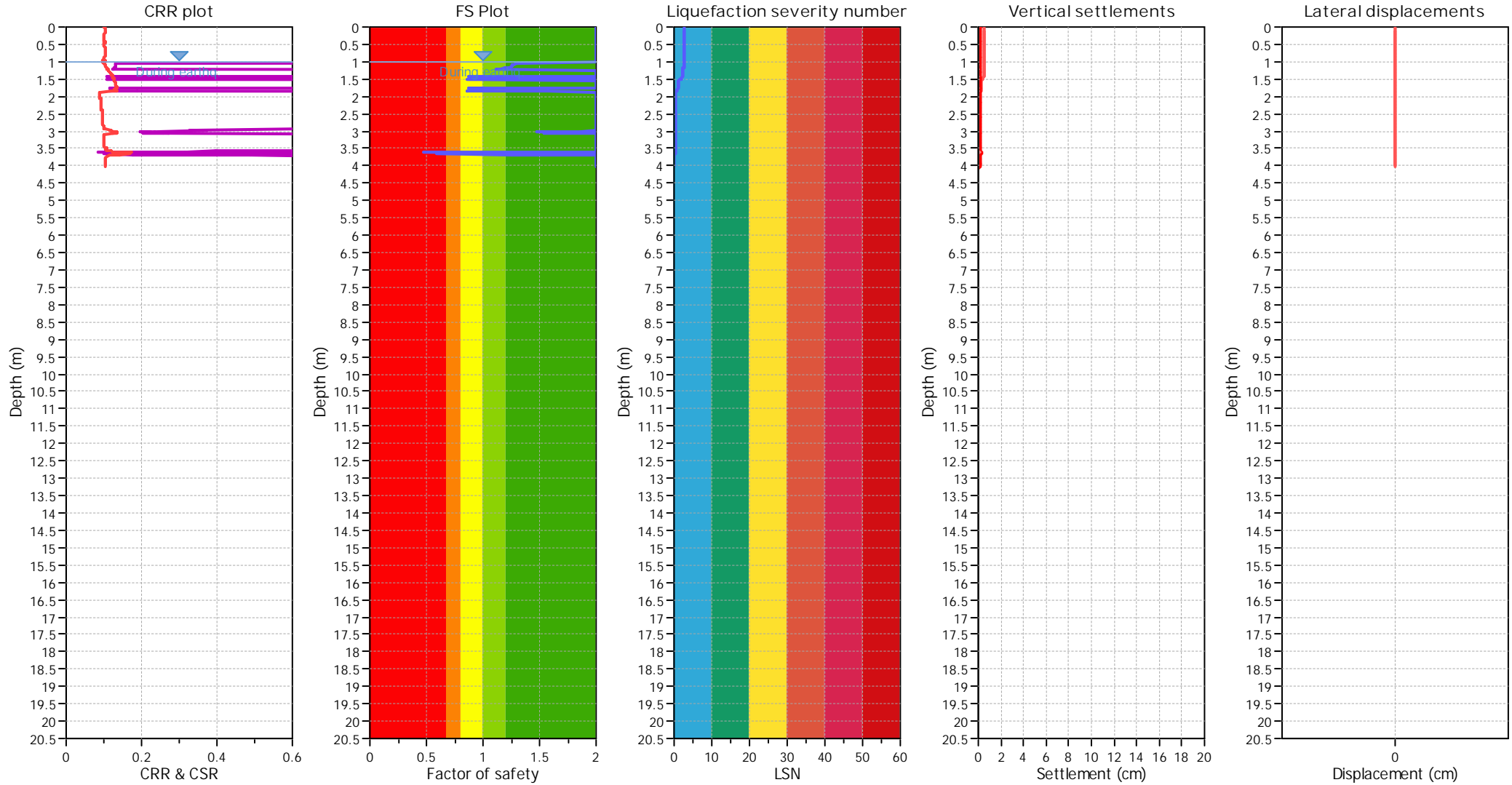
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Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on I <sub>c</sub> value	I <sub>c</sub> cut-off value:	2.60	K <sub>σ</sub> applied:	Yes
Earthquake magnitude M <sub>w</sub> :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.00 m	Fill height:	N/A	Limit depth:	10.00 m

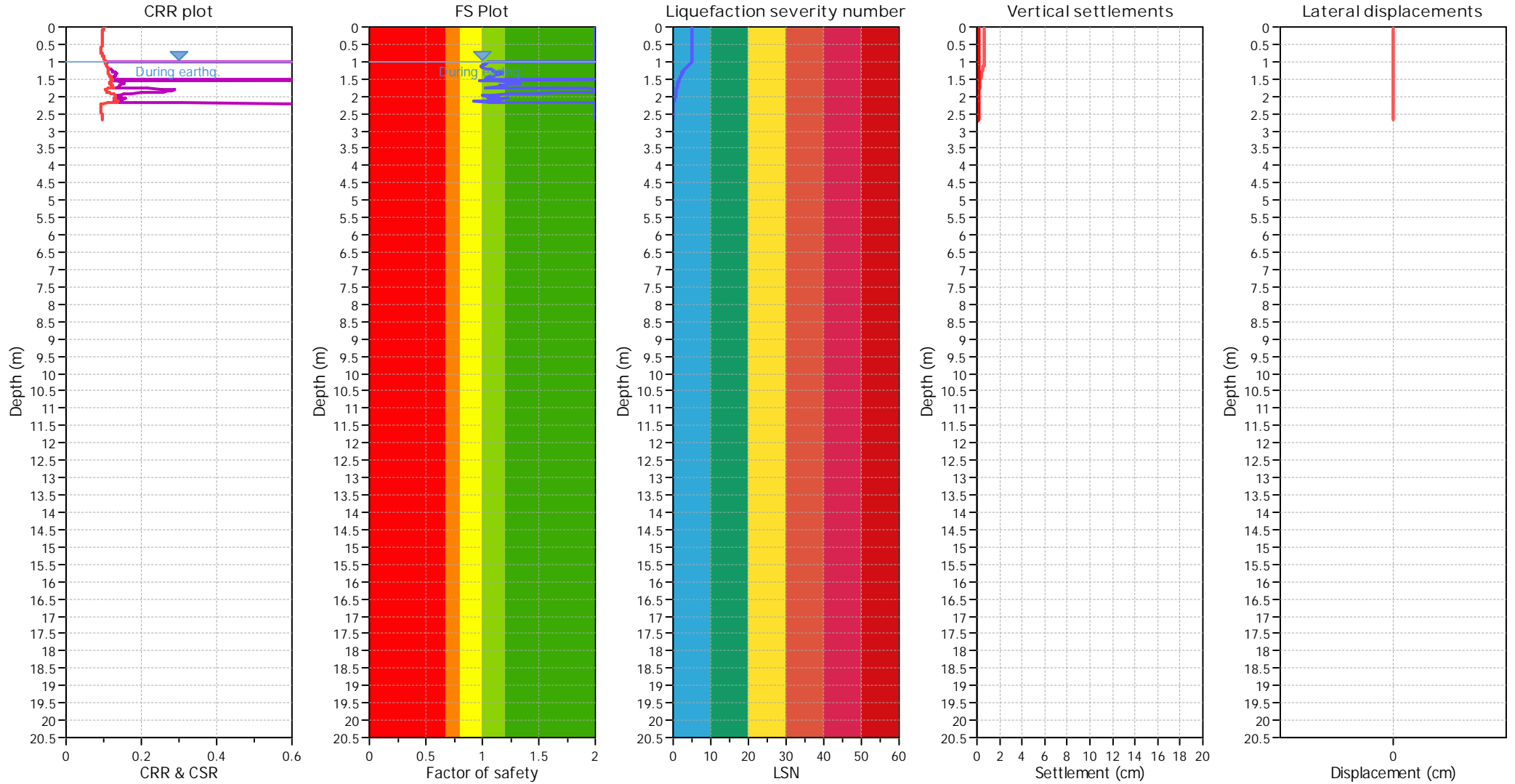
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Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_q$ applied:	Yes
Earthquake magnitude $M_w$ :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.00 m	Fill height:	N/A	Limit depth:	10.00 m

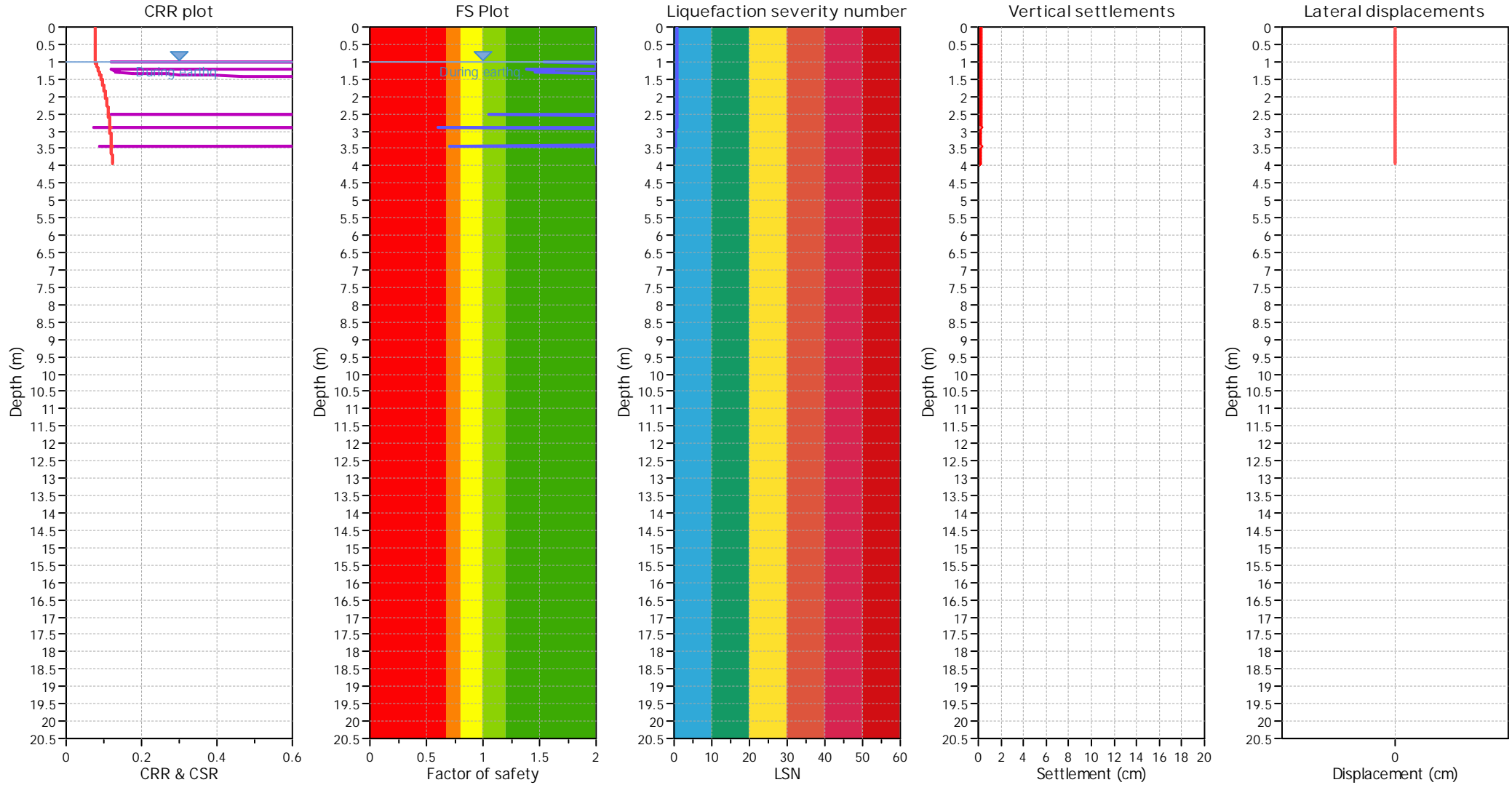
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Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_q$ applied:	Yes
Earthquake magnitude $M_w$ :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.00 m	Fill height:	N/A	Limit depth:	10.00 m

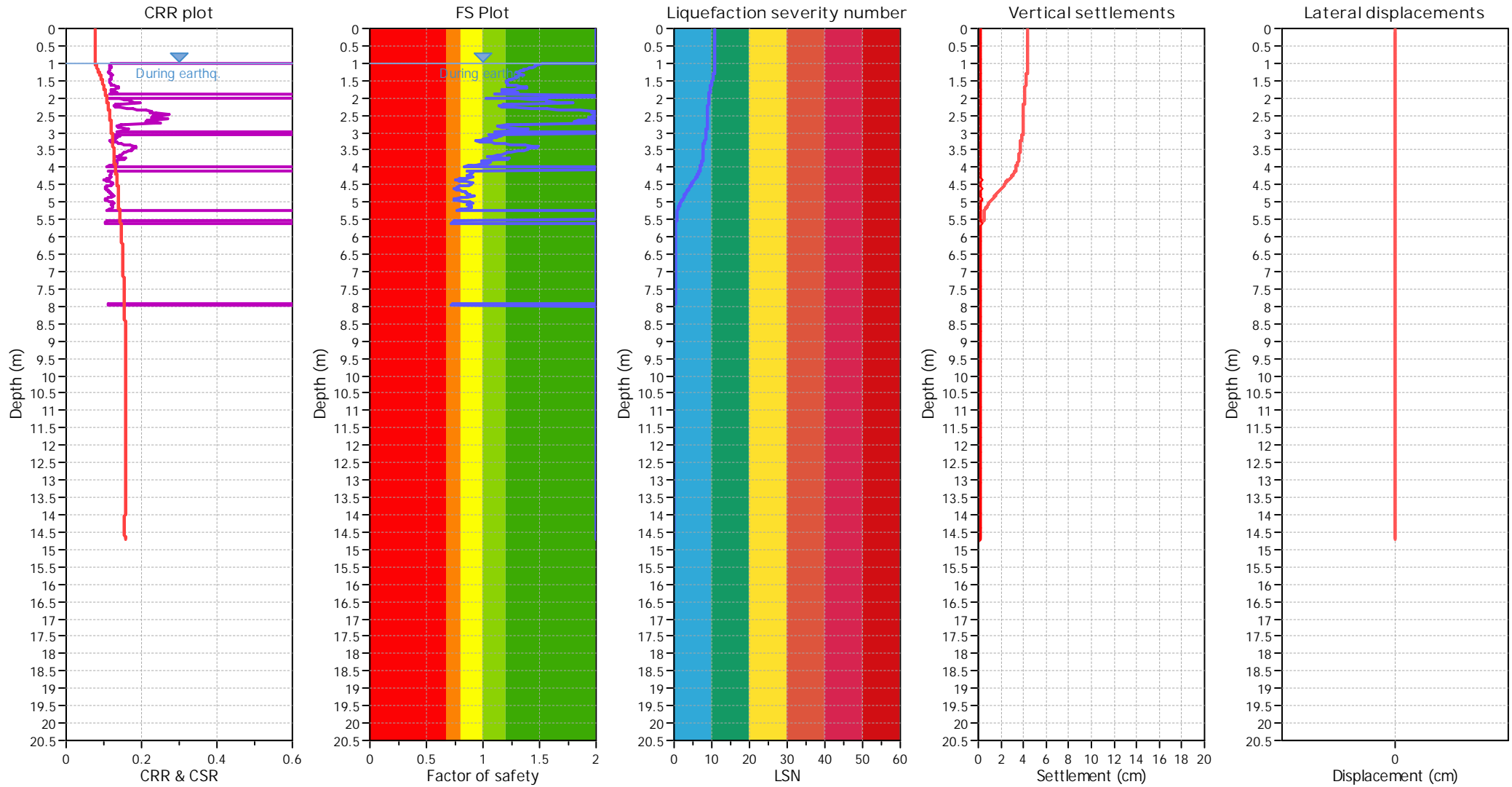
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### Liquefaction analysis overall plots



#### Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_q$ applied:	Yes
Earthquake magnitude $M_w$ :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.00 m	Fill height:	N/A	Limit depth:	10.00 m

#### F.S. color scheme

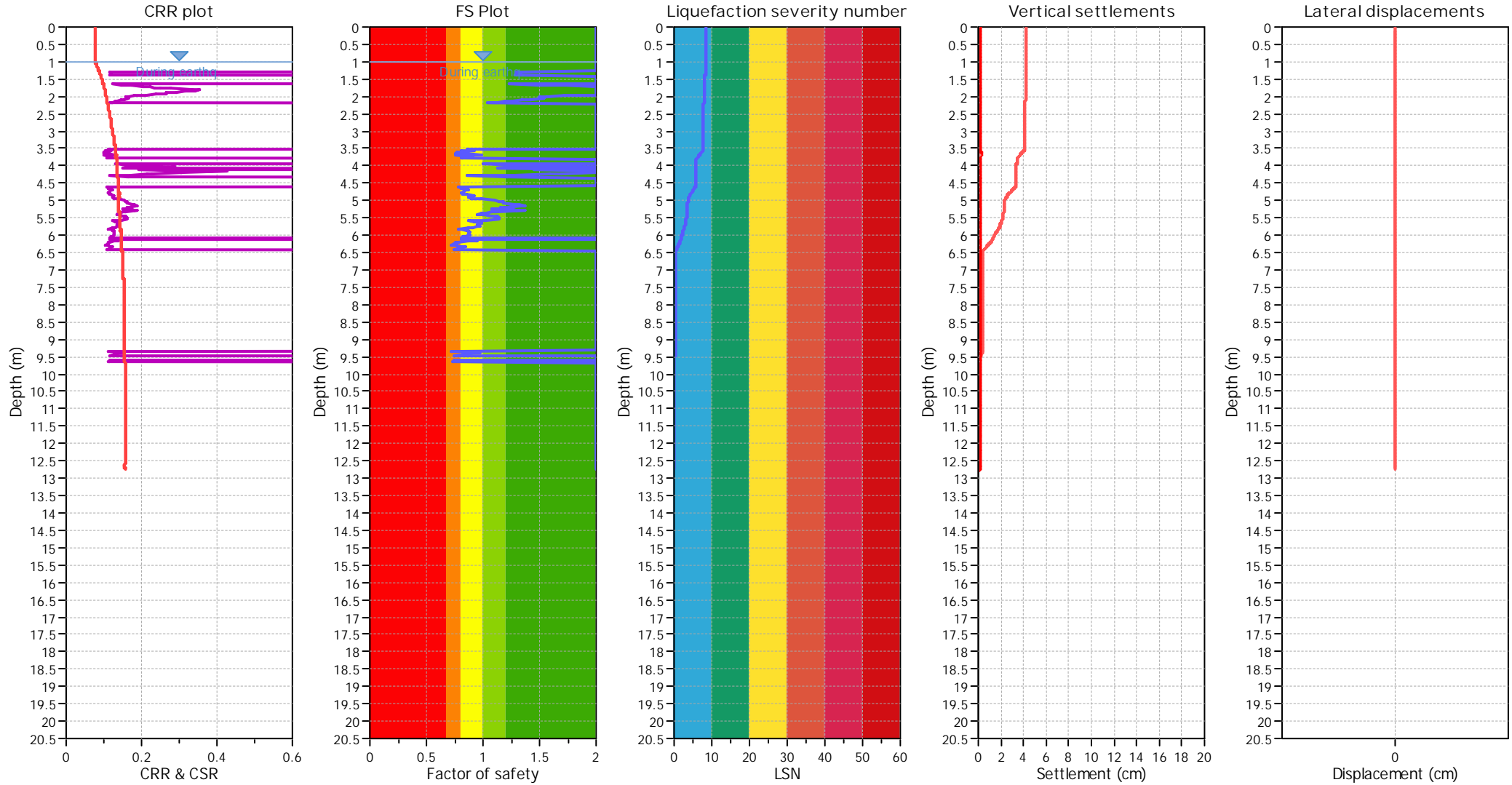
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Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
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Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.00 m	Fill height:	N/A	Limit depth:	10.00 m

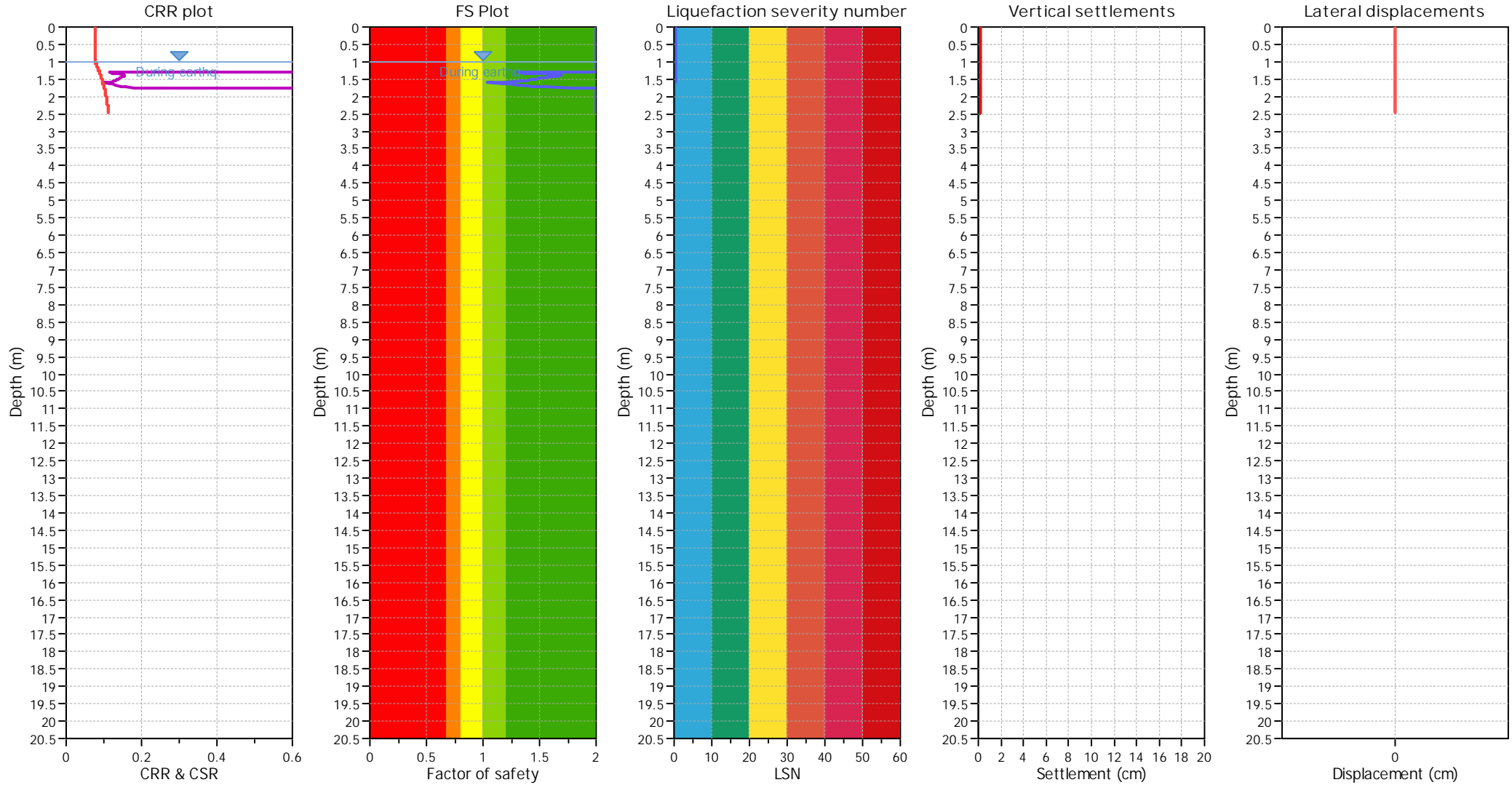
#### F.S. color scheme

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

#### LSN color scheme

- Severe damage
- Major expression of liquefaction
- Moderate to severe exp. of liquefaction
- Moderate expression of liquefaction
- Minor expression of liquefaction
- Little to no expression of liquefaction

### Liquefaction analysis overall plots



#### Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on I <sub>c</sub> value	I <sub>c</sub> cut-off value:	2.60	K <sub>σ</sub> applied:	Yes
Earthquake magnitude M <sub>w</sub> :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.00 m	Fill height:	N/A	Limit depth:	10.00 m

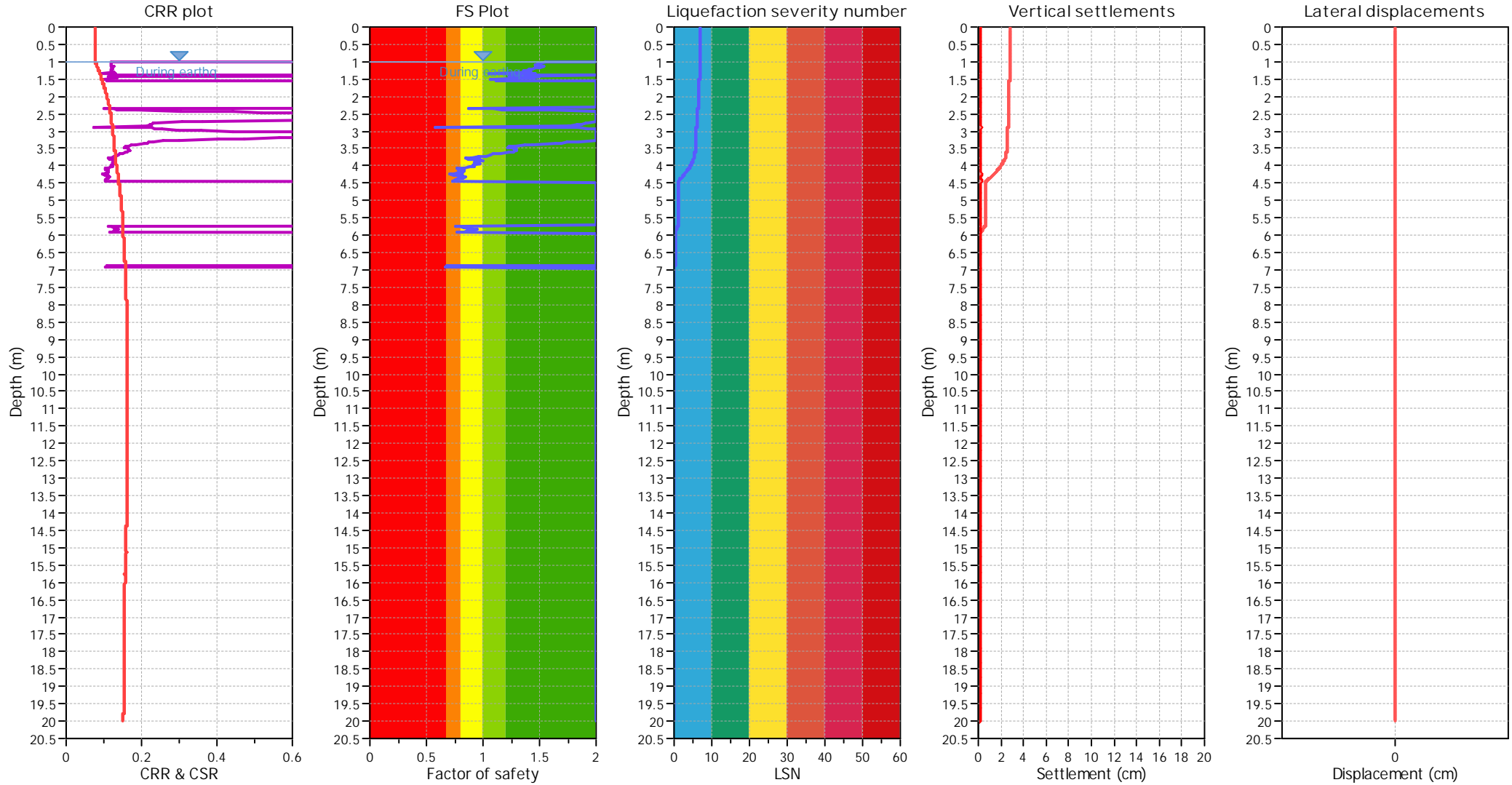
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Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_q$ applied:	Yes
Earthquake magnitude $M_w$ :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.00 m	Fill height:	N/A	Limit depth:	10.00 m

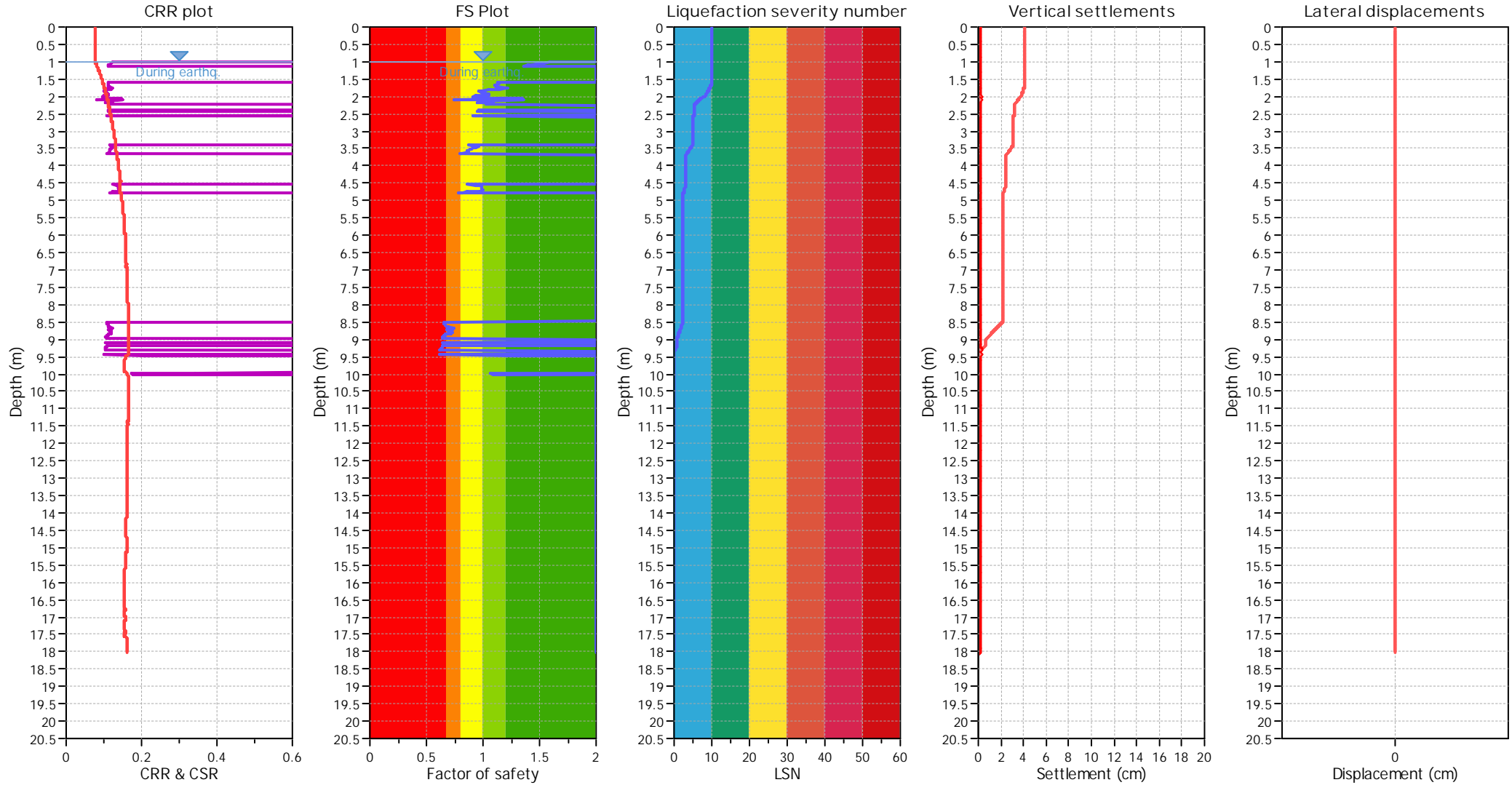
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Earthquake magnitude $M_w$ :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.00 m	Fill height:	N/A	Limit depth:	10.00 m

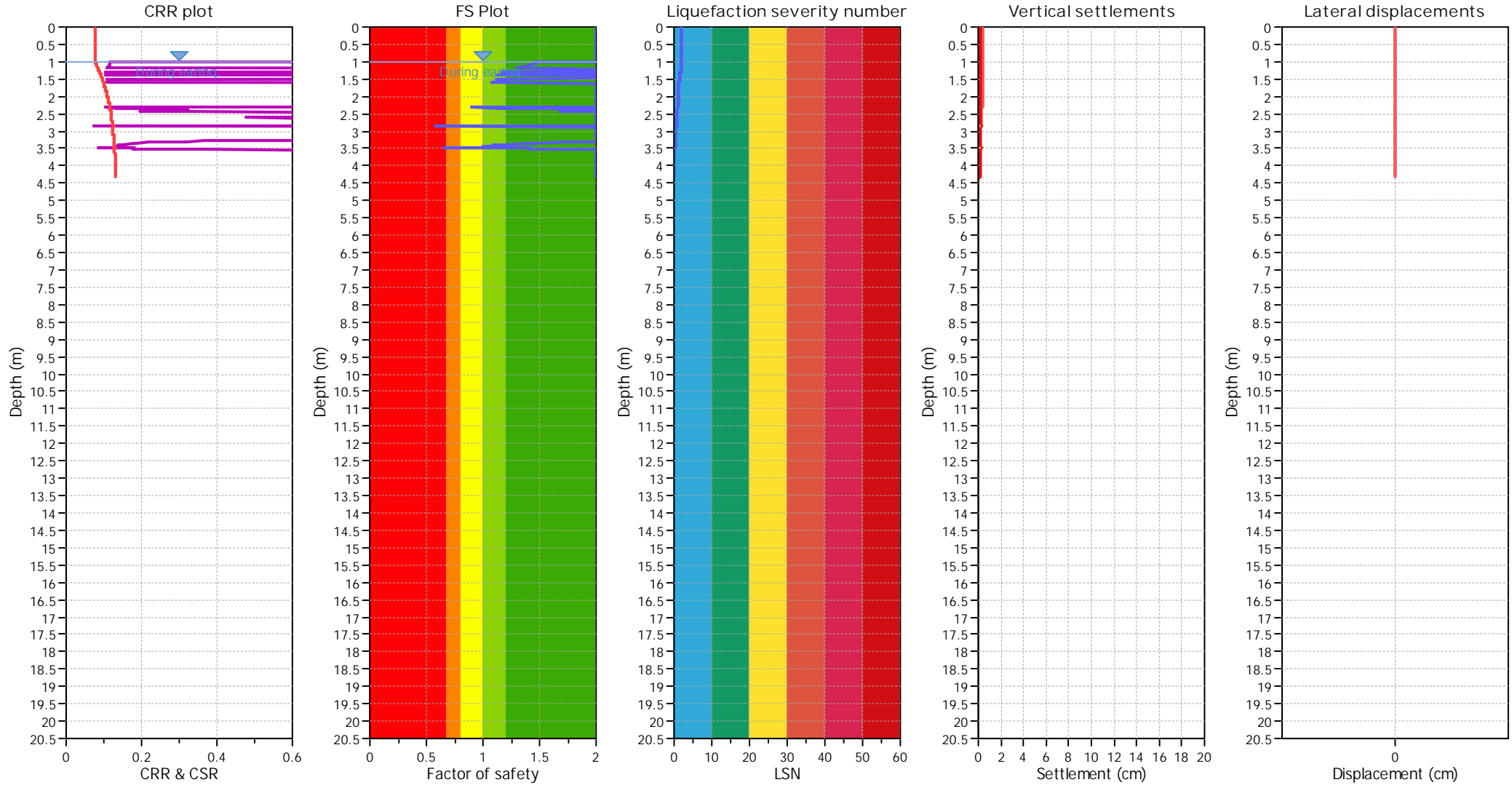
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Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
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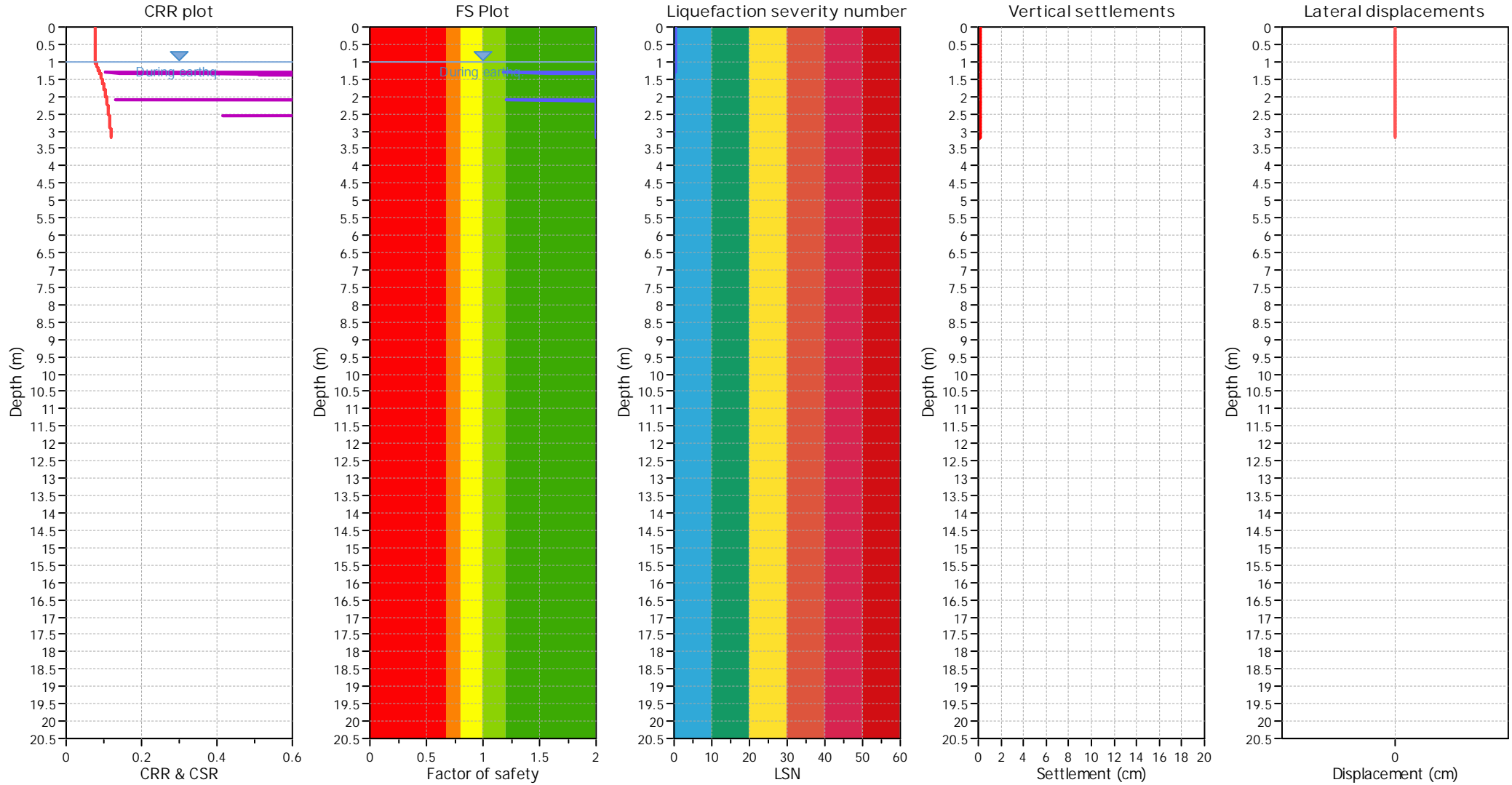
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Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_d$ applied:	Yes
Earthquake magnitude $M_w$ :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.00 m	Fill height:	N/A	Limit depth:	10.00 m

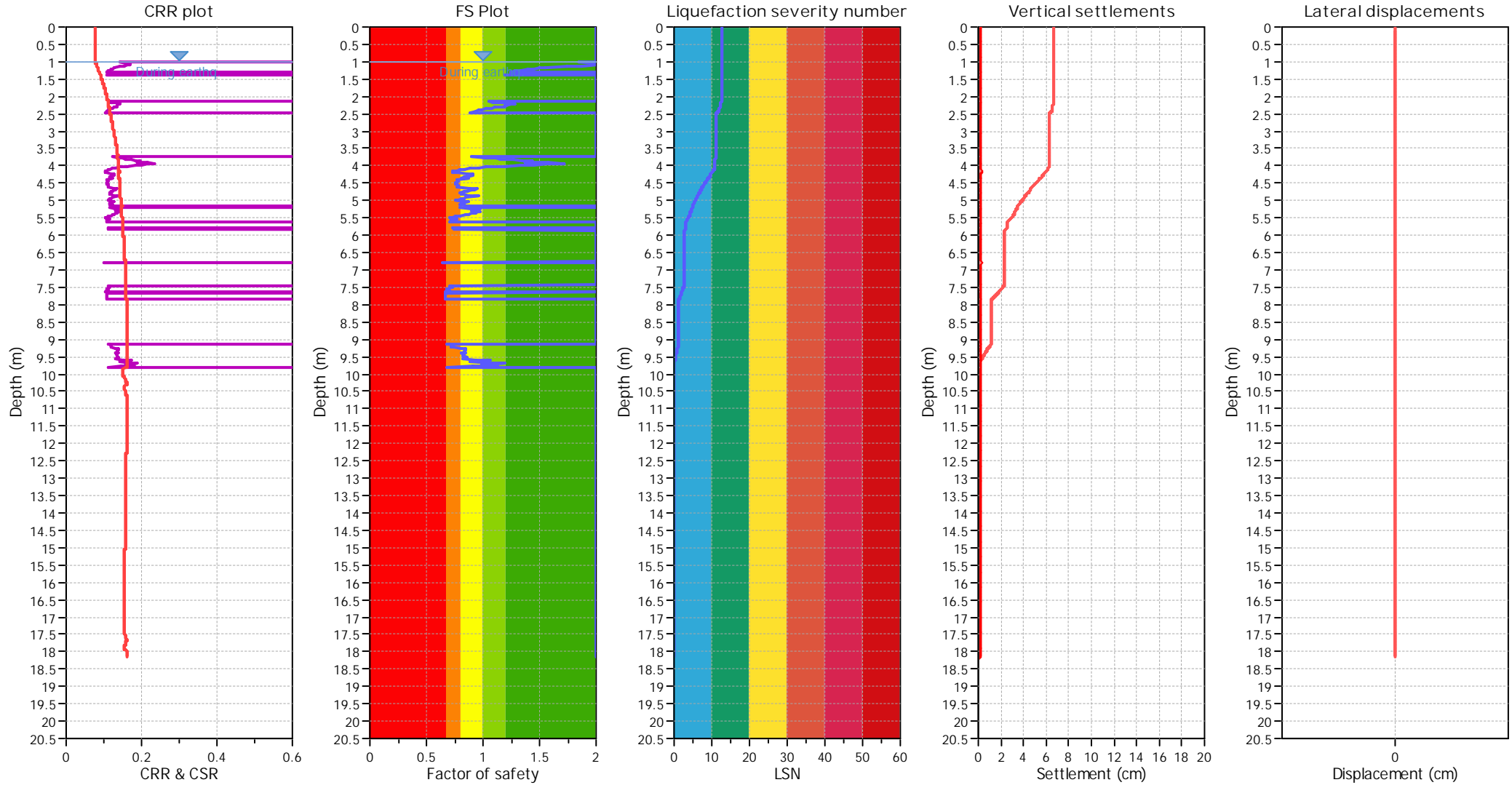
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Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_d$ applied:	Yes
Earthquake magnitude $M_w$ :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.00 m	Fill height:	N/A	Limit depth:	10.00 m

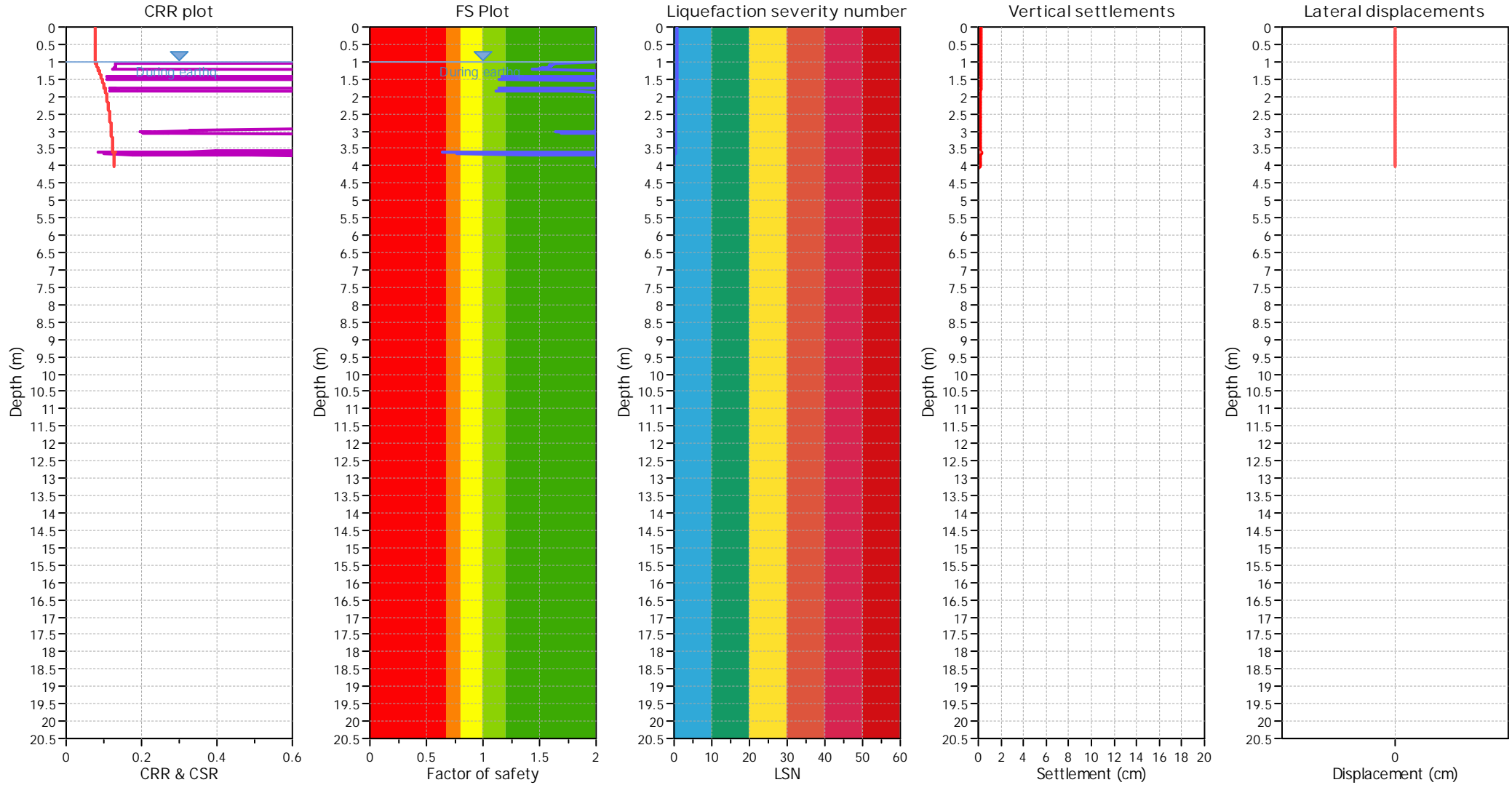
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Depth to water table (insitu):	1.00 m	Fill height:	N/A	Limit depth:	10.00 m

#### F.S. color scheme

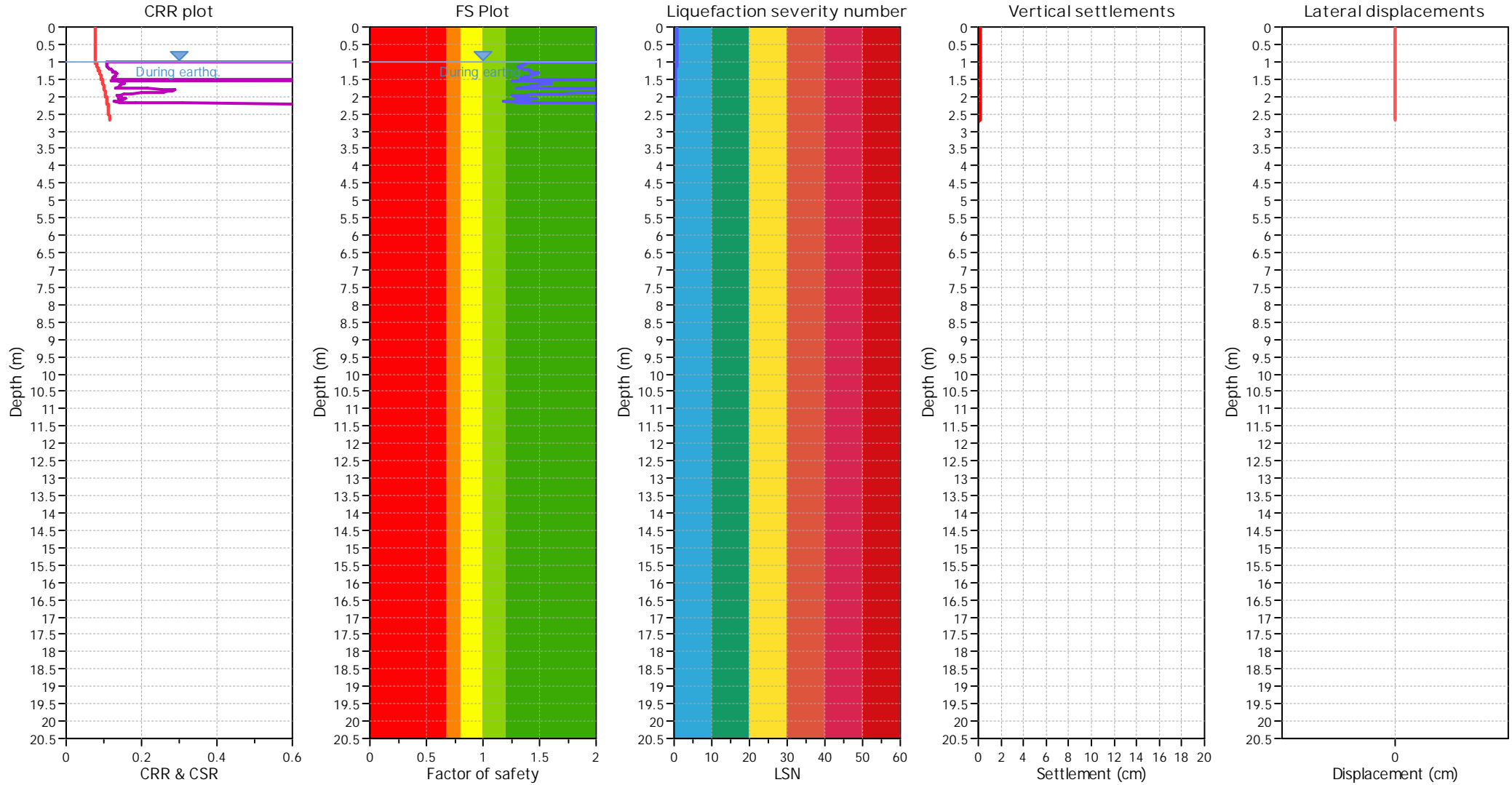
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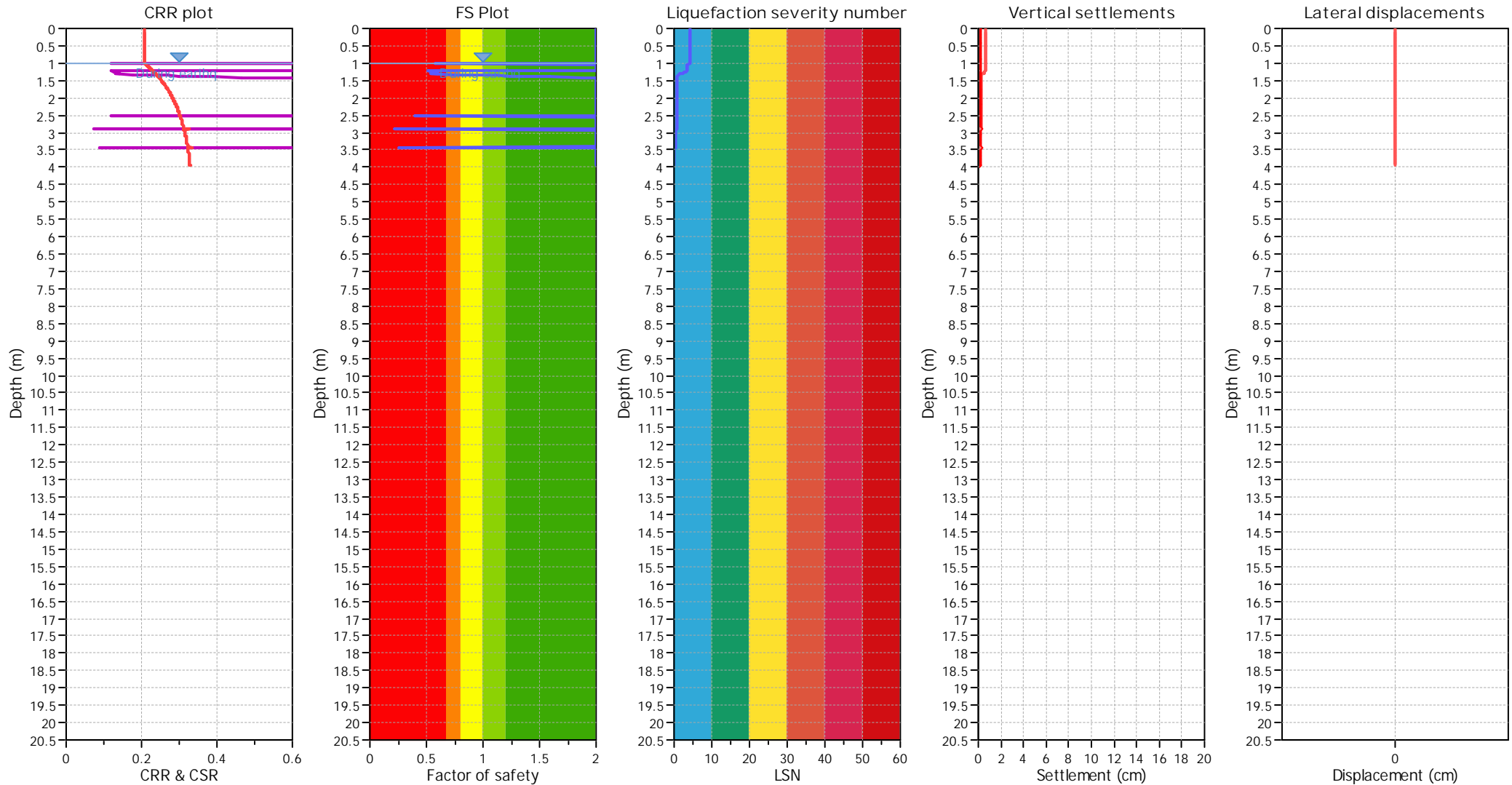
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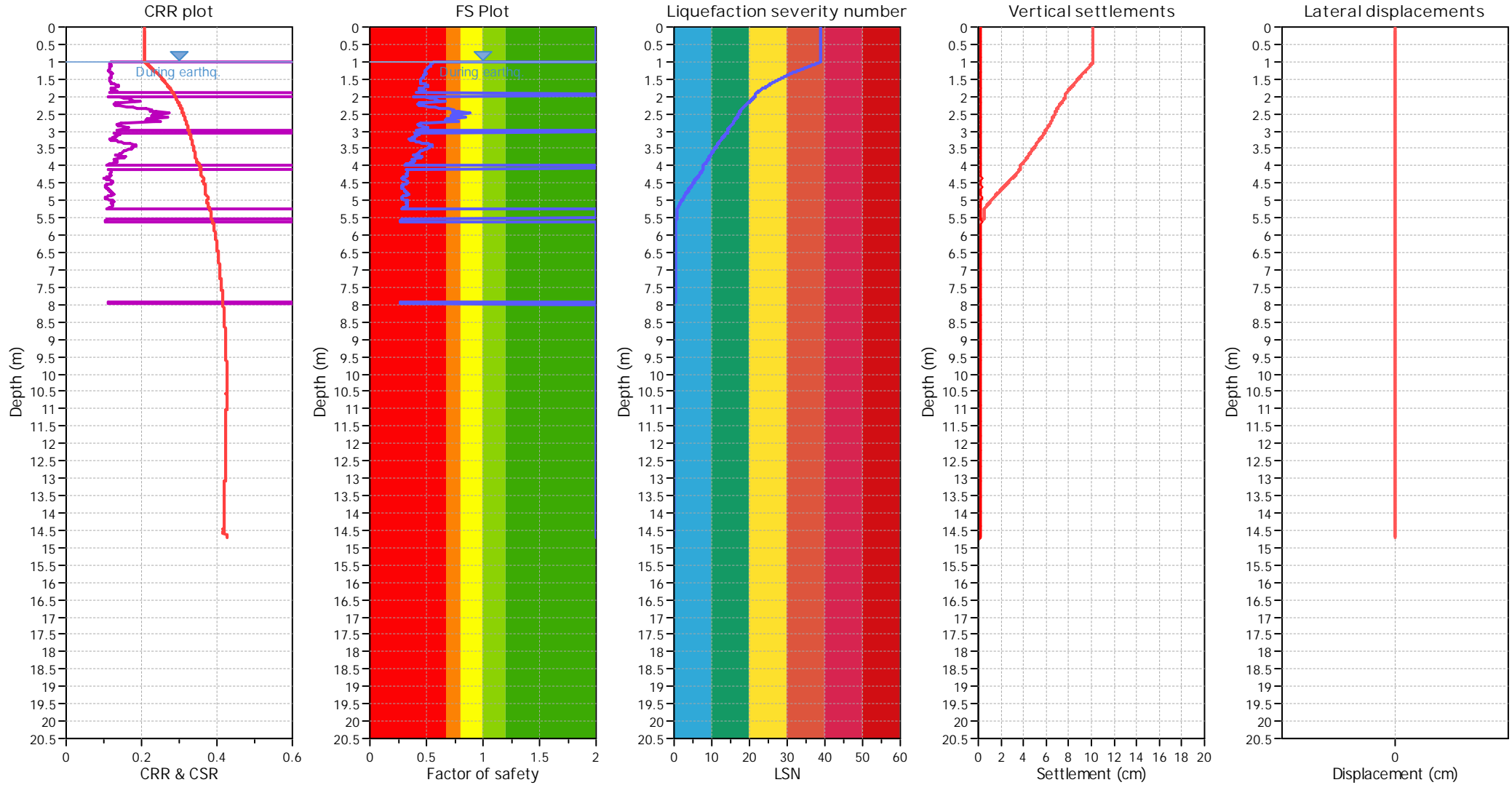
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Points to test:	Based on I <sub>c</sub> value	I <sub>c</sub> cut-off value:	2.60	K <sub>σ</sub> applied:	Yes
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Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.00 m	Fill height:	N/A	Limit depth:	10.00 m

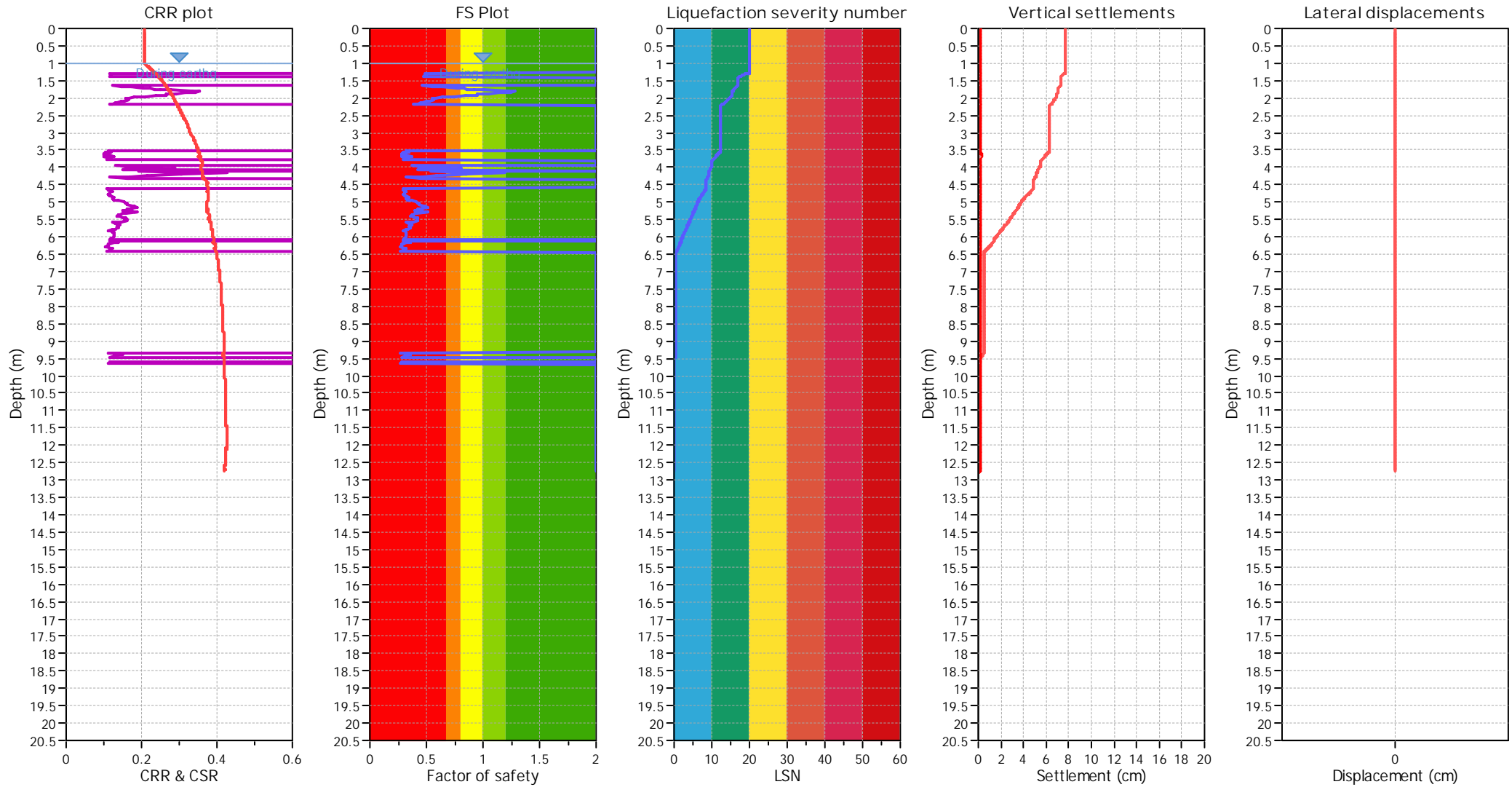
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Earthquake magnitude M <sub>w</sub> :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
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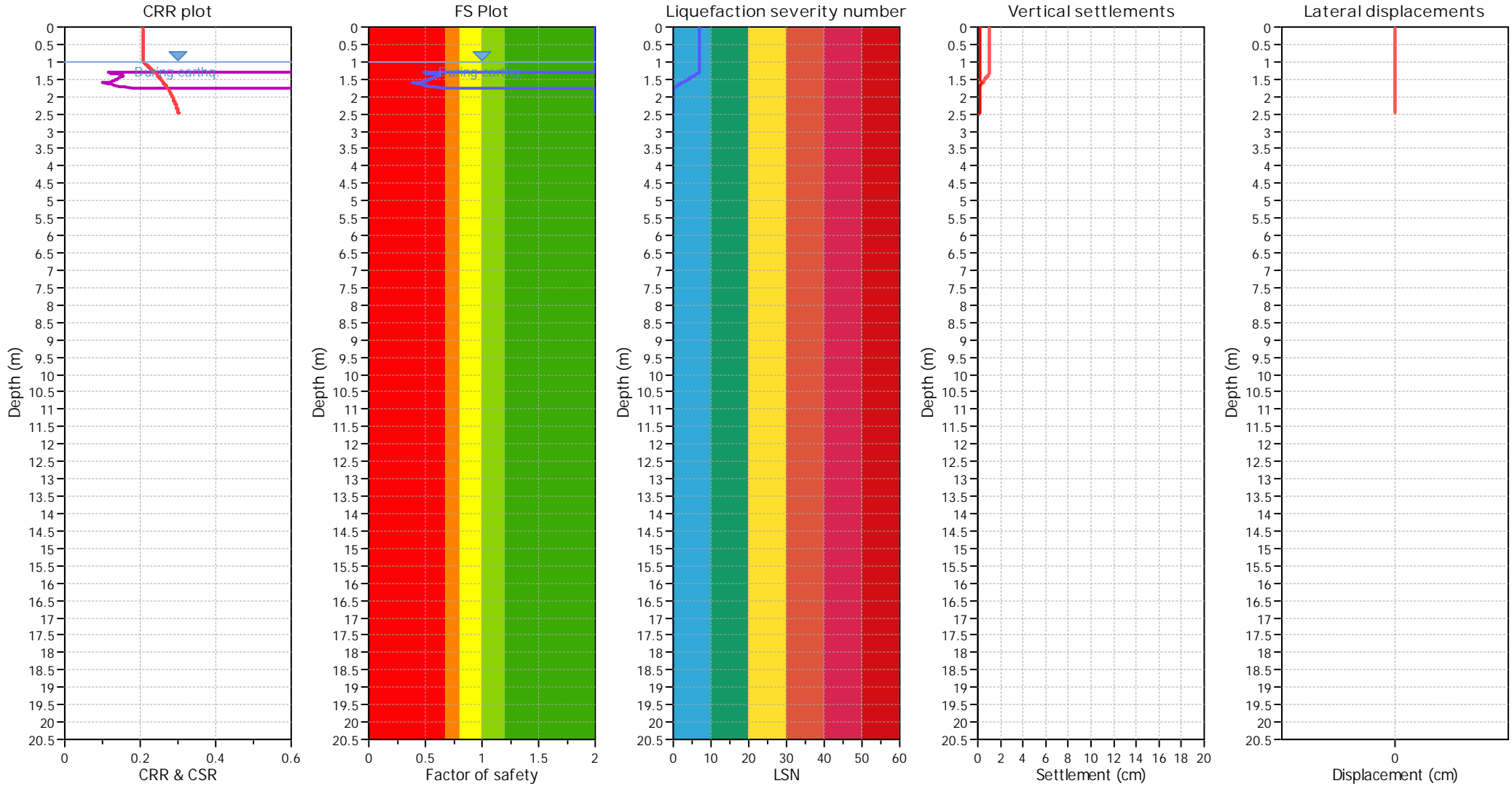
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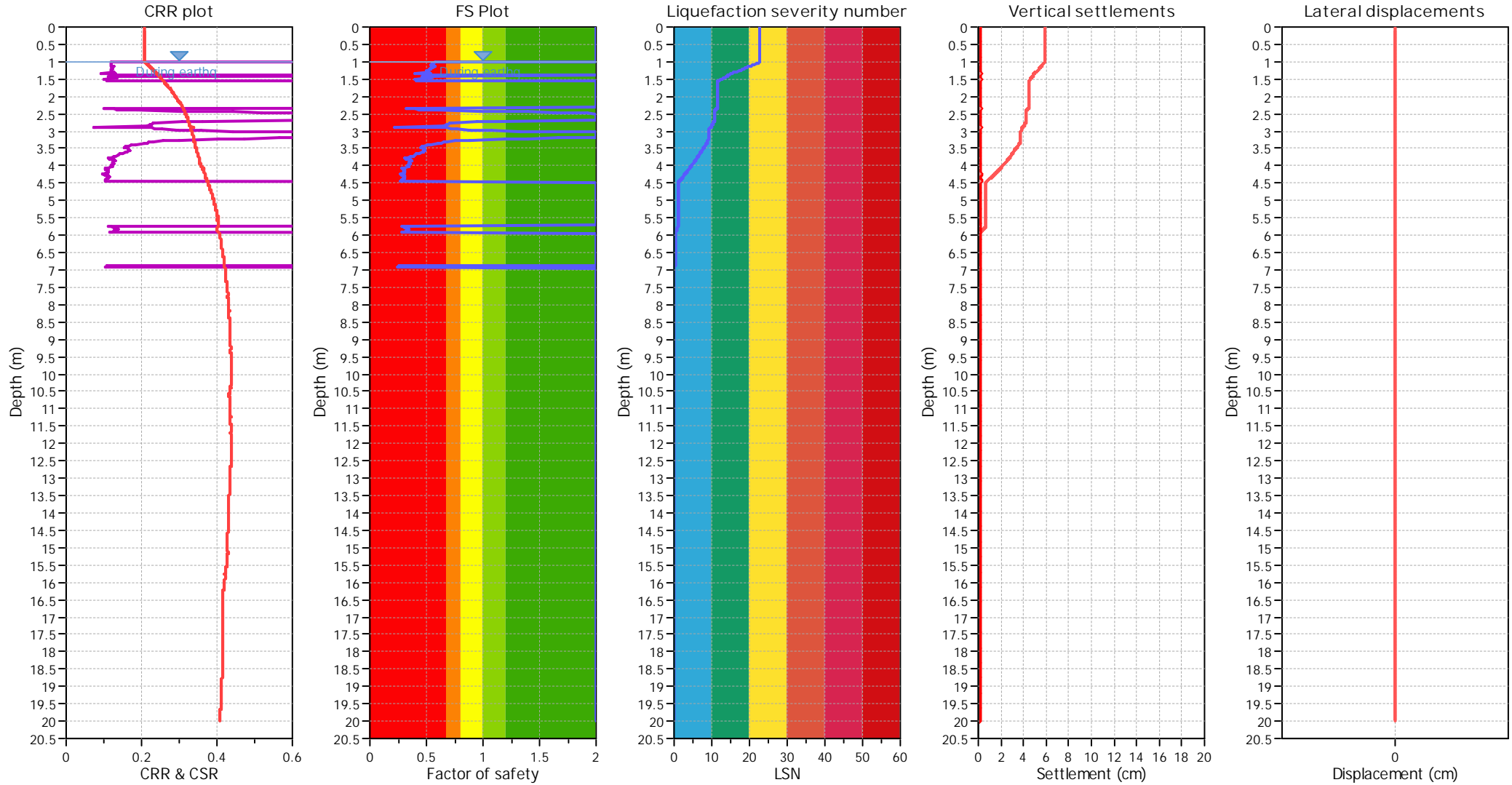
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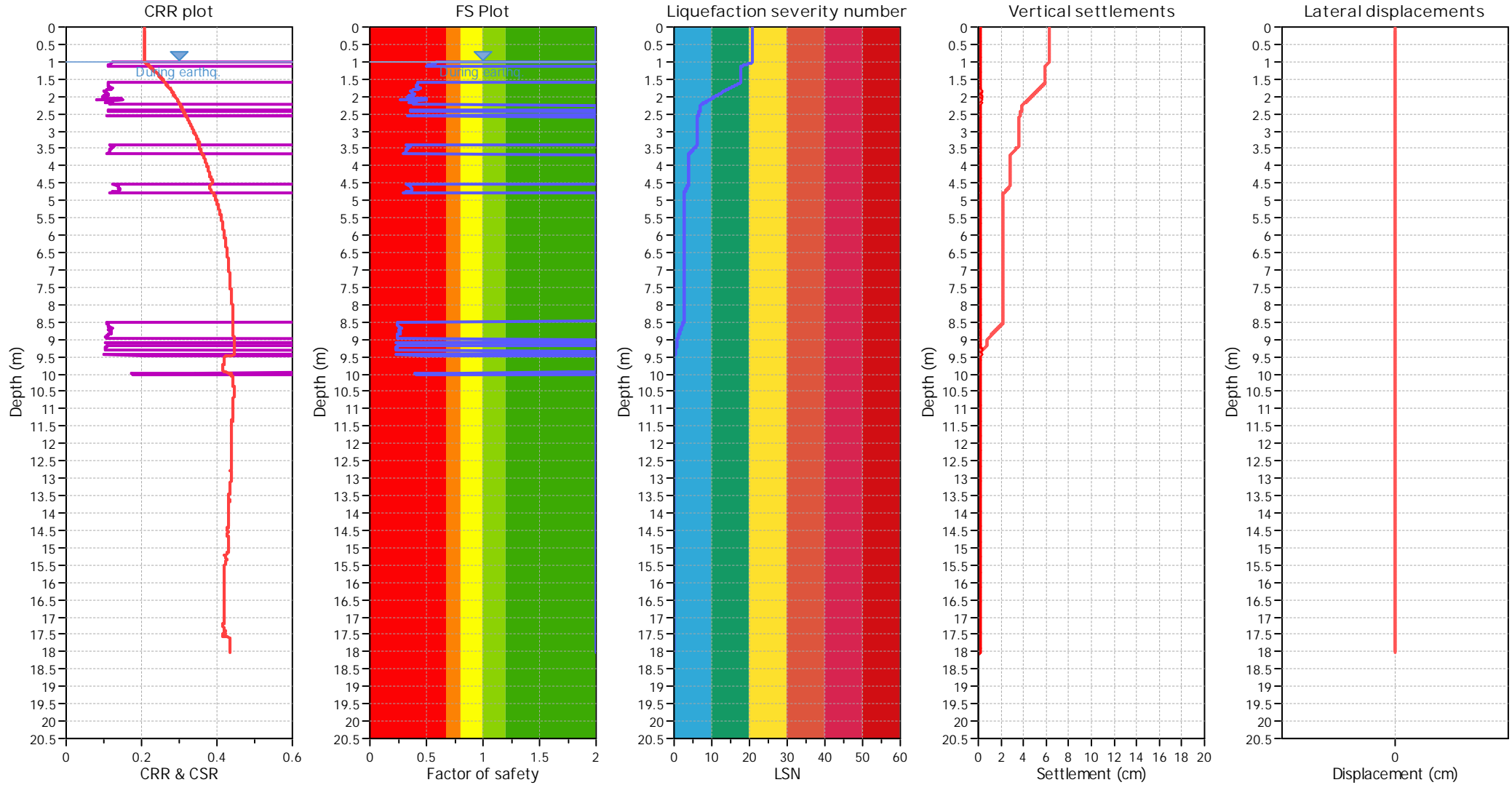
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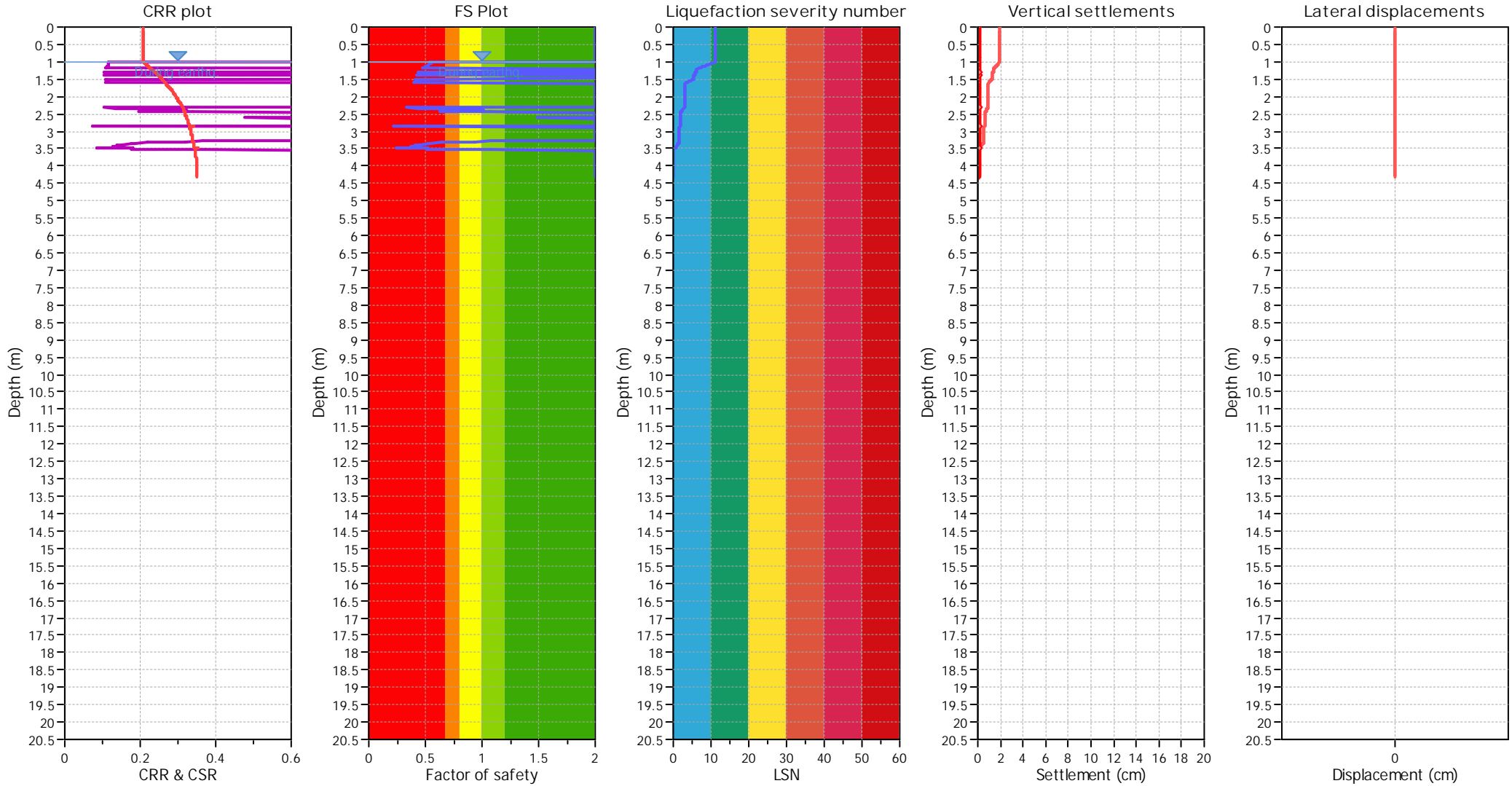
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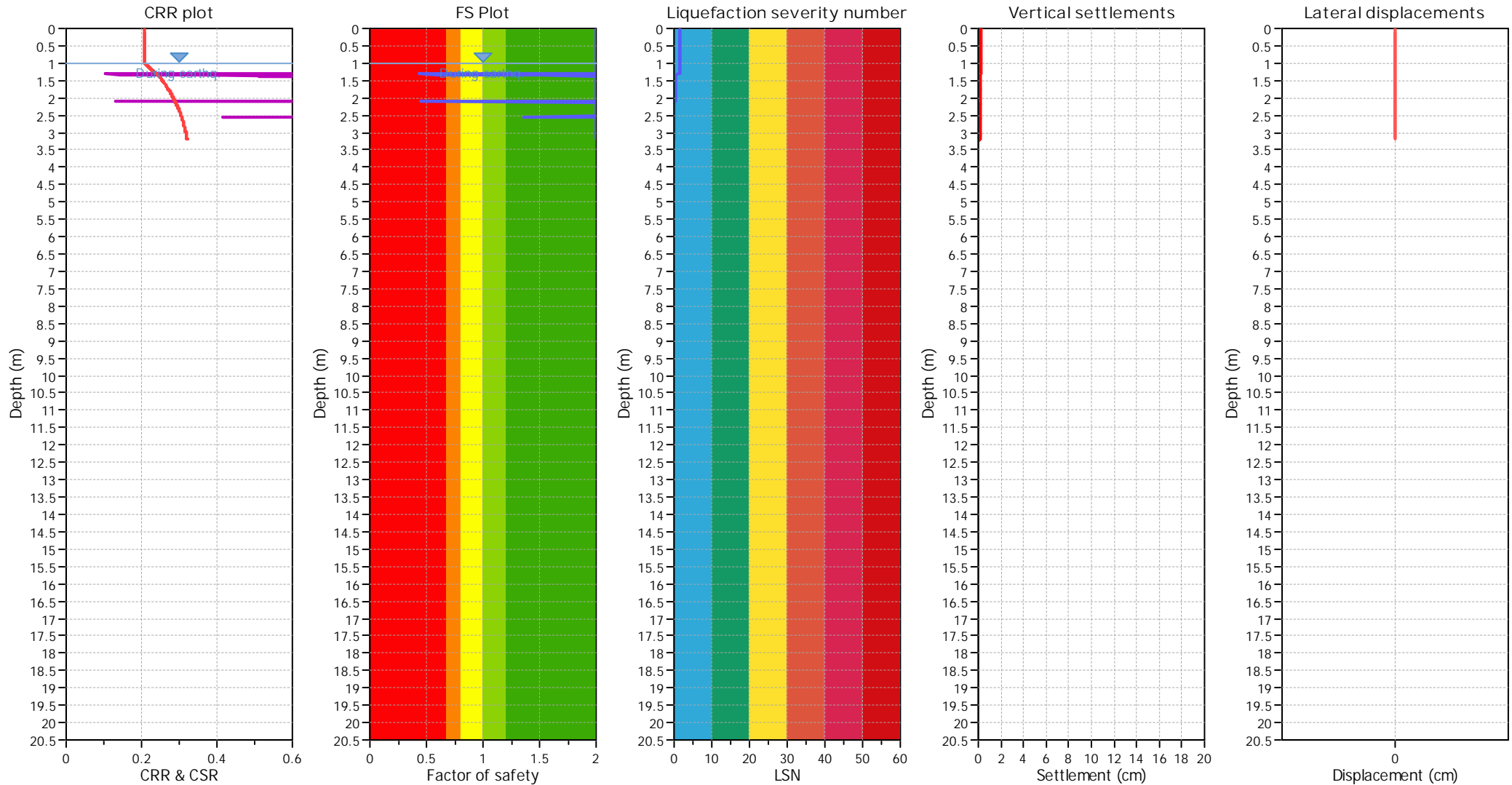
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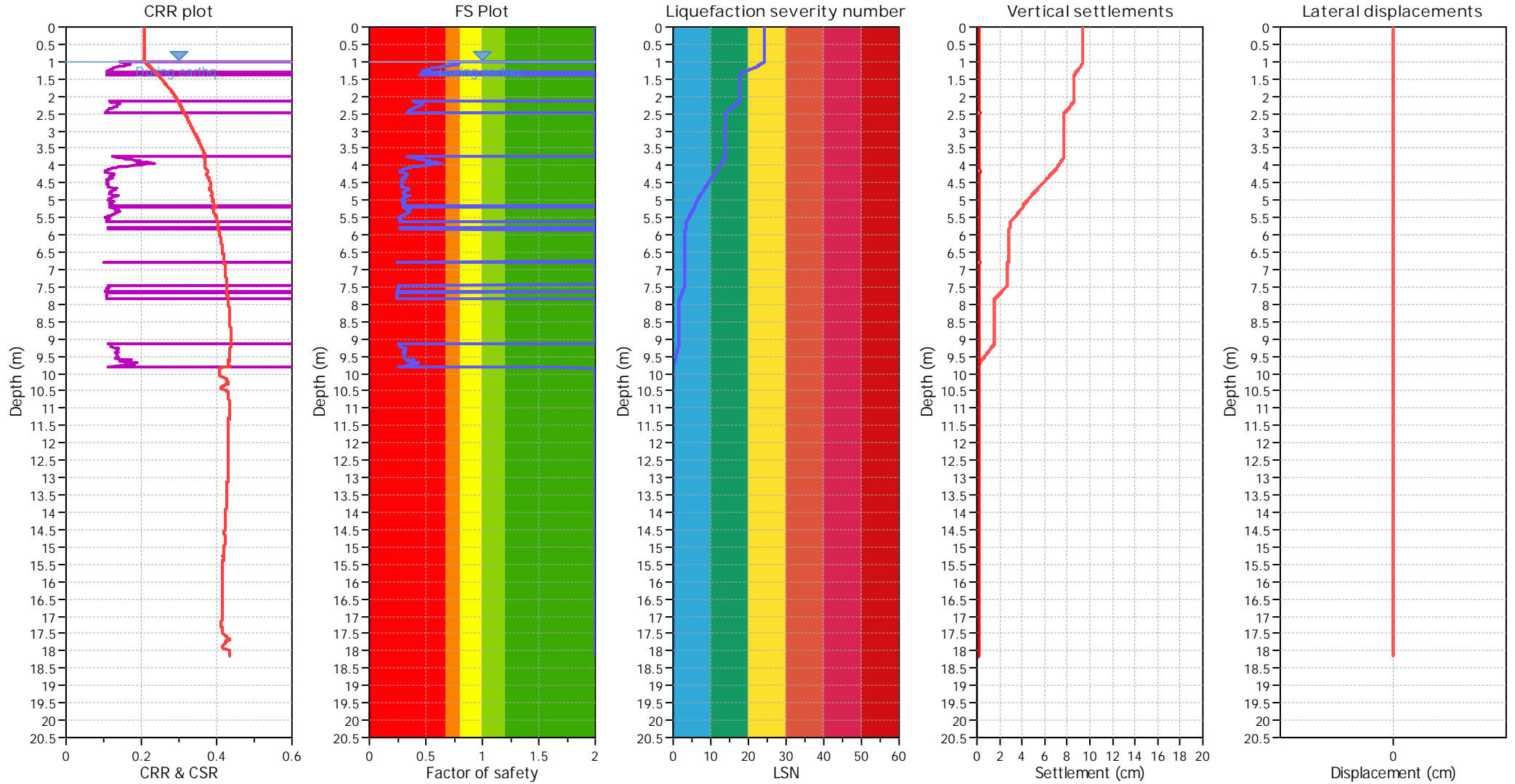
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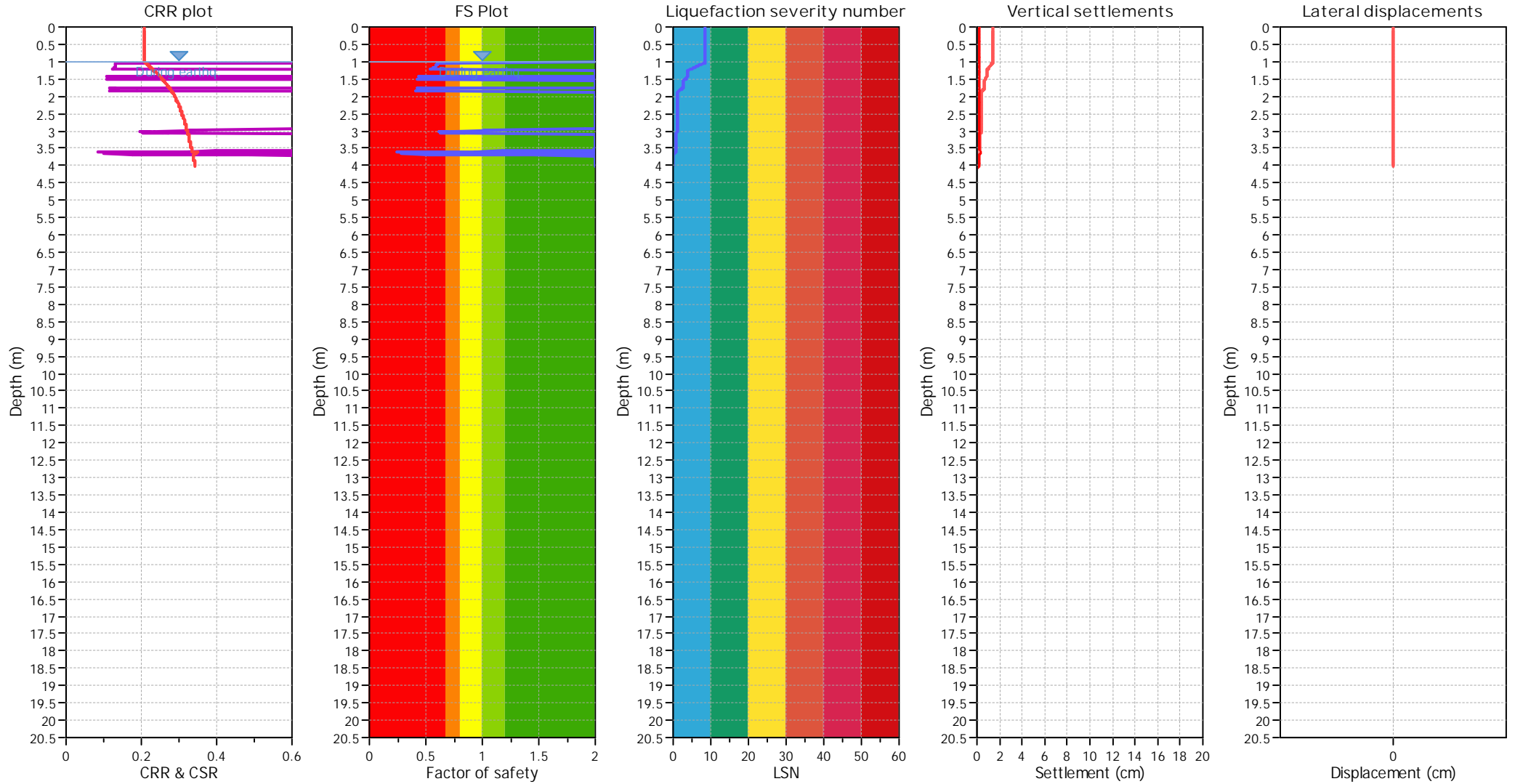
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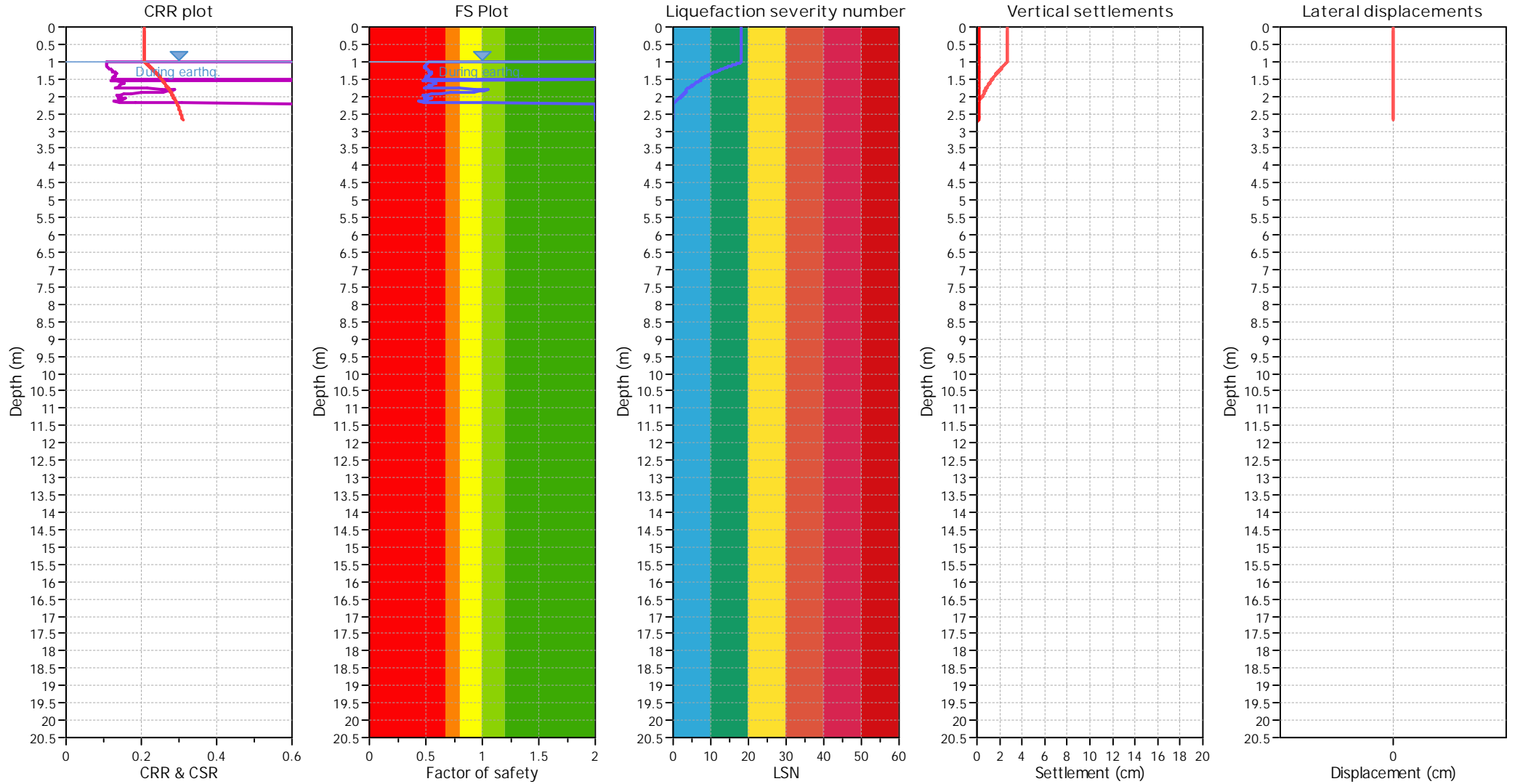
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- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

#### LSN color scheme

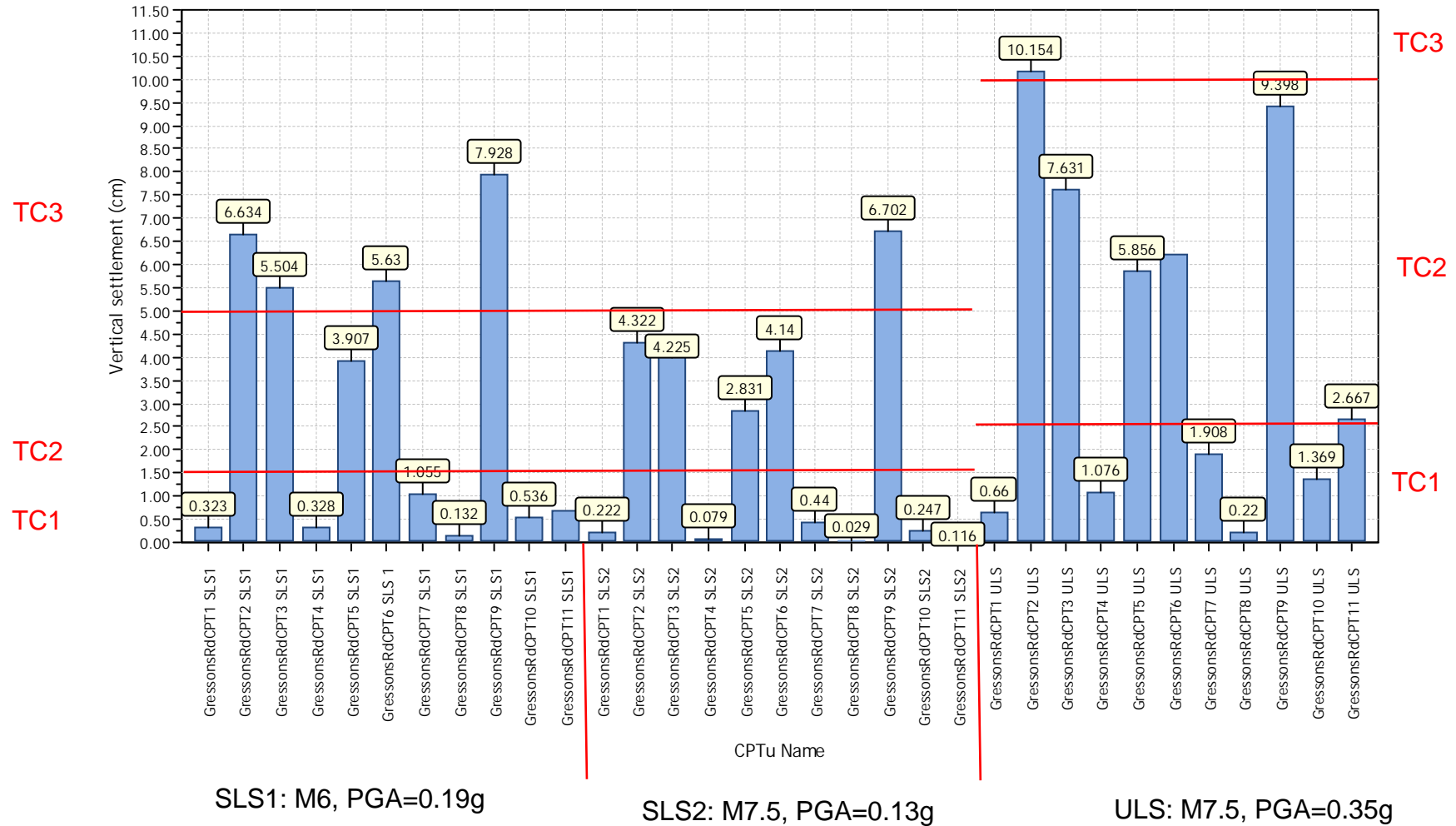
- Severe damage
- Major expression of liquefaction
- Moderate to severe exp. of liquefaction
- Moderate expression of liquefaction
- Minor expression of liquefaction
- Little to no expression of liquefaction

## Overall Vertical Settlements

Project title : Northside Country

Location : 81 Gressons Road

Overall vertical settlements report

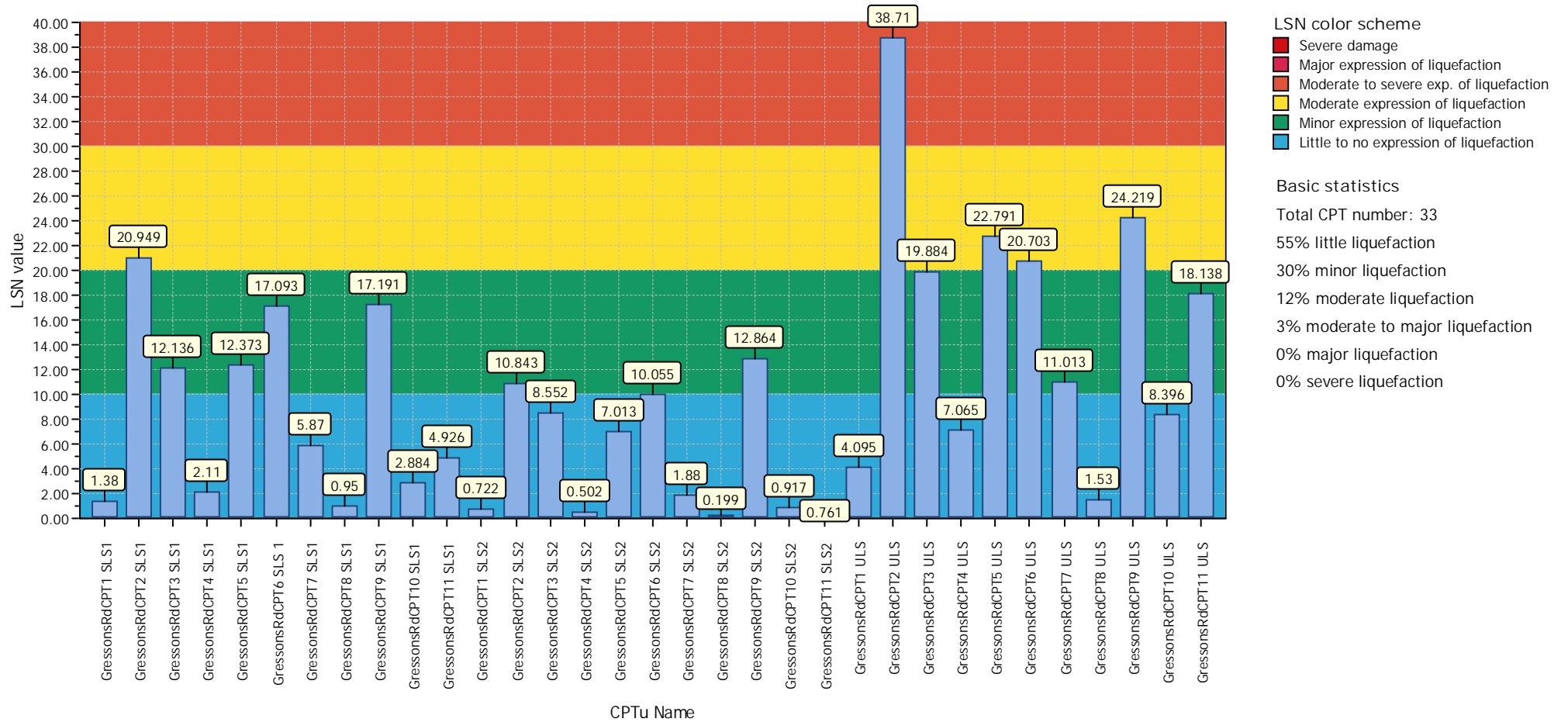


Overall Liquefaction Severity Number (LSN)

Project title : Northside Country

Location : 81 Gressons Road

### Overall Liquefaction Severity Number report





## **Appendix 2**



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**Project Number #19640.000.001**

## **Geotechnical Investigation**

81 Gresson & 1375 Main North Road, Waikuku,

Submitted to:

Westside Country Ltd

250 Oxford Terrace

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Christchurch 8011

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Appendix 2: Inferred Technical Category Map

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Appendix 5: Liquefaction Analysis Outputs

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### ENGEO Document Control:

Report Title	Geotechnical Investigation - 81 Gresson & 1375 Main North Road, Waikuku			
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Client	Westside Country Ltd	Client Contact	Brian Stokes	
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## 1 Introduction

ENGEO Ltd was requested by Westside Country Ltd to undertake a geotechnical investigation of the property at 81 Gresson & 1375 Main North Road, Waikuku, (herein referred to as ‘the site’). The purpose of the assessment was to support plan change of this area from rural to residential land use.

This work has been carried out in accordance with our signed agreement (2021.005.919\_02, signed 18 November 2021).

Our scope of works included:

- Site walkover assessment by ENGEO.
- Coordination with a specialist contractor to drill 41 Cone Penetrometer Tests (CPTs) evenly distributed across the site area (excluding the portion previously investigated).
- Assessment of geohazards across the site utilising the CPT data from the investigations - specifically liquefaction and inferred peat deposits.
- Provision of seismic subsoil category based on our understanding of the regional geology – this has not been specifically investigated.
- Analysis of liquefaction potential under Serviceability Limit State (SLS), Ultimate Limit State (ULS) and Intermediate Limit State (ILS) conditions.
- Development of plans indicating:
  - The inferred Technical Categories (TC) across the site; and
  - Other geological constraints on development such as the presence of compressible cohesive and organic material and areas of artesian water.
- Assessment of the site against Section 106 of the Resource Management Act.
- A Geotechnical Report suitable to inform plan change requirements, covering the aspects above.

A report by Elliot Sinclair (dated 27 November 2020, ref. 350494) to support plan change was completed for the northern portion of the site (see Figure 1). We have incorporated the data from their investigation into this current report for completeness and our assessment / recommendations cover this area.

This report should be read in conjunction with our environmental Preliminary Site Investigation report (dated 23 November 2021, ref 19640.000.001\_01) which details the site history.

## 2 Site Description

The site at 81 Gresson & 1375 Main North Road (south of Waikuku) is currently rural farmland with an area of approximately 100 hectares. The landform is generally sub-horizontal with drainage channels through areas of the site. Waikuku Stream runs through the most northern extent of the site, and a smaller unnamed stream runs through the centre of the site. The approximate location of the drainage channels and Waikuku stream are shown in Figure 1.

Figure 1: Site Location Plan



Image sourced from LINZ and edited in DataNest. Not to scale.

### 3 Desktop Review

#### 3.1 Regional Geology

The site has been regionally mapped by GNS Science as being underlain by unweathered, variably sorted gravel, sand silt and clay of modern river floodplains or low level degradation terraces. Regional mapping completed by Forsyth et al (2008) indicates that the site is underlain by grey river alluvium beneath plains or low level terraces.

## 3.2 Geohazards

### 3.2.1 Seismicity

The nearest faults to the site are the Loburn and Ashley faults (part of the Ashley Fault Zone), mapped approximately 4.5 km northwest and 11 km west of the site respectively. The faults within the Ashley Fault Zone trend roughly east-west, and the fault strands within it are indicated as having equal components of dip-slip and strike-slip movement (Barrell and Van Dissen, 2014). The average recurrence interval of the Ashley Fault Zone is assessed as being between 7,000 and 15,000 years, although it could be as low as 5,000 years. The site is mapped outside of the Ashley Fault Awareness Zone.

Large regional areas of faulting (GNS, 2015) namely the Porters Pass-Amberley Fault Zone, and the Hope and Alpine Faults, are further afield but present a high seismic hazard to the Christchurch area due to the anticipated size of earthquakes generated. The largest of these faults is the Alpine Fault, which has a return period of 250-300 years and is expected to produce a M8 earthquake. The last rupture on the Alpine Fault is believed to have occurred in 1717 (Pettinga et al., 2001).

### 3.2.2 Canterbury Earthquake Sequence

#### Ground Shaking

O'Rourke et al (2012) have developed a contour map of the conditional median peak ground accelerations (PGA) interpolated from data measured at various recording stations during the 2010-2011 Canterbury Earthquake Sequence. The nearest monitoring stations to the site are at Kaiapoi North School and Ashley School.

This mapping indicates that the site experienced peak ground motions of approximately 0.21g during the September 2010 Darfield earthquake. The site is therefore likely to have experienced seismic accelerations in excess of SLS. Contour mapping is not available for the February, June or December 2011 earthquakes.

#### Liquefaction

The site has been mapped by the Waimakariri District Council as being within an area where 'Liquefaction damage is possible' and further assessment is needed.

Mapping by GNS Science following the September 2010 and February 2011 earthquakes identified sand boil formations to the south, west and northeast of the site (Figure 2). No liquefaction ejecta was recorded on-site; however, this mapping was largely based of area wide aerial photography rather than site specific observations.

**Figure 2: Mapped Liquefaction – September 2010 and February 2011 Earthquakes**

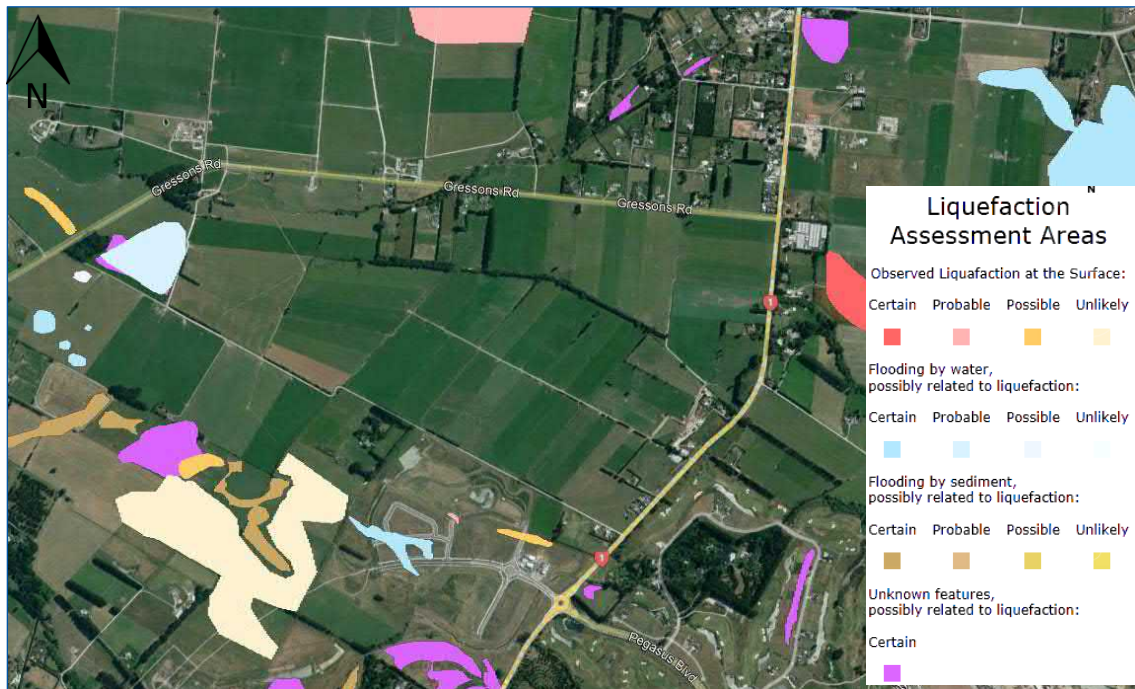


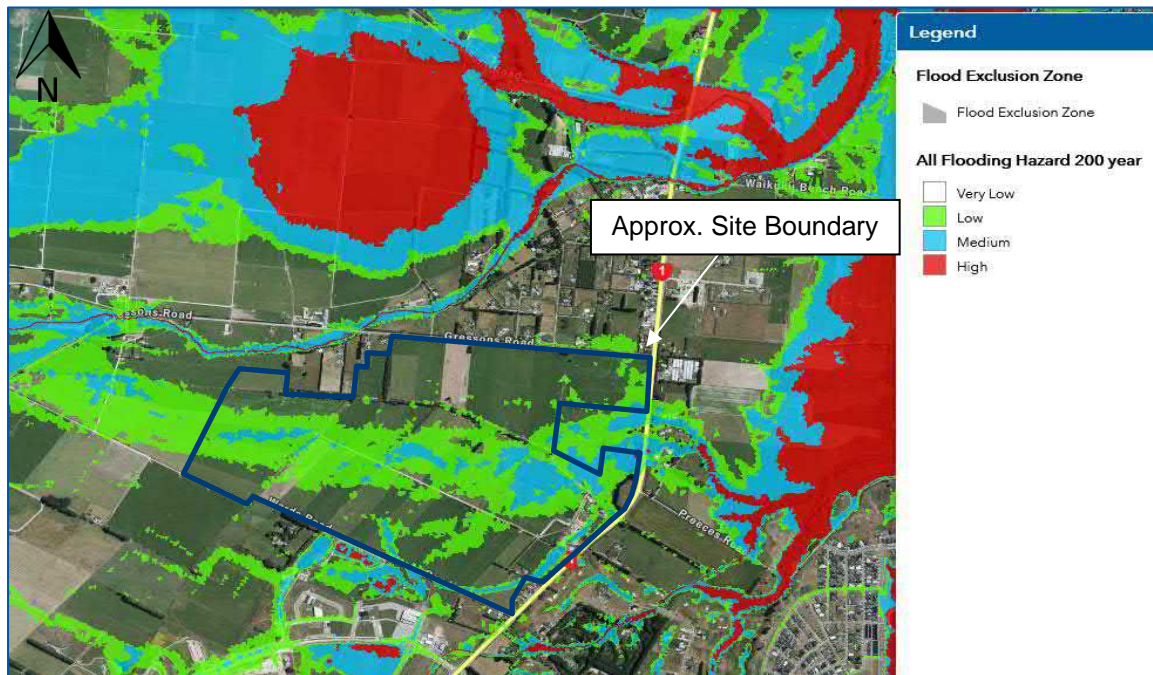
Image sourced from Google Maps. Not to scale.

### 3.2.3 Flooding

We have reviewed the Waimakariri District Council GIS database and have presented a snapshot of the map with the approximate site boundary overlain. The mapping indicates that parts of the site may be subject to a medium flood hazard (defined as inundation depth of greater than 0.3 m) during a 1 in 200 year flood event.



Figure 3: 1 in 200 Year Flood Hazard Map



Sourced from WDC Flooding GIS layer.

### 3.3 Historic Aerial Photography

We have reviewed historic aerial photographs of the site available through Canterbury Maps (Property Search) dating back to 1940. The site appears to have been used as agricultural grazing land since the earliest available photograph in 1940. In the 1940 photograph, paleo-channels are visible across the site, generally running in a west to east direction. We have highlighted one significant channel in Figure 4, which appears to correlate with an area of compressible material, refer to Section 5.4. Many of these paleo-channels appear to have been filled in the next available photograph, taken in 1960.

Several structures, inferred to be for agricultural use, were constructed in the late 1990s / early 2000s in the eastern part of the site.

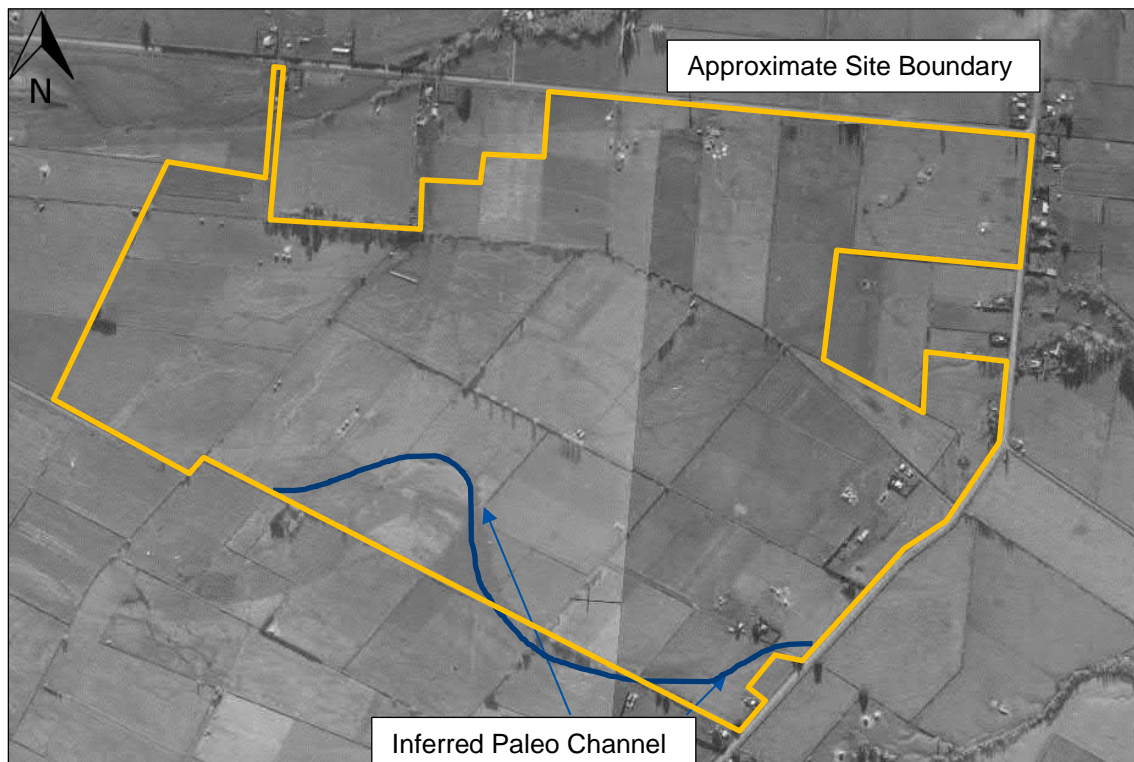
**Figure 4: 1940 Historic Aerial Photograph**

Image sourced from Canterbury Maps. Not to scale.

### 3.4 Tsunami

Assessing the risk from tsunami is outside of our scope, however, we note the site is located outside of any tsunami excavation zones defined in the Waimakariri District Plan.

### 3.5 Previous Reporting

Elliot Sinclair Ltd have previously produced a report to support the plan change of the northern part of the site (dated 27 November 2021, ref: 350494). They completed 11 CPTs (shown in Figure 5) across the northern part of the site to inform their report. Elliot Sinclair considered that the most relevant hazards to the site included surface deformation due to liquefaction and inundation due to flooding of the Ashley River. They concluded that, provided these hazards are addressed, there are no significant geotechnical constraints that would prevent the re-zoning of the land.

## 4 Site Investigation

ENGEO visited the site on 8 November 2021 and made the following observations:

- The site was generally level, agricultural land, with drainage channels and vegetated tree lines separating different paddocks. The Waikuku Stream runs beneath a driveway in the northern tip of the site, whilst another smaller stream runs through the middle of the site (see Figure 1).
- Drainage channels were typically up to 1 m depth on the south-western side of the site, increasing in depth as they flowed into the stream that ran through the site. This stream had a free face of approximately 2 m to 2.5 m depth.

- Drainage channels typically had soft, saturated ground at the base, but no active flows. The stream running through the site had water flowing in it, approximately 300 to 500 mm deep.

#### 4.1 Cone Penetration Testing

The CPT probe gathers raw data including cone tip resistance, friction sleeve resistance, and pore water pressure at 1 cm intervals during the test. This information is used to infer the soil type, soil density and water pressure in undisturbed conditions in the ground and can be used to assess the liquefaction susceptibility of the ground and to calculate geotechnical bearing capacity in the soil.

At our request, McMillan Drilling Ltd pushed 40 CPTs at the approximate location shown on the test location plan in Figure 5. Thirteen tests were pushed to a target depth of 15 m, three were pushed until they met practical refusal and the remaining 24 were pushed to a target depth of 10 m. The CPT logs are attached to this report in Appendix 3.

The CPTs west and southeast of the site generally met practical refusal on an inferred shallow gravel or dense gravelly sand layer. CPTs through the centre of the site did not intercept this layer and generally met target depth.

Figure 5: Investigation Location Plan



Image sourced from LINZ and edited in DataNest. Not to scale.

## 4.2 Groundwater

CPT holes were dipped by McMillan Drilling on the completion of each test. The groundwater levels varied between 0 m to 2.6 m across the site. CPTs 7, 8, 10, 11, 21, 22, 28, 29 and 30 encountered artesian conditions where water was flowing at the surface once the CPT rods had been removed from the hole (or encountered very shallow in the CPT hole). These CPTs appear to follow a subsurface channel that extends west to east through the site. Based on high level review of the CPT data it appears that there may be a confined layer of water bearing sand below approximately 3.5 to 4 m depth - it is possible that the artesian pressure is occurring from this layer.

Figure 5, located in Appendix 1, outlines the inferred subsurface channel where artesian water pressures have been observed.

We recommend installing several multi-stage piezometers though this area to better understand where the artesian water pressures are occurring and how they may affect the proposed development.

## 4.3 Discussion on Inferred Geological Profile

The testing to date indicates that the composition of the subsurface soils is highly variable across the site. This is consistent with the alluvial depositional environment where rivers have avulsed across the landscape over time, creating a layered subsurface profile comprising loose silts, sands, peat, sensitive fine-grained soils and gravel layers. Given the proximity of the site to the coastline, marginal marine deposits may also be present, which are likely to be susceptible to liquefaction.

A comprehensive geological model should be formed during the subdivision consent stage to assist in informing the master planning decisions for the site.

# 5 Geotechnical Assessment

Based on our review of mapped land damage in the surrounding area of the site and the ground conditions encountered in our investigations, we consider surface deformation due to liquefaction and consolidation settlement of the soft compressible material encountered in our geotechnical investigation to be the primary geotechnical considerations for the site. As such, we have carried out assessments of the liquefaction potential and a preliminary assessment of the long-term consolidation settlement potential of the site using on-site CPT data. Analysis methods, parameters and results are outlined in the following sections.

## 5.1 Seismic Subsoil Class

For the purpose of seismic design, we consider the soil classification in line with NZS 1170.5:2004 to most likely be 'Class D – Deep or soft soil sites'.

## 5.2 Liquefaction Assessment

### 5.2.1 Soil Liquefaction

Liquefaction results from loss of strength during cyclic loading, such as imposed by earthquakes. The liquefaction potential of a site depends on the presence, and thickness of potentially liquefiable soil (sands and silts below the groundwater table), and the intensity of earthquake shaking at the site.

Liquefaction can lead to settlement of the ground surface, sand boil formation (ejected liquefied material), ground cracking and lateral displacement of the ground surface, slope instability, and differential and vertical settlement of foundations.

We have undertaken a liquefaction assessment using the on-site and CPT data and liquefaction procedures described in the following sections. We have included both the Elliot Sinclair CPTs (refer Section 3.5) and the CPTs completed as part of our geotechnical investigation.

### 5.2.2 Ground Motion Parameters for Liquefaction Assessment

We have assessed the likelihood of liquefaction triggering and post-liquefaction induced vertical settlement occurring at the site for design earthquake scenarios in accordance with NZS 1170, Module 1 of MBIE's Geotechnical Engineering Practice Guidance. Based on our understanding of the intended use and capacity of the development we assume that the proposed buildings will be Importance Level 2 (IL2), with a design life of 50 years. According to NZS 1170.5:2004, Importance Level 2 buildings are required to be designed to resist earthquake shaking with an annual probability of exceedance of 1/500 (i.e. a 500 year return period) at Ultimate Limit State (ULS) design seismic loading. It is necessary that buildings are designed to tolerate the ULS loading without collapse or endangering life. Furthermore, Importance Level 2 buildings should sustain little or no structural damage under a Serviceability Limit State (SLS) design load case, which is based on earthquake shaking with a 25-year return period. The design scenarios and performance requirements for each scenario are outlined in Table 1.

**Table 1: Seismic Design Scenarios**

Design Case	Seismic Performance Expectations	Assumed Site Class / Importance Level / Design Life	Return Interval	PGA (g)	Magnitude
ULS	Under Ultimate Limit State (ULS) seismic loading the structure should be able to accommodate the potential deformations without structural collapse and protect the safety of the occupants.	Class D/ IL2/ 50 years	500 yrs	0.35	7.5
ILS	Intermediate Limit State (ILS) -. The Waimakariri District Plan liquefaction mitigation design standards (Table 32.3) sets a limit of 100 mm of liquefaction induced vertical settlement and 250 mm of lateral spreading at an intermediate limit state of 1 in 150 year event. This earthquake scenario represents an intensity of shaking that is considered to have a high likelihood of occurring within the land use planning horizon.		150 yrs	0.20	7.5
SLS			25 yrs	0.13	7.5

Design Case	Seismic Performance Expectations	Assumed Site Class / Importance Level / Design Life	Return Interval	PGA (g)	Magnitude
	Under Serviceability Limit State (SLS) design seismic loading, the expectation is that deflections do not result in damage causing loss of function of the structure and that damage is readily repairable.			0.19 <sup>2</sup>	6 <sup>2</sup>

<sup>1</sup>ILS scaled from the ULS design case using the Return Period Factor for IL2 from Table B1 of the MoE Structural and Geotechnical Guidelines.

<sup>2</sup>As per Issue 7, Update 50 of the clarifications and updates to the 2012 MBIE Guidance. This second SLS case should be assessed when using the B&I liquefaction triggering procedure.

### 5.2.3 Liquefaction Triggering

- Liquefaction triggering method: Boulanger and Idriss (2014) as prescribed by MBIE.
- Design ground motions (detailed in Table 1).
- A threshold probability of liquefaction ( $P_L$ ) of 16% for design earthquake loading.
- A soil behaviour type index ( $I_c$ ) cut-off value of 2.6 to differentiate between susceptible and non-susceptible to liquefaction soils.
- For purposes of liquefaction analysis, we have adopted the groundwater level that the dip test following each CPT recorded. Where CPTs were not able to be dipped (due to hole collapse) we have averaged the dipped groundwater levels for surrounding CPTs. The assumed water level is shown on the analysis outputs.

#### Consequences of Liquefaction

- Vertical Settlement - The Zhang, Robertson, and Brachman (2002) procedure for estimating volumetric strain and vertical settlement.
- Surface Expression of Liquefaction - We have estimated surface expression of liquefaction (e.g. sand boil formation) through the index parameter Liquefaction Severity Number (LSN).

### 5.2.4 Liquefaction Analysis Results

Results of our liquefaction analysis are presented in Appendix 4, with the liquefaction analysis outputs are included in Appendix 5. The site was found to be generally consistent with Technical Category 2 criteria, with localised areas experiencing TC3-like deformations.

Based on the results of our analysis we have mapped these areas across the site, refer to Appendix 2. Also included are areas of uncertainty of the deeper geological profile where the CPTs met shallow refusal. These areas will require further investigation (using machine boreholes); however, we do not consider this needs to be completed until the subdivision consent stage. Note that while the analysis indicated that some areas of the site may be in line with TC1 type performance, we consider that these areas should be considered as TC2 due to the significant variation of the geological profile across the site. This could be further refined through a more detailed testing regime to assess boundaries between the inferred technical categories across the site.

### 5.3 Lateral Spread

Given the civil / landscaping design of the site wide landform has not yet been developed we have not specifically addressed lateral spread. This should be assessed during the subdivision consent works. We recommend avoiding forming large bodies of water such as those at the neighbouring Pegasus development as these form “free-faces” for the ground surface to move towards during a seismic event when liquefaction occurs.

### 5.4 Preliminary Consolidation Analysis

Weak cohesive material such as the estuarine deposits identified in the CPTs can be susceptible to consolidation over time. The consolidation rate can be increased when additional load is placed on the site due to the proposed new dwelling. To estimate the consolidation potential on this site, we have completed a preliminary settlement calculation using the geotechnical software CPet-IT. While we have not completed any consolidation or lab testing of the subsurface materials, we consider this is appropriate as a “first-pass” to indicate the likely consolidation potential.

#### 5.4.1 Consolidation Analysis Parameters

As a subdivision earthworks plan has not yet been developed we have considered a generalised fill load across the approximate area of a residential building. We have considered the following parameters for the analysis:

- We have assumed that any fill will be placed on the material directly below topsoil. For this preliminary analysis we have considered a 20 m wide and 1.0 m deep fill platform founded directly below topsoil. This has been modelled as a fill pressure of 20 kPa acting at 0.3 m below ground level.
- This scenario has been modelled for six months of primary settlement and 600 months (50 years) of secondary settlement, which we assume is the design life of the structures within the proposed development.

#### 5.4.2 Analysis Results

Results of our consolidation analysis are presented in Figure 5, with the outputs attached to this report in Appendix 6. The analysis calculates that large areas of the site may be susceptible to consolidation settlement of the soft cohesive material identified in many of the CPTs. More than 25 mm is predicted over the assumed 50 year design life for large parts of the centre and north of the site, whilst over 50 mm is predicted for an area in the south of the site and a small section in the centre of the site. As noted in section 3.3, the area of highly compressible material in the south of the site appears to correlate with an infilled paleo-channel. Also mapped in Figure 5 are areas of large uncertainty, due to shallow CPT refusal.

These settlements are outside of the acceptable tolerance for a residential structure, and as such must be mitigated during subdivision design

## 6 Geo-Hazard Assessment

Based on our observations and analyses, we consider the primary geohazards to be surface deformation due to liquefaction, and long-term consolidation settlement of soft cohesive or organic material across areas of the site (see Appendices 1 and 2 for our hazard maps – specifically areas mapped as TC3 or over 50 mm of long term consolidation settlement). The risks presented by these

hazards can be mitigated through earthworks, ground improvement or specifically engineered foundations. We therefore do not consider that these hazards should preclude this site from progressing through plan change, however, additional work will be required during the Subdivision Consent phase to refine the geological ground model to more accurately define the boundaries of these areas and the options available to remediate them.

We also recommend that the flooding hazard (noted in Section 3.2.3) is considered during civil engineering subdivision design. Assessment of the effects of tsunami is outside of our scope, however, a brief review of the WDC natural hazards viewer shows the evacuation zones terminating on the eastern side of State Highway 1 (i.e. outside of the site boundary).

## 7 Conclusions and Future Works

In conclusion, we consider this site can be developed through industry standard practices found in the Canterbury Region and that the ground conditions are generally similar to the Ravenswood and Pegasus Developments. Further geotechnical assessment works will be required as the project progresses into subdivision consent and the works may include:

- Undertaking additional geotechnical testing across the site to further delineate the boundaries between TC1, TC2 and TC3 type performance across the site and the areas through which significant amounts of compressible material may be present. Further testing is also required in the areas of shallow CPT refusal, particularly in the east of the site, to more accurately define the deeper geological profile in these areas.
- Groundwater monitoring, especially in areas that have artesian pressures.
- Laboratory sampling including fines content analyses to refine the liquefaction analyses and 1D Consolidation testing if significant peat deposits are encountered.
- Understanding the implications of artesian water pressures for the proposed development as discussed in Section 4.2.

## 8 Sustainability

We encourage you to consider sustainability when assessing the options available for your project. Where suitable for the project, we recommend prioritising the use of sustainable building materials (such as timber in favour of concrete or steel), locally sourced (materials readily available to Contractors as opposed to materials requiring import), and installed in an environmentally friendly way (e.g., reduced carbon emissions and minimal contamination). If you would like to discuss these options further, ENGE staff are available to offer suggestions.

Site won material should be used wherever possible to minimise the environmental impact of the project. Where site won materials are unsuitable first consider mechanical stabilisation of the fill as an alternative to imported material, and when imported material is still required, consider using recycled aggregates such as crushed concrete – which can absorb carbon out of the atmosphere due to the carbonation process.



## 9 Limitations

- i. We have prepared this report in accordance with the brief as provided. This report has been prepared for the use of our client, Westside Country Ltd, their professional advisers and the relevant Territorial Authorities in relation to the specified project brief described in this report. No liability is accepted for the use of any part of the report for any other purpose or by any other person or entity.
- ii. The recommendations in this report are based on the ground conditions indicated from published sources, site assessments and subsurface investigations described in this report based on accepted normal methods of site investigations. Only a limited amount of information has been collected to meet the specific financial and technical requirements of the client's brief and this report does not purport to completely describe all the site characteristics and properties. The nature and continuity of the ground between test locations has been inferred using experience and judgement and it should be appreciated that actual conditions could vary from the assumed model.
- iii. Subsurface conditions relevant to construction works should be assessed by contractors who can make their own interpretation of the factual data provided. They should perform any additional tests as necessary for their own purposes.
- iv. This Limitation should be read in conjunction with the Engineering NZ/ACENZ Standard Terms of Engagement.
- v. This report is not to be reproduced either wholly or in part without our prior written permission.

We trust that this information meets your current requirements. Please do not hesitate to contact the undersigned on (03) 328 9012 if you require any further information.

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Geotechnical Engineer

## 10 References

Barrell, D. J. A., & Van Dissen, R. J. (2014). Assessment of active fault ground deformation hazards associated with the Ashley Fault Zone, Loburn, North Canterbury.

Canterbury Earthquake Recovery Authority. (2013). Canterbury Geotechnical Database. Retrieved May 2013, from <https://canterburyrecovery.projectorbit.com/cgd>

Elliot Sinclair Ltd. (2020). 81 Gressons Road and 1375 Main North Road, Waikuku Geotechnical Report. Ref: 350494.

Environment Canterbury, Canterbury Maps. Property Information. Retrieved November 2021, from <https://propertysearch.canterburymaps.govt.nz/>

Forsyth, P., Barrell, D. J., & Jongens, R. (2008). Sheet 16 - Geology of the Christchurch Area 1:250,000. Lower Hutt: Institute of Geological and Nuclear Sciences.

GNS Science, Earthquake Commission. (n.d.). Aftershocks. Retrieved 2013, from Geonet: [www.geonet.org.nz/canterbury-quakes/aftershocks](http://www.geonet.org.nz/canterbury-quakes/aftershocks)

Idriss and Boulanger. (2008). Soil Liquefaction during Earthquakes - EERI Monograph MNO12.

New Zealand Geotechnical Society and Ministry of Business, Innovation and Employment (2016). Geotechnical Earthquake Engineering Practice in New Zealand: Modules 1 to 3.

The Ministry of Business, Innovation, and Employment. (2012). Guidance-Repairing and rebuilding houses affected by the Canterbury earthquakes. Christchurch: The Ministry of Business, Innovation, and Employment.

The Ministry of Business, Innovation, and Employment (2016). New Zealand Geotechnical Database. Retrieved November 2021, from <https://www.nzgd.org.nz>

O'Rourke et al. (2012). Underground Lifeline System Performance during the Canterbury Earthquake Sequence, Proceedings of the 15<sup>th</sup> World Congress on Earthquake Engineering (15WCEE), Lisbon, Portugal, 24-28 Sep 2012.

Standards Association of New Zealand (2004). Structural Design Actions, Part 5: Earthquake Actions – New Zealand, NZS 1170.5:2004. Standards New Zealand, Wellington.

Zhang, G., Robertson, P. K., & Brachman, R. (2002). Estimating Liquefaction Induced Ground Settlements from the CPT. 39, 1168-1180.

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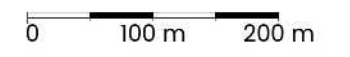
## **APPENDIX 1:**

### Compressible Material Hazard Map



**Legend**

- △ ENGEO Test Locations
- △ Elliot Sinclair CPT Locations
- Site Boundary
- ⊖ Insufficient Data
- ⬡ Approximate Area of Artesian Water Pressure
- 🟢 0 - 25 mm Settlement Over 50 Year Design Life
- 🟡 25 - 50 mm Settlement over 50 Year Design Life
- 🟤 50+ mm Settlement over 50 Year Design Life



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Produced by **Datanest.earth**

Title: Compressible Soil Areas		
Client: Westside Country Ltd.		
Project: Gresson and Main North Road	Drawn: DKi	Figure No: 5 Size: A3
Date: 22-11-2021	Checked: RC	
Proj No: P2021.005.919	Scale: 1:8250	Version: Final



**APPENDIX 2:**  
Inferred Technical Category Map



**Legend**

- CPT - (Depth of Investigation) [Liquefaction induced vertical settlement at ULS]
- Site Boundary
- Insufficient Data
- TC2
- TC3

0 100 m 200 m

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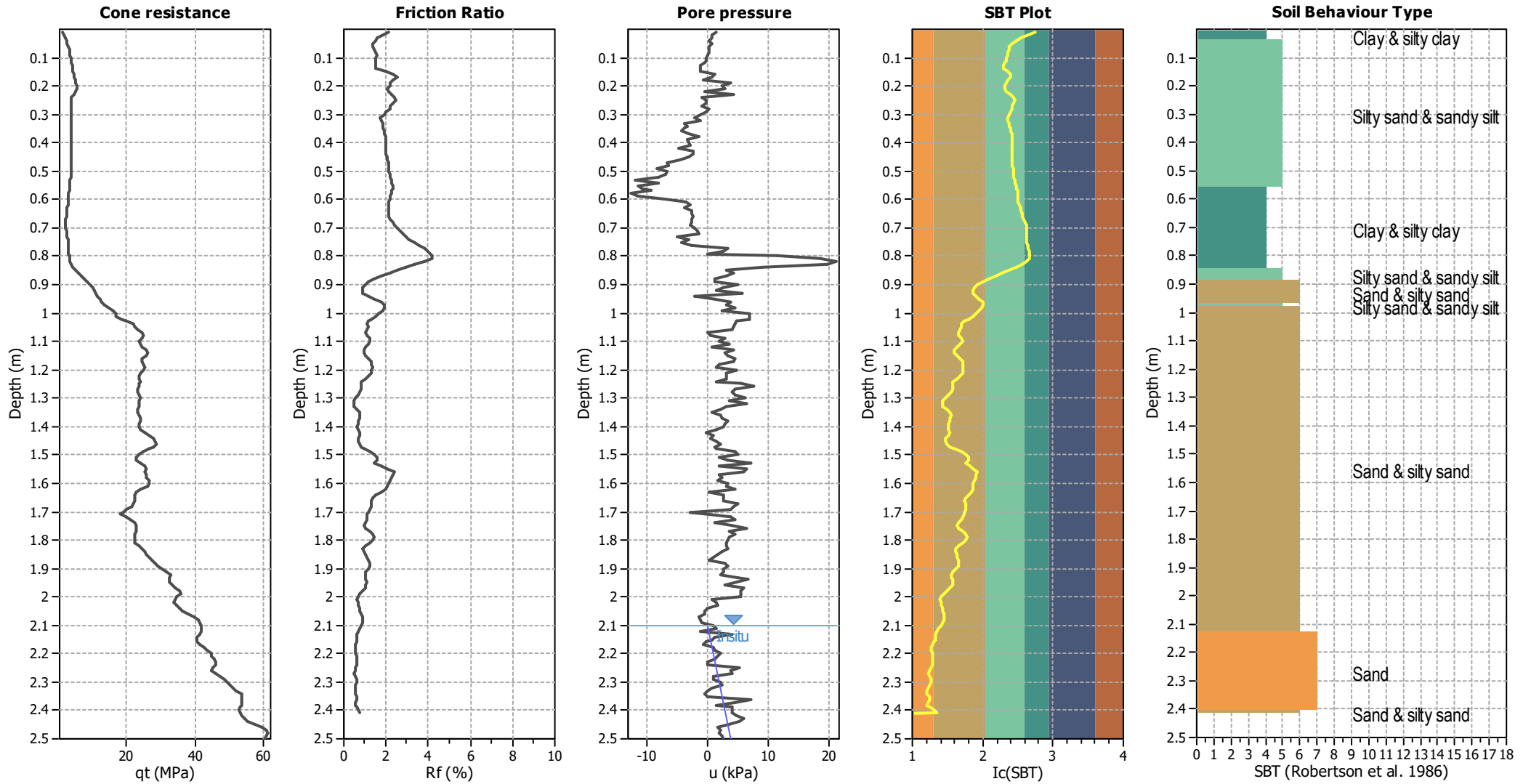
**ENGEO**

Produced by **Datanest.earth**

Title: Inferred Technical Category Map		
Client: Westside Country Ltd.		
Project: Gresson and Main North Road	Drawn: DKi	Figure No: 6 Size: A3
Date: 22-11-2021	Checked: RC	
Proj No: P2021.005.919	Scale: 1:8250	Version: Final

## **APPENDIX 3:** CPT Logs

### CPT basic interpretation plots



#### Input parameters and analysis data

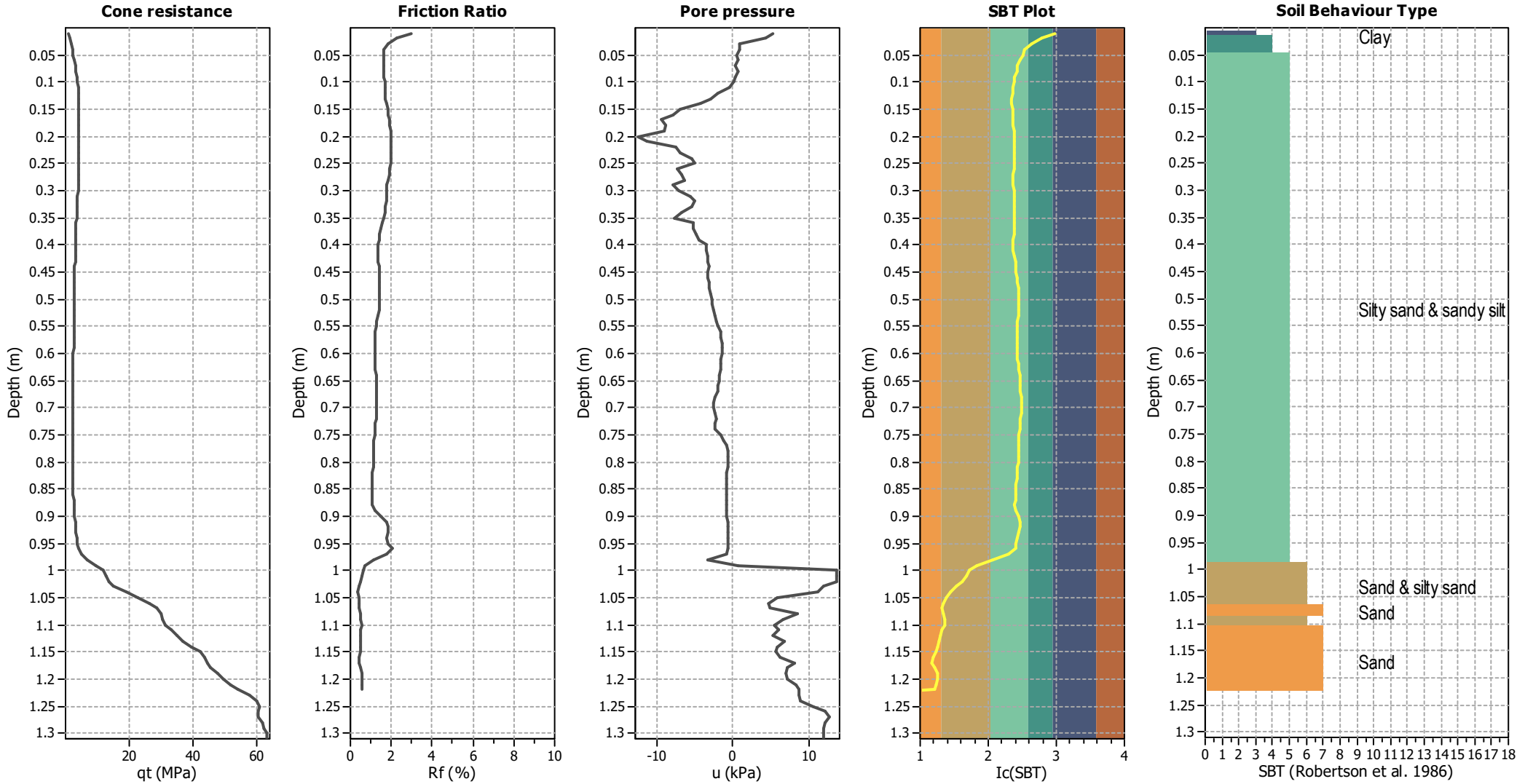
Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.10 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K <sub>0</sub> applied:	Yes
Earthquake magnitude M <sub>w</sub> :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.10 m	Fill height:	N/A	Limit depth:	10.00 m

#### SBT legend

1. Sensitive fine grained	4. Clayey silt to silty	7. Gravely sand to sand
2. Organic material	5. Silty sand to sandy silt	8. Very stiff sand to
3. Clay to silty clay	6. Clean sand to silty sand	9. Very stiff fine grained



### CPT basic interpretation plots



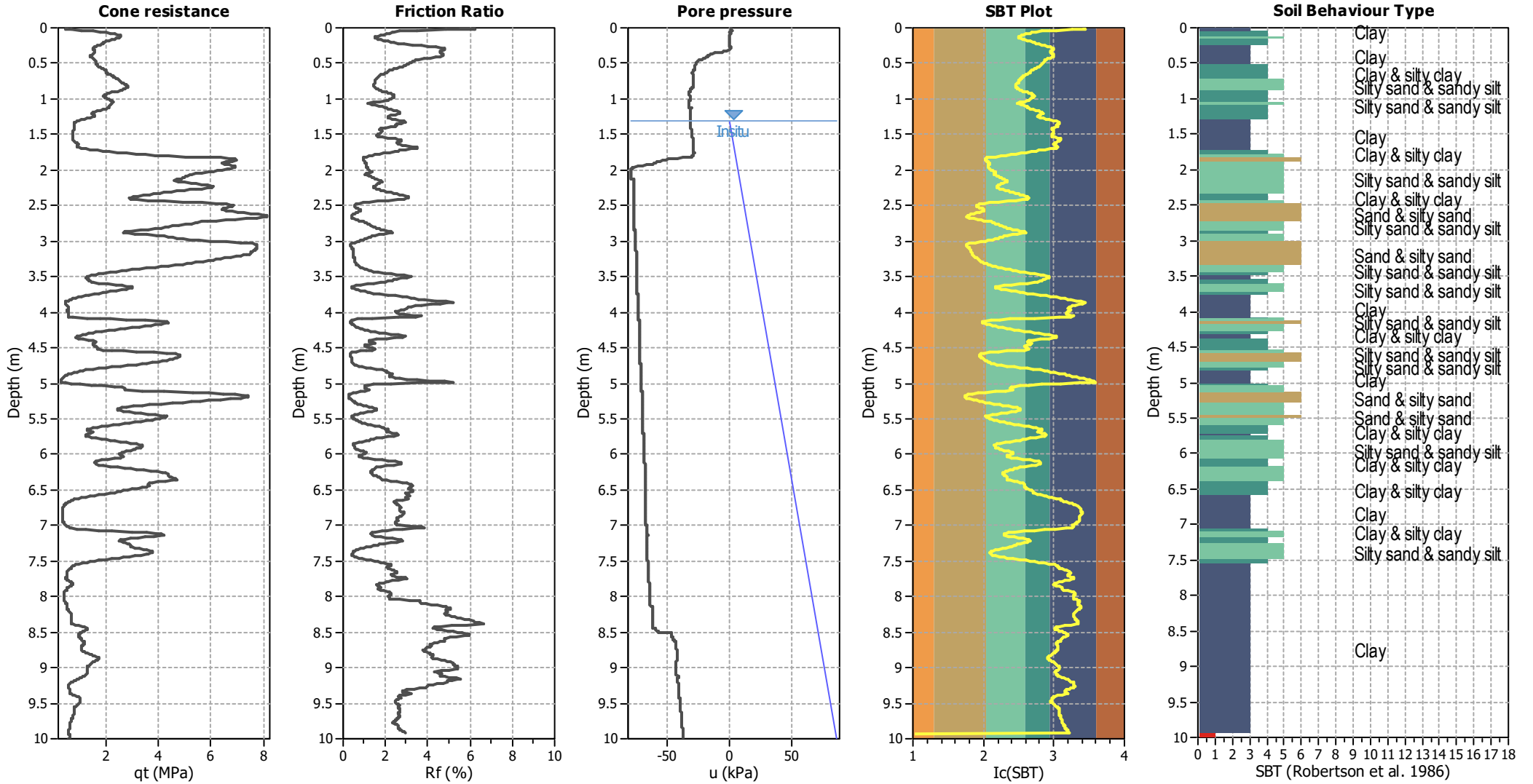
#### Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.10 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K <sub>v</sub> applied:	Yes
Earthquake magnitude M <sub>w</sub> :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.10 m	Fill height:	N/A	Limit depth:	10.00 m

#### SBT legend

1. Sensitive fine grained	4. Clayey silt to silty	7. Gravely sand to sand
2. Organic material	5. Silty sand to sandy silt	8. Very stiff sand to
3. Clay to silty clay	6. Clean sand to silty sand	9. Very stiff fine grained

### CPT basic interpretation plots



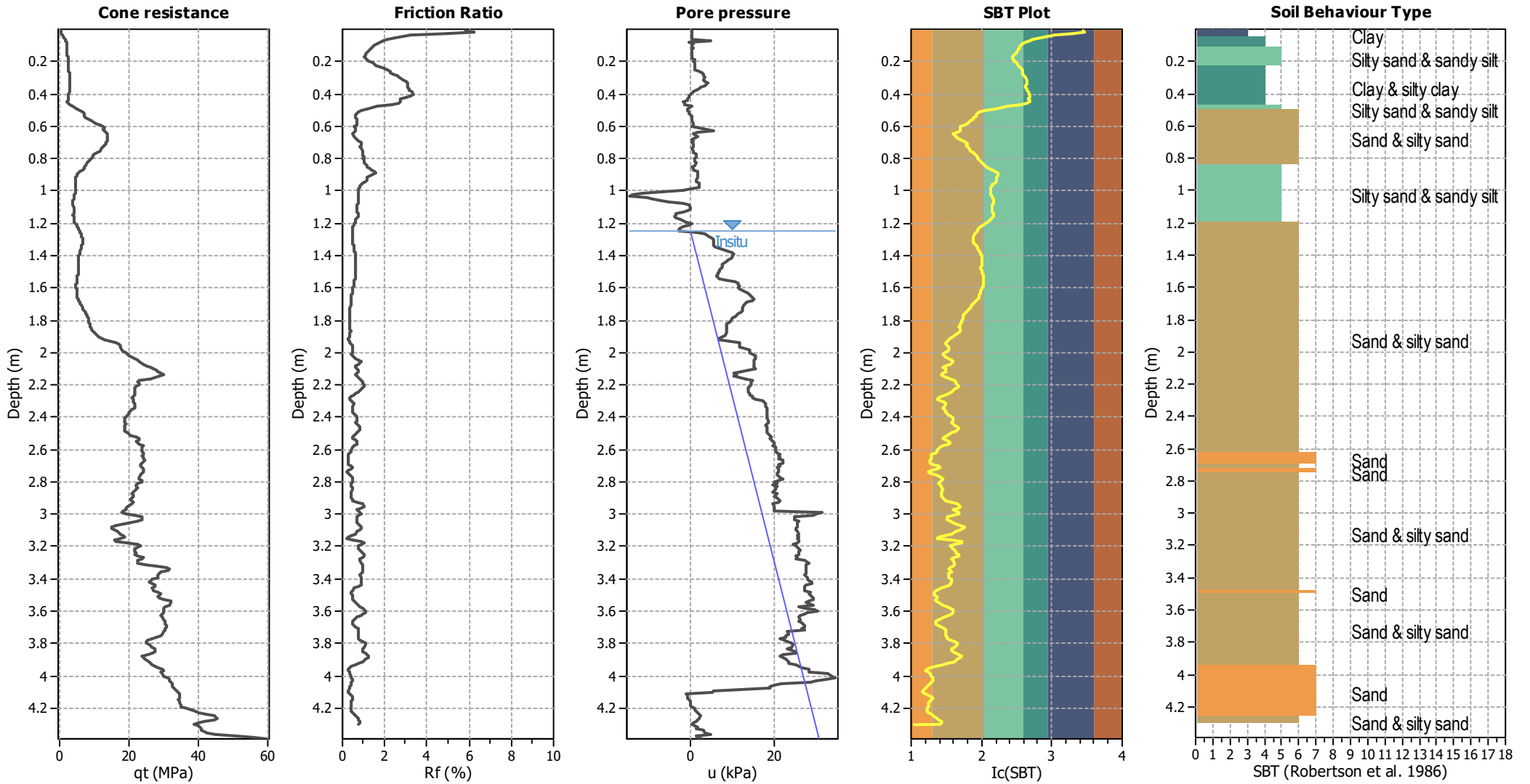
#### Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.30 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_0$ applied:	Yes
Earthquake magnitude $M_w$ :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.30 m	Fill height:	N/A	Limit depth:	10.00 m

#### SBT legend

<span style="color:red">■</span> 1. Sensitive fine grained	<span style="color:teal">■</span> 4. Clayey silt to silty	<span style="color:orange">■</span> 7. Gravely sand to sand
<span style="color:blue">■</span> 2. Organic material	<span style="color:green">■</span> 5. Silty sand to sandy silt	<span style="color:grey">■</span> 8. Very stiff sand to
<span style="color:darkblue">■</span> 3. Clay to silty clay	<span style="color:yellow">■</span> 6. Clean sand to silty sand	<span style="color:lightgrey">■</span> 9. Very stiff fine grained

### CPT basic interpretation plots



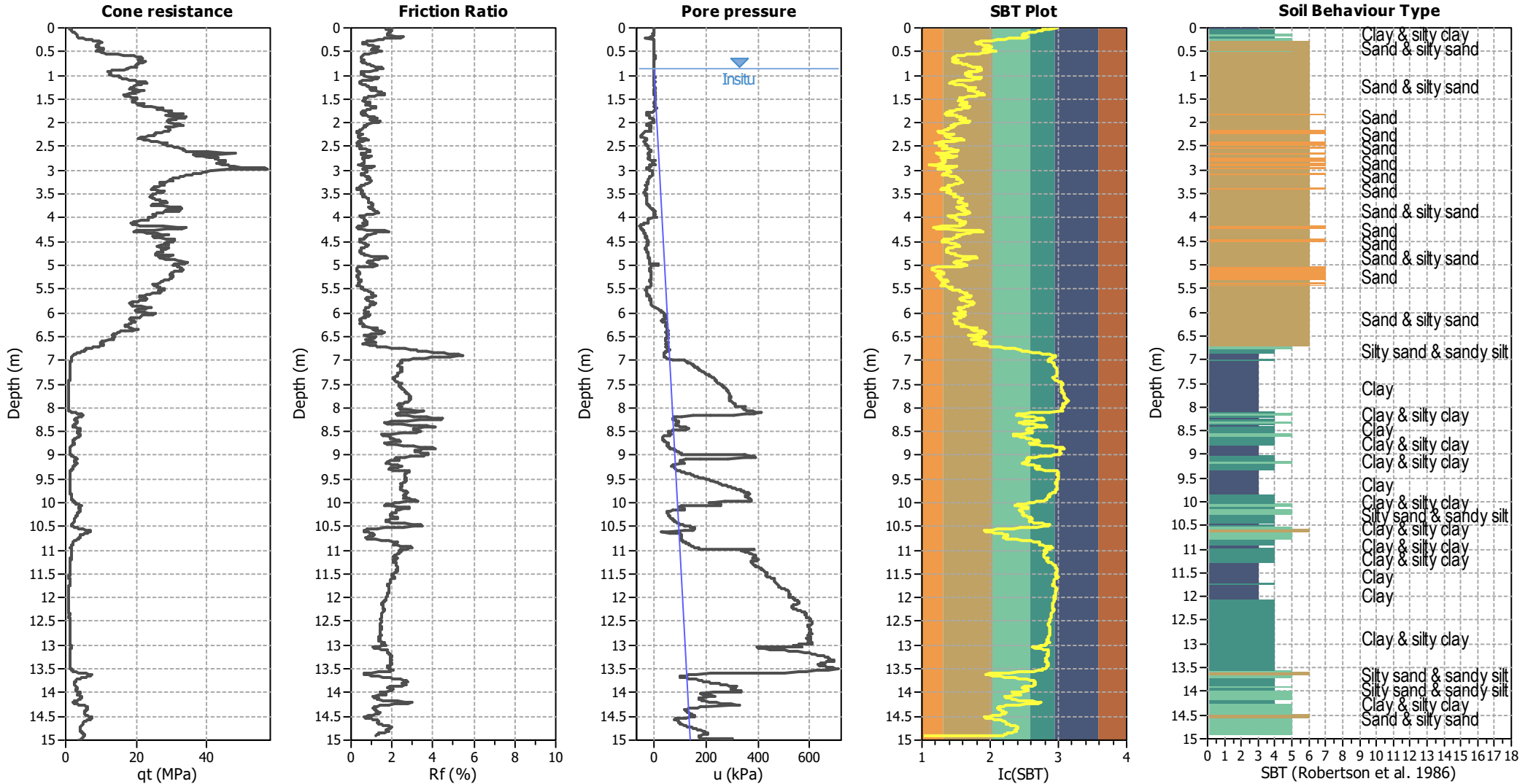
#### Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.25 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_v$ applied:	Yes
Earthquake magnitude $M_w$ :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.25 m	Fill height:	N/A	Limit depth:	10.00 m

#### SBT legend

1. Sensitive fine grained	4. Clayey silt to silty	7. Gravely sand to sand
2. Organic material	5. Silty sand to sandy silt	8. Very stiff sand to
3. Clay to silty clay	6. Clean sand to silty sand	9. Very stiff fine grained

### CPT basic interpretation plots



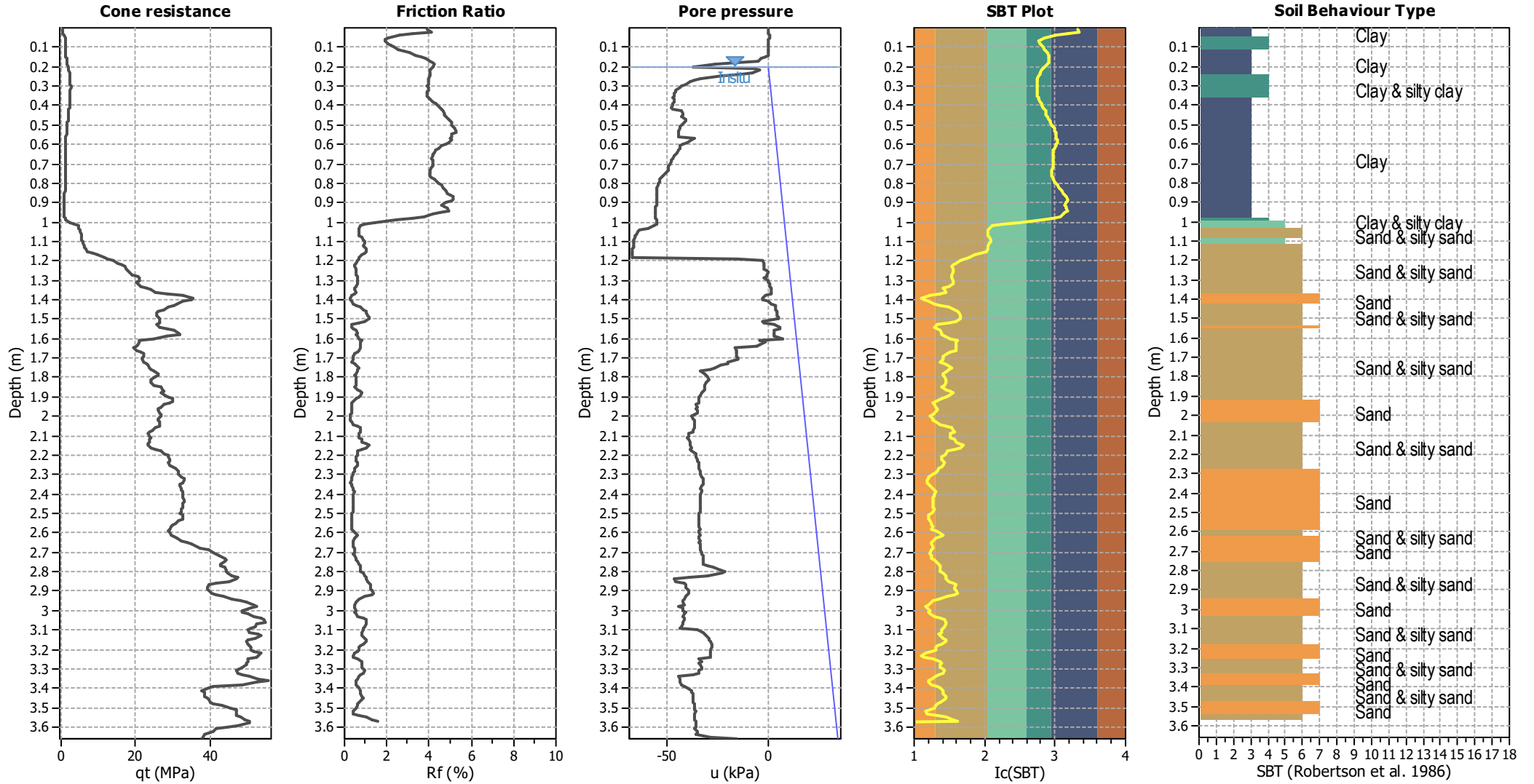
#### Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	0.85 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_f$ applied:	Yes
Earthquake magnitude $M_w$ :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	0.85 m	Fill height:	N/A	Limit depth:	10.00 m

#### SBT legend

1. Sensitive fine grained	4. Clayey silt to silty	7. Gravely sand to sand
2. Organic material	5. Silty sand to sandy silt	8. Very stiff sand to
3. Clay to silty clay	6. Clean sand to silty sand	9. Very stiff fine grained

### CPT basic interpretation plots



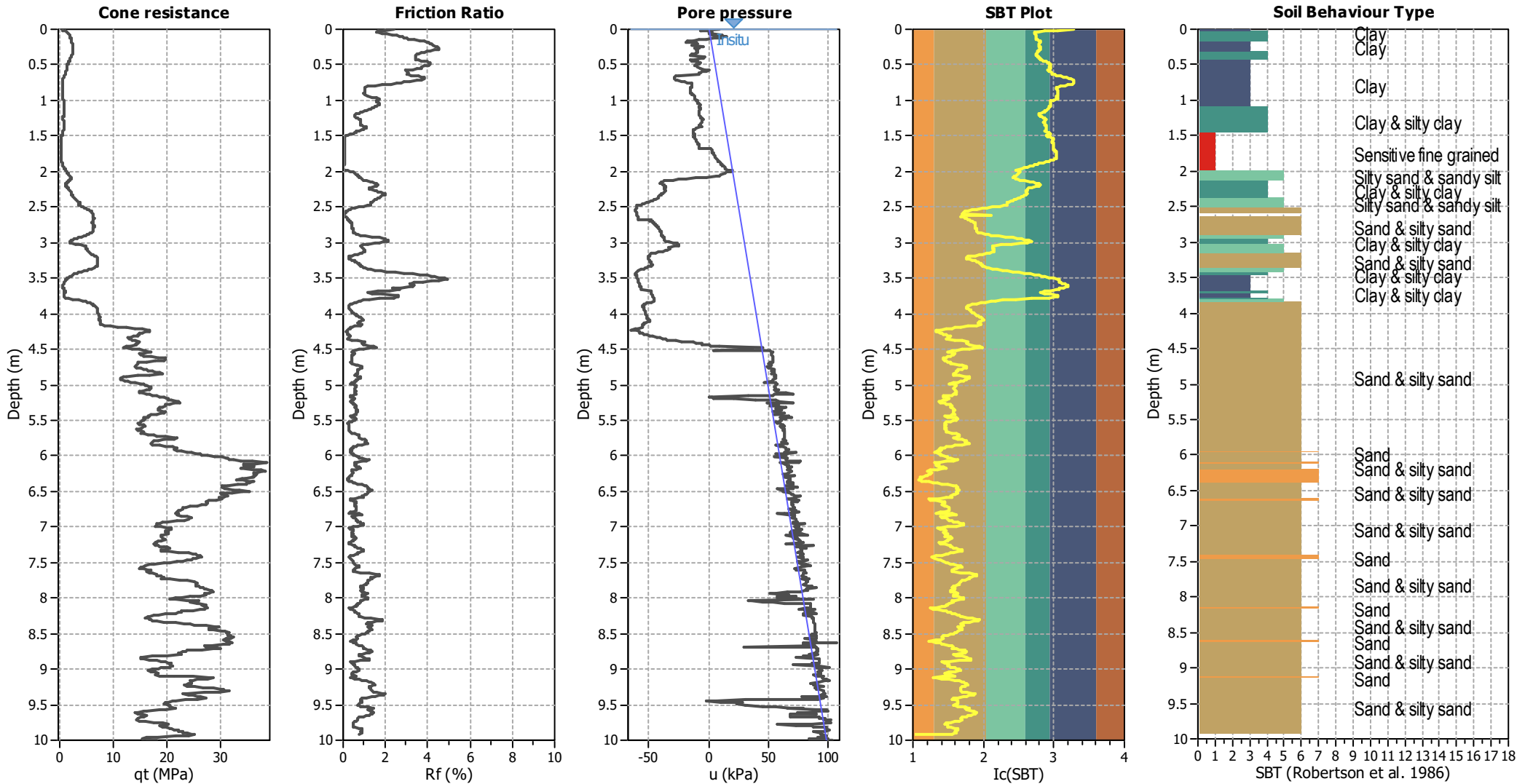
#### Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	0.20 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_v$ applied:	Yes
Earthquake magnitude $M_w$ :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	0.20 m	Fill height:	N/A	Limit depth:	10.00 m

#### SBT legend

1. Sensitive fine grained	4. Clayey silt to silty	7. Gravely sand to sand
2. Organic material	5. Silty sand to sandy silt	8. Very stiff sand to
3. Clay to silty clay	6. Clean sand to silty sand	9. Very stiff fine grained

### CPT basic interpretation plots



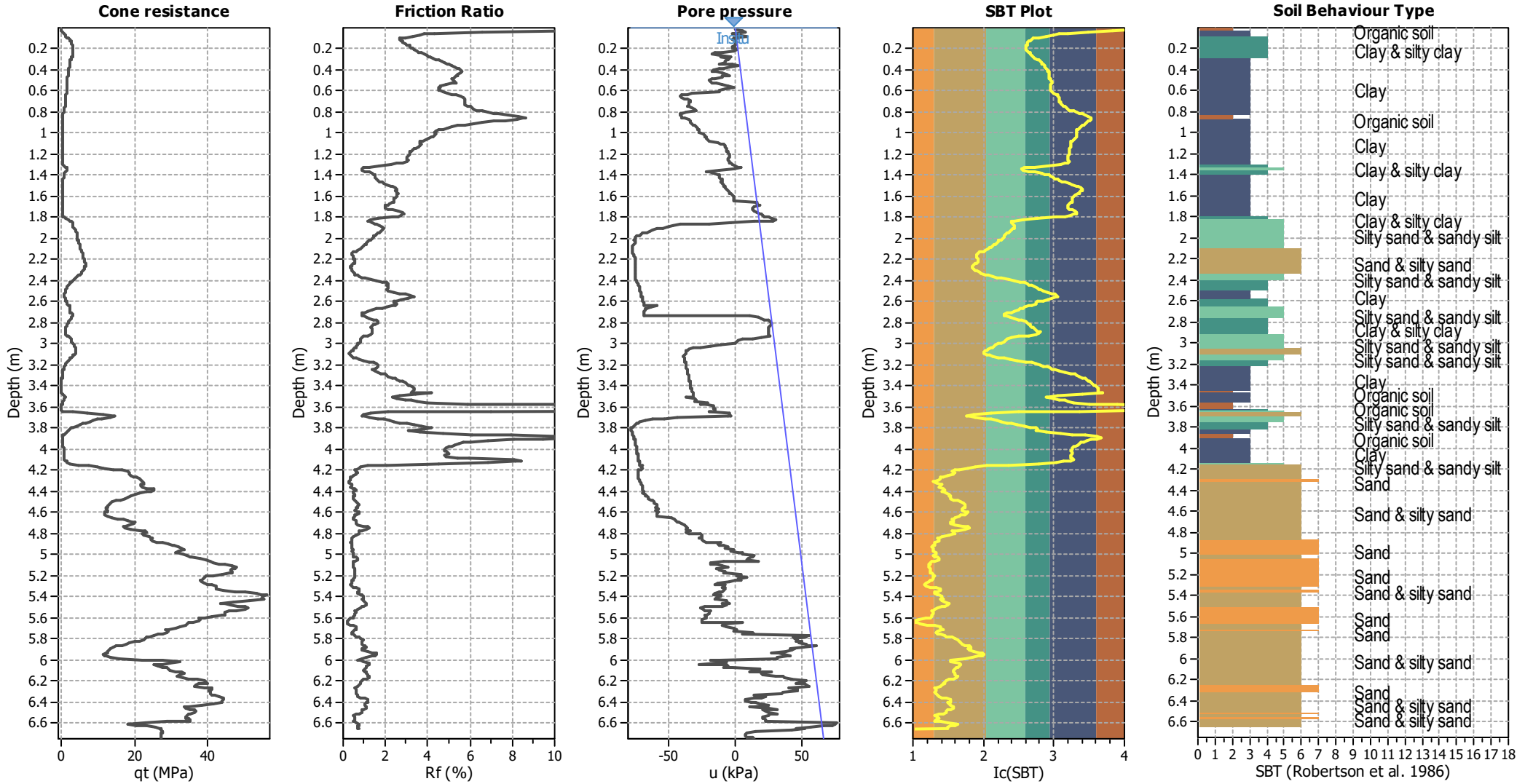
#### Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	0.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_f$ applied:	Yes
Earthquake magnitude $M_w$ :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	0.00 m	Fill height:	N/A	Limit depth:	10.00 m

#### SBT legend

<span style="color:red">■</span> 1. Sensitive fine grained	<span style="color:teal">■</span> 4. Clayey silt to silty	<span style="color:orange">■</span> 7. Gravely sand to sand
<span style="color:brown">■</span> 2. Organic material	<span style="color:green">■</span> 5. Silty sand to sandy silt	<span style="color:grey">■</span> 8. Very stiff sand to
<span style="color:darkblue">■</span> 3. Clay to silty clay	<span style="color:tan">■</span> 6. Clean sand to silty sand	<span style="color:lightgrey">■</span> 9. Very stiff fine grained

### CPT basic interpretation plots



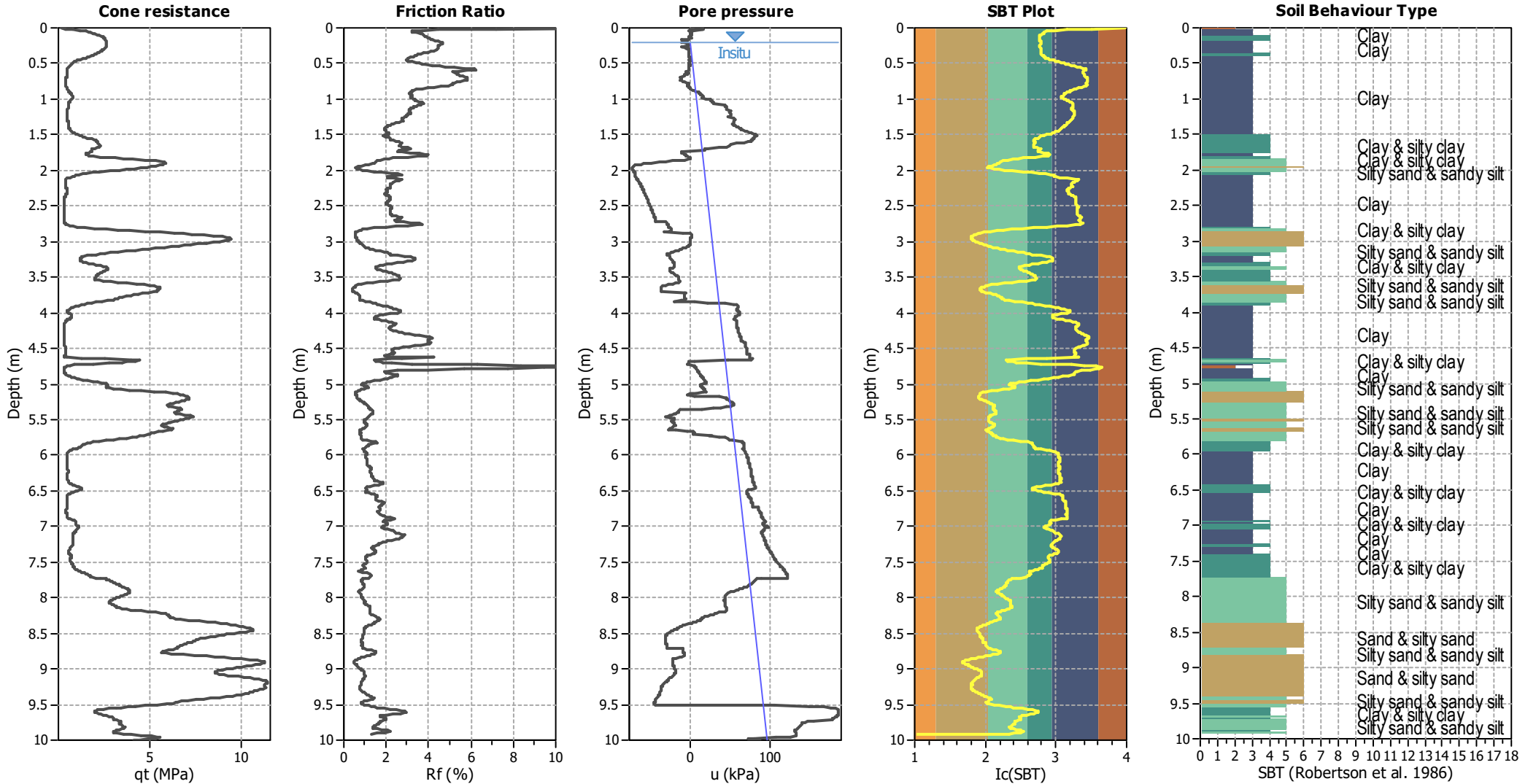
#### Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	0.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_v$ applied:	Yes
Earthquake magnitude $M_w$ :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	0.00 m	Fill height:	N/A	Limit depth:	10.00 m

#### SBT legend

1. Sensitive fine grained	4. Clayey silt to silty	7. Gravely sand to sand
2. Organic material	5. Silty sand to sandy silt	8. Very stiff sand to
3. Clay to silty clay	6. Clean sand to silty sand	9. Very stiff fine grained

### CPT basic interpretation plots



#### Input parameters and analysis data

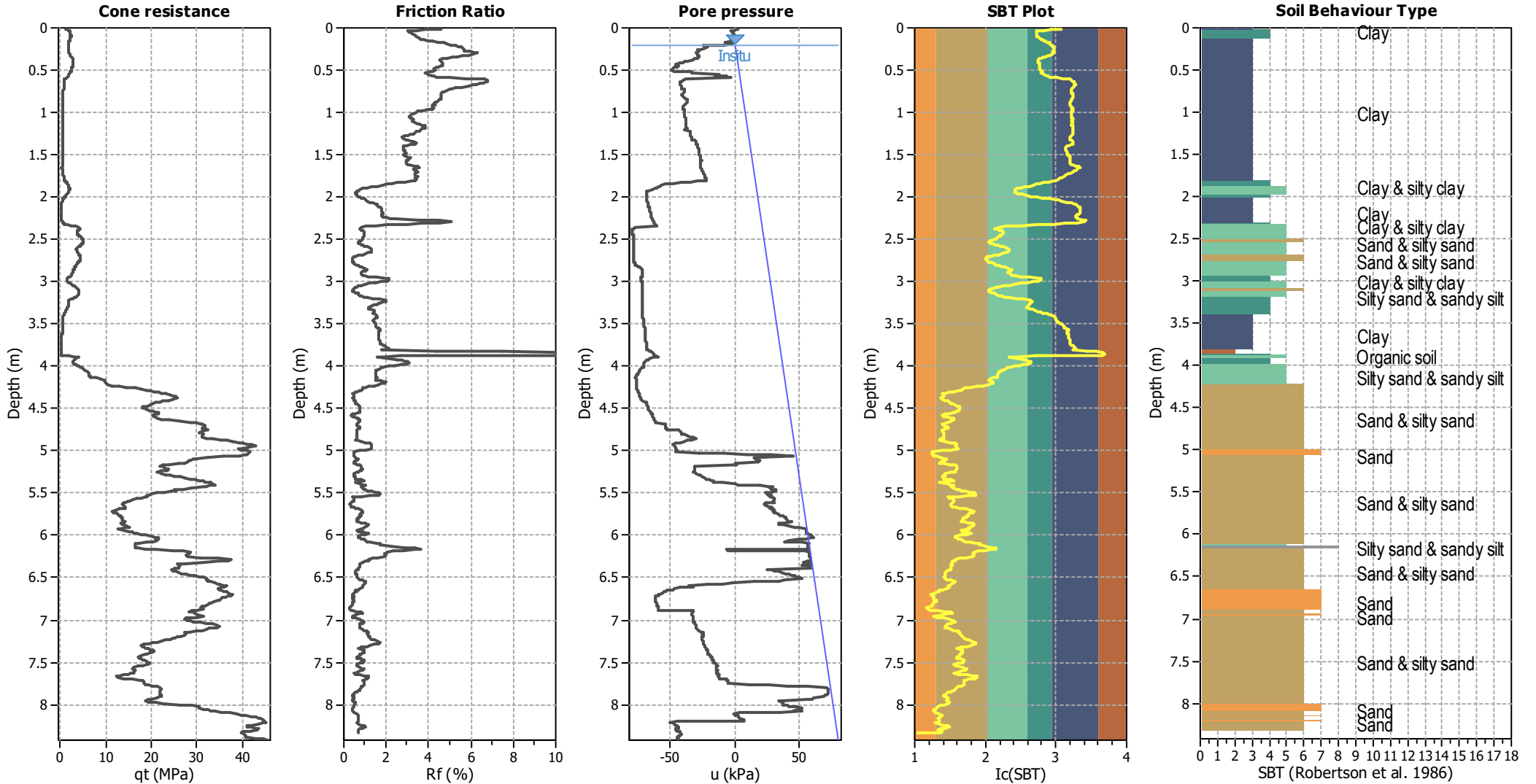
Analysis method:	B&I (2014)	Depth to GWT (erthq.):	0.20 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_0$ applied:	Yes
Earthquake magnitude $M_w$ :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	0.20 m	Fill height:	N/A	Limit depth:	10.00 m

#### SBT legend

1. Sensitive fine grained	4. Clayey silt to silty	7. Gravely sand to sand
2. Organic material	5. Silty sand to sandy silt	8. Very stiff sand to
3. Clay to silty clay	6. Clean sand to silty sand	9. Very stiff fine grained



### CPT basic interpretation plots



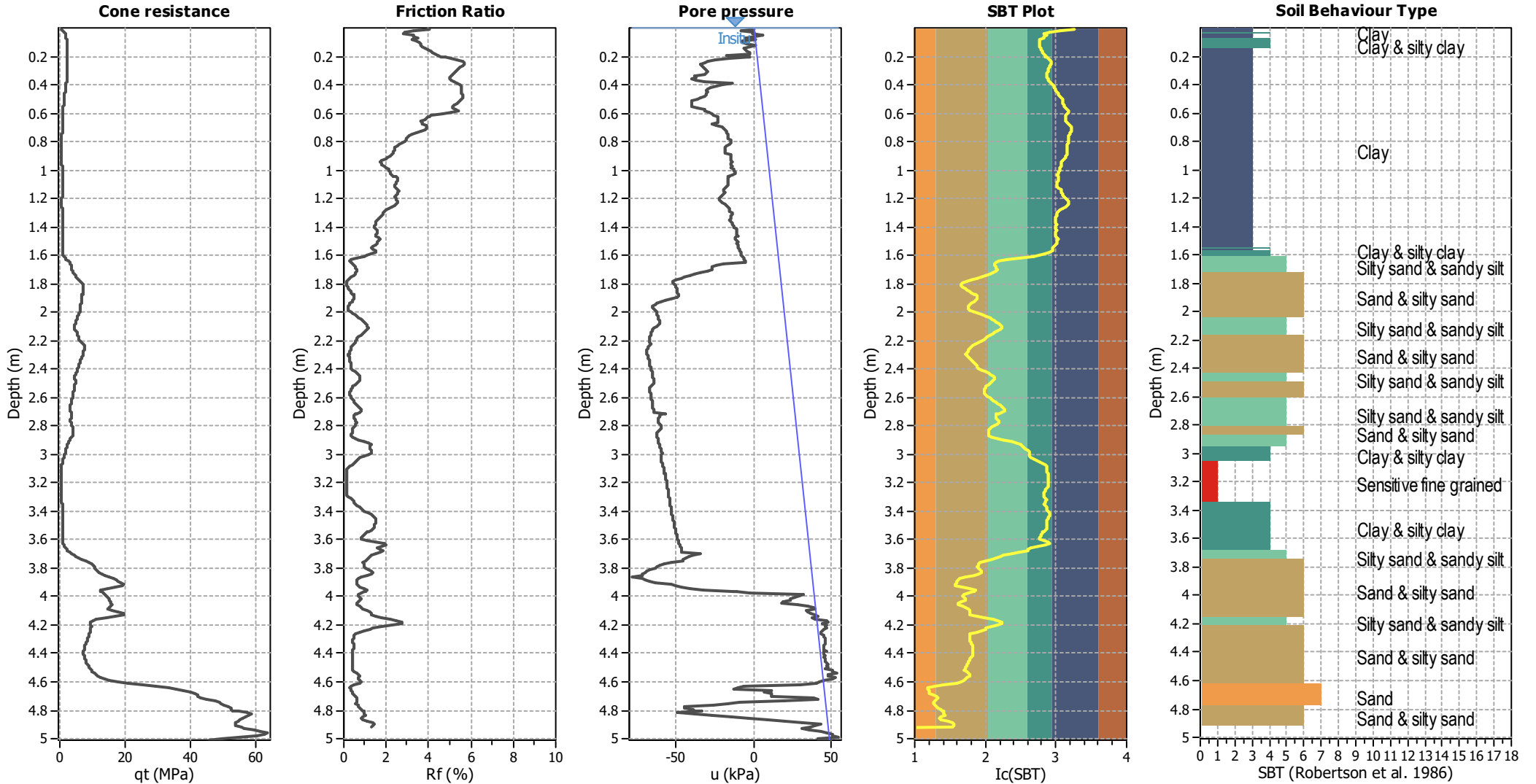
#### Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	0.20 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_v$ applied:	Yes
Earthquake magnitude $M_w$ :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	0.20 m	Fill height:	N/A	Limit depth:	10.00 m

#### SBT legend

1. Sensitive fine grained	4. Clayey silt to silty	7. Gravely sand to sand
2. Organic material	5. Silty sand to sandy silt	8. Very stiff sand to
3. Clay to silty clay	6. Clean sand to silty sand	9. Very stiff fine grained

### CPT basic interpretation plots



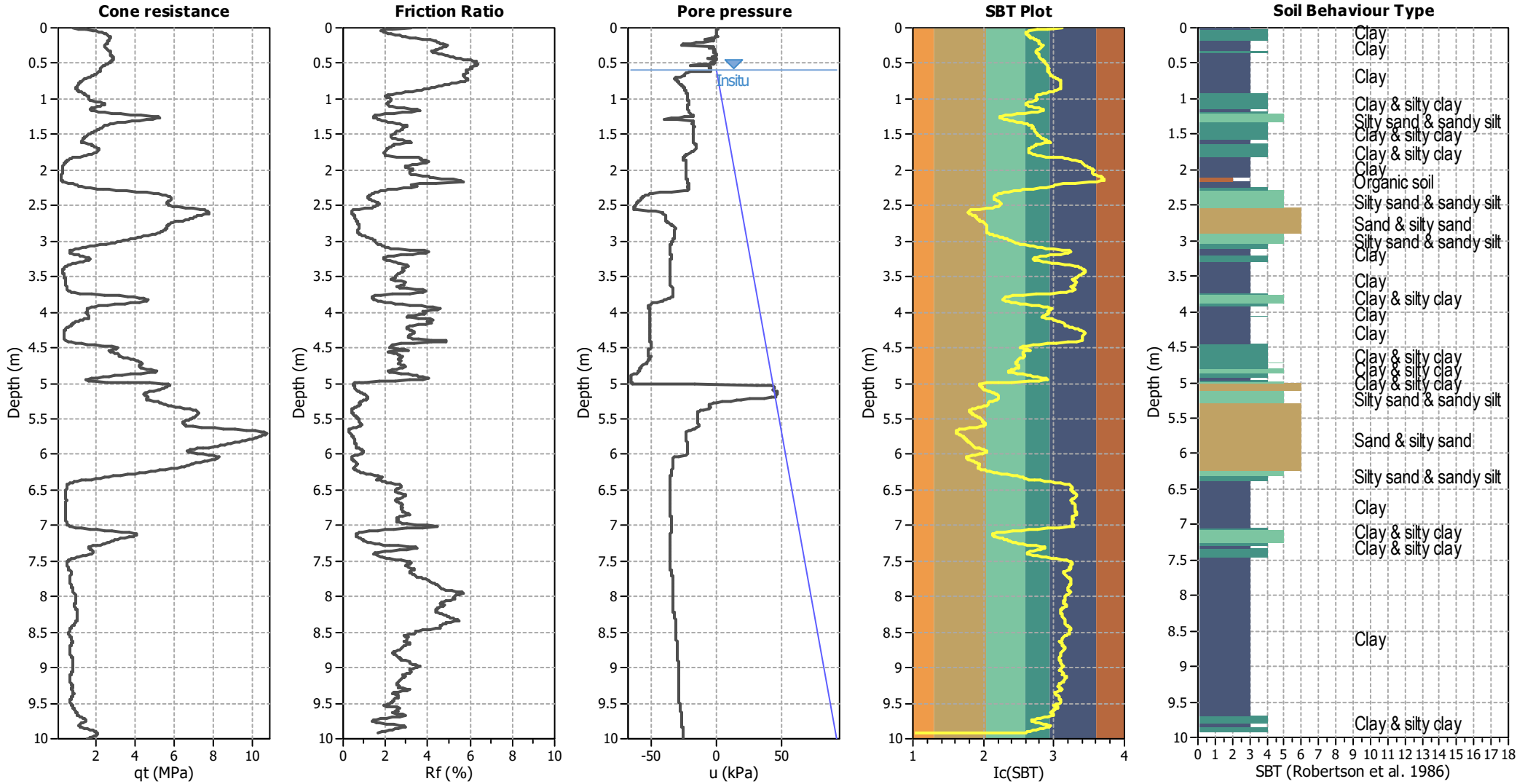
#### Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	0.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_0$ applied:	Yes
Earthquake magnitude $M_w$ :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	0.00 m	Fill height:	N/A	Limit depth:	10.00 m

#### SBT legend

1. Sensitive fine grained	4. Clayey silt to silty	7. Gravely sand to sand
2. Organic material	5. Silty sand to sandy silt	8. Very stiff sand to
3. Clay to silty clay	6. Clean sand to silty sand	9. Very stiff fine grained

### CPT basic interpretation plots



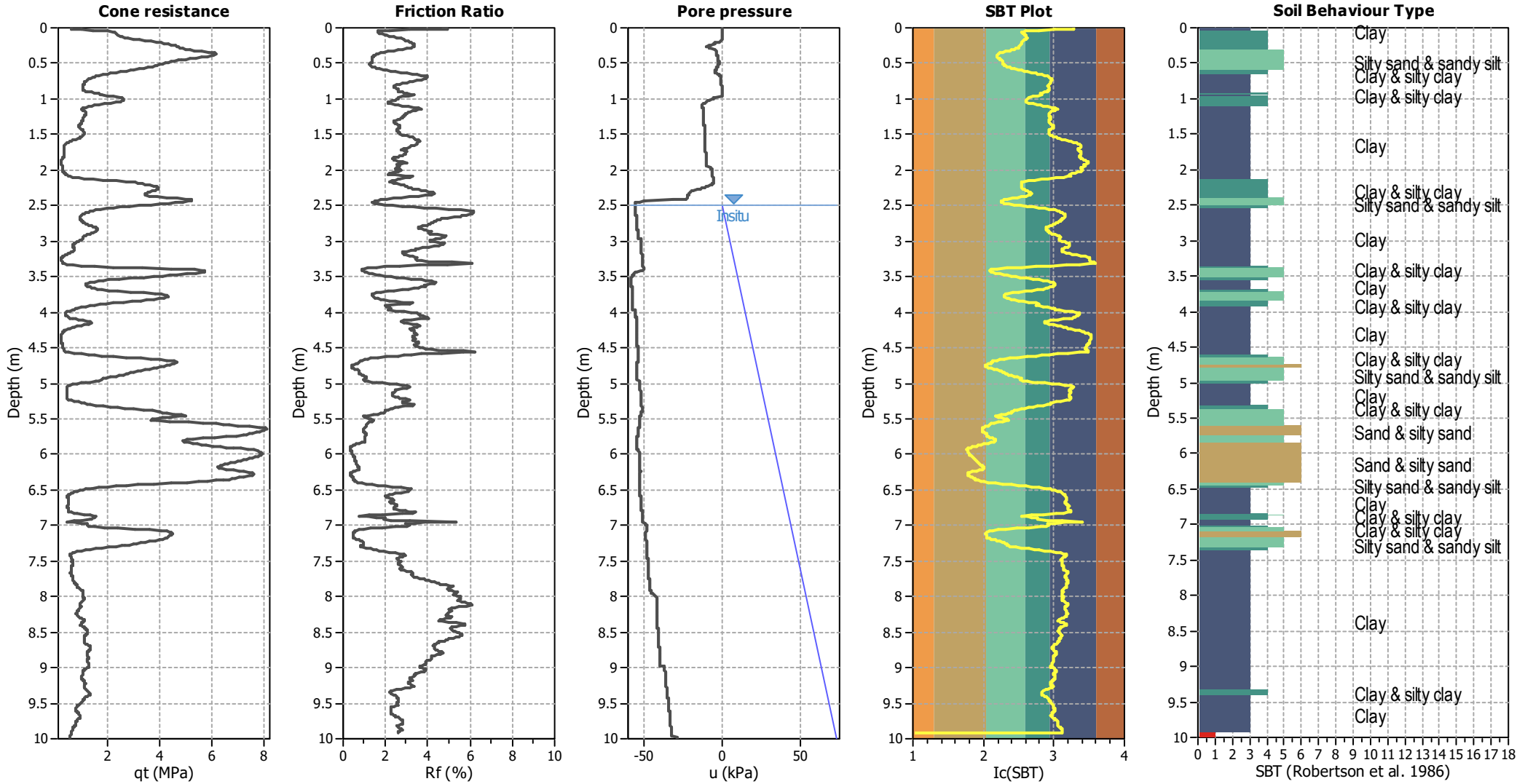
#### Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	0.60 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K <sub>0</sub> applied:	Yes
Earthquake magnitude M <sub>w</sub> :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	0.60 m	Fill height:	N/A	Limit depth:	10.00 m

#### SBT legend

1. Sensitive fine grained	4. Clayey silt to silty	7. Gravely sand to sand
2. Organic material	5. Silty sand to sandy silt	8. Very stiff sand to
3. Clay to silty clay	6. Clean sand to silty sand	9. Very stiff fine grained

### CPT basic interpretation plots



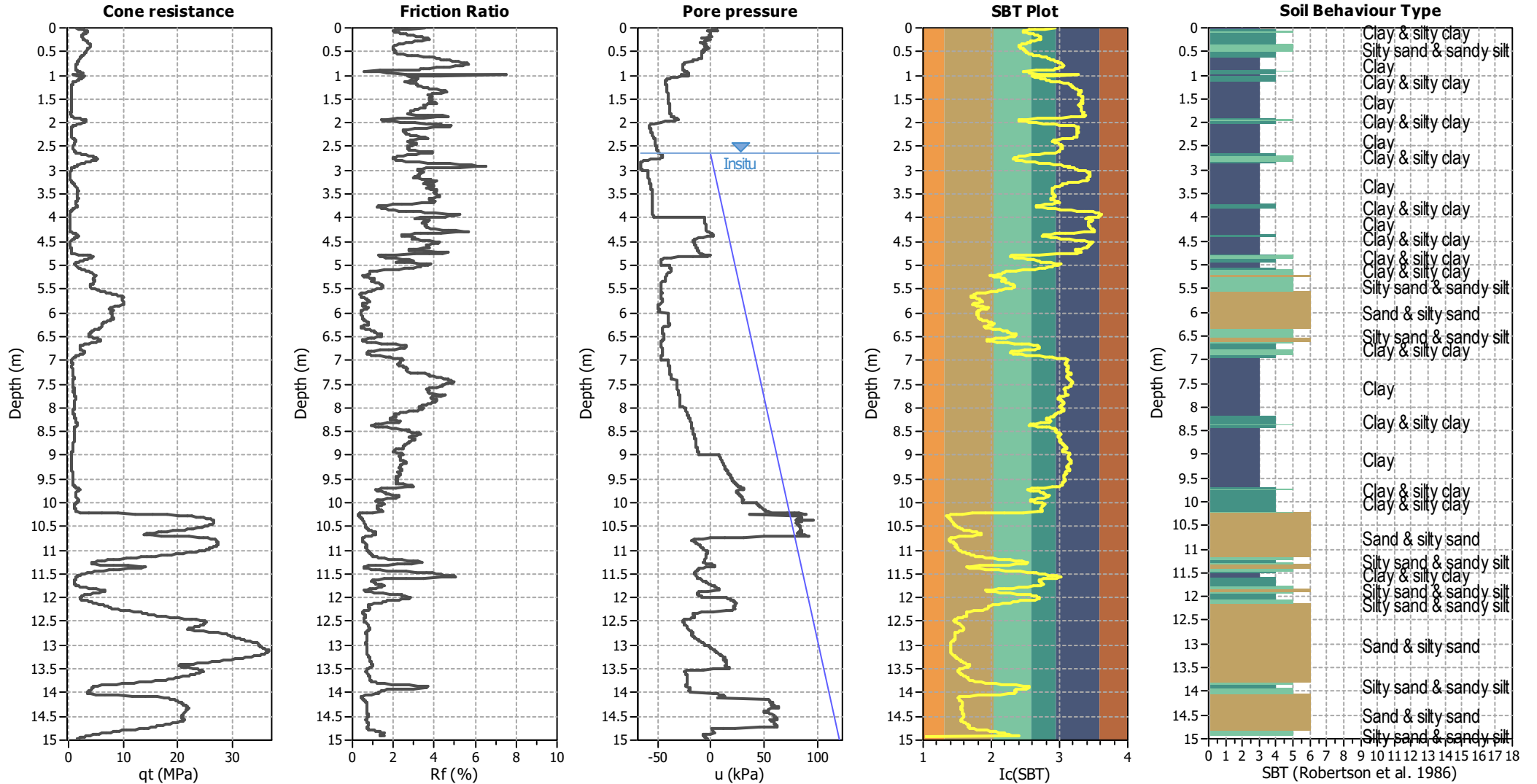
#### Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.50 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K <sub>g</sub> applied:	Yes
Earthquake magnitude M <sub>w</sub> :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.50 m	Fill height:	N/A	Limit depth:	10.00 m

#### SBT legend

<span style="color:red">■</span> 1. Sensitive fine grained	<span style="color:green">■</span> 4. Clayey silt to silty	<span style="color:orange">■</span> 7. Gravely sand to sand
<span style="color:brown">■</span> 2. Organic material	<span style="color:lightgreen">■</span> 5. Silty sand to sandy silt	<span style="color:grey">■</span> 8. Very stiff sand to
<span style="color:blue">■</span> 3. Clay to silty clay	<span style="color:yellow">■</span> 6. Clean sand to silty sand	<span style="color:lightgrey">■</span> 9. Very stiff fine grained

### CPT basic interpretation plots



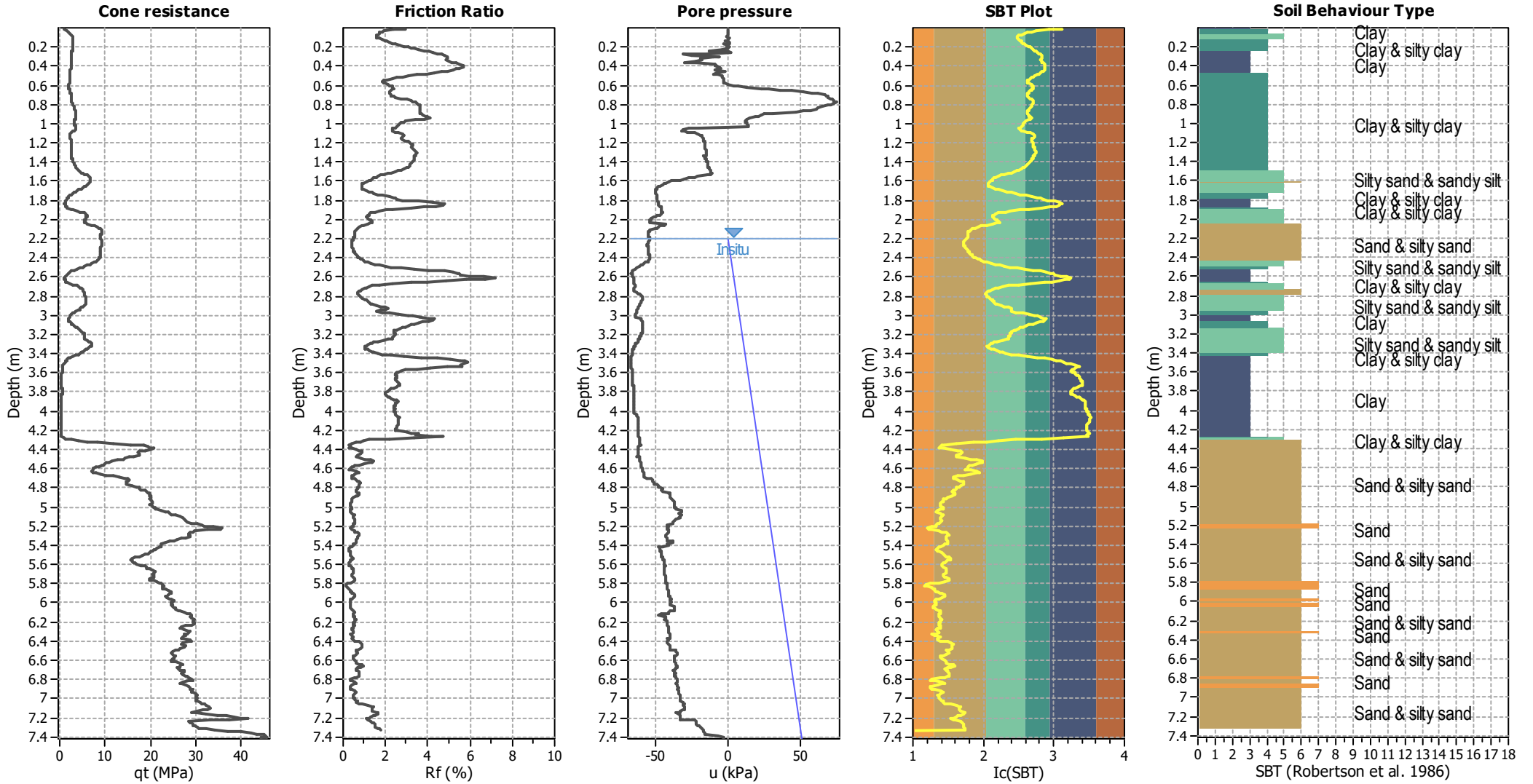
#### Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.65 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_v$ applied:	Yes
Earthquake magnitude $M_w$ :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.65 m	Fill height:	N/A	Limit depth:	10.00 m

#### SBT legend

1. Sensitive fine grained	4. Clayey silt to silty	7. Gravely sand to sand
2. Organic material	5. Silty sand to sandy silt	8. Very stiff sand to
3. Clay to silty clay	6. Clean sand to silty sand	9. Very stiff fine grained

### CPT basic interpretation plots



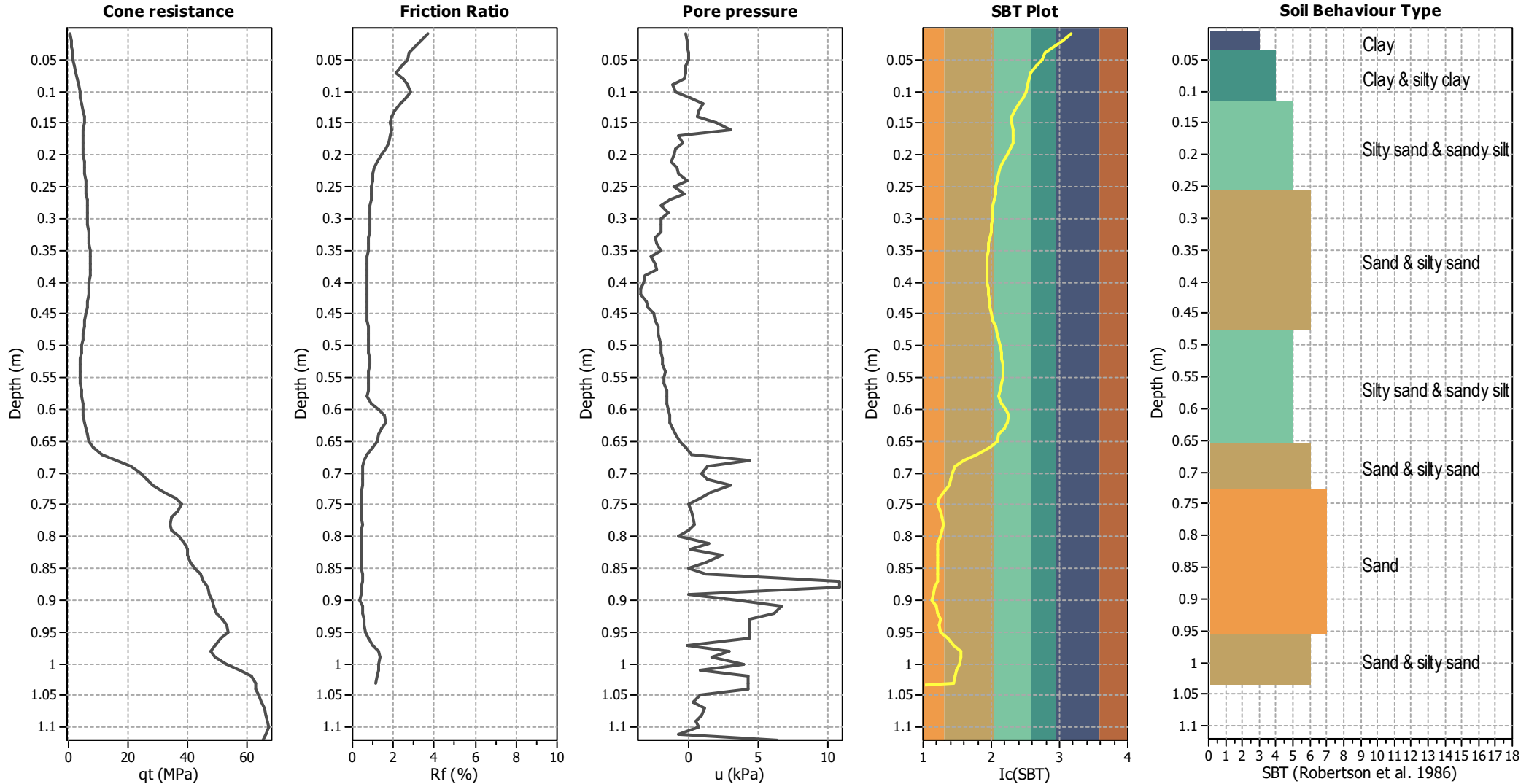
#### Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.20 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_v$ applied:	Yes
Earthquake magnitude $M_w$ :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.20 m	Fill height:	N/A	Limit depth:	10.00 m

#### SBT legend

1. Sensitive fine grained	4. Clayey silt to silty	7. Gravely sand to sand
2. Organic material	5. Silty sand to sandy silt	8. Very stiff sand to
3. Clay to silty clay	6. Clean sand to silty sand	9. Very stiff fine grained

### CPT basic interpretation plots



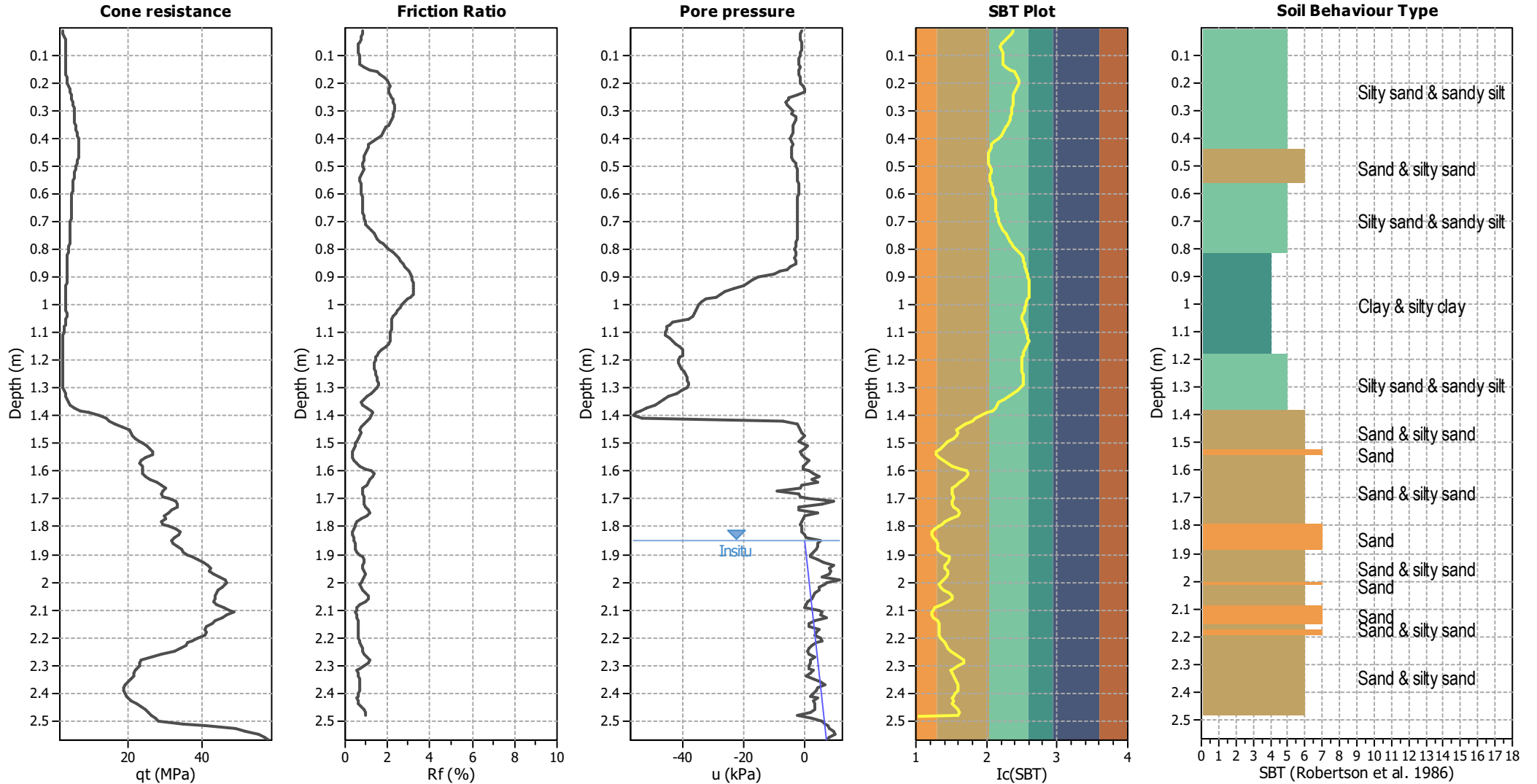
#### Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K <sub>g</sub> applied:	Yes
Earthquake magnitude M <sub>w</sub> :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.00 m	Fill height:	N/A	Limit depth:	10.00 m

#### SBT legend

1. Sensitive fine grained	4. Clayey silt to silty	7. Gravely sand to sand
2. Organic material	5. Silty sand to sandy silt	8. Very stiff sand to
3. Clay to silty clay	6. Clean sand to silty sand	9. Very stiff fine grained

### CPT basic interpretation plots



#### Input parameters and analysis data

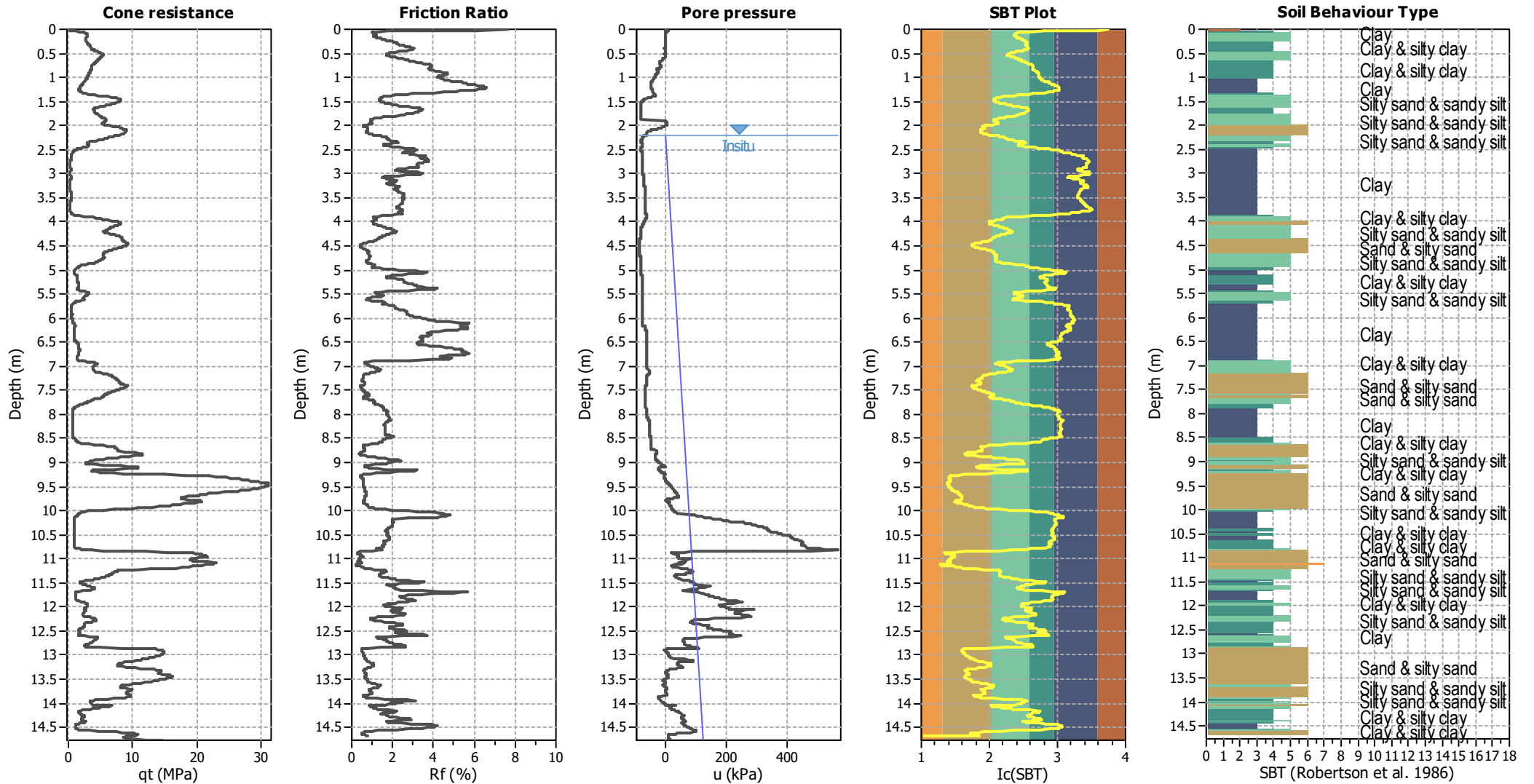
Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.85 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_v$ applied:	Yes
Earthquake magnitude $M_w$ :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.85 m	Fill height:	N/A	Limit depth:	10.00 m

#### SBT legend

<span style="color: red;">■</span> 1. Sensitive fine grained	<span style="color: teal;">■</span> 4. Clayey silt to silty	<span style="color: orange;">■</span> 7. Gravely sand to sand
<span style="color: brown;">■</span> 2. Organic material	<span style="color: lightgreen;">■</span> 5. Silty sand to sandy silt	<span style="color: grey;">■</span> 8. Very stiff sand to
<span style="color: blue;">■</span> 3. Clay to silty clay	<span style="color: tan;">■</span> 6. Clean sand to silty sand	<span style="color: lightgrey;">■</span> 9. Very stiff fine grained



### CPT basic interpretation plots



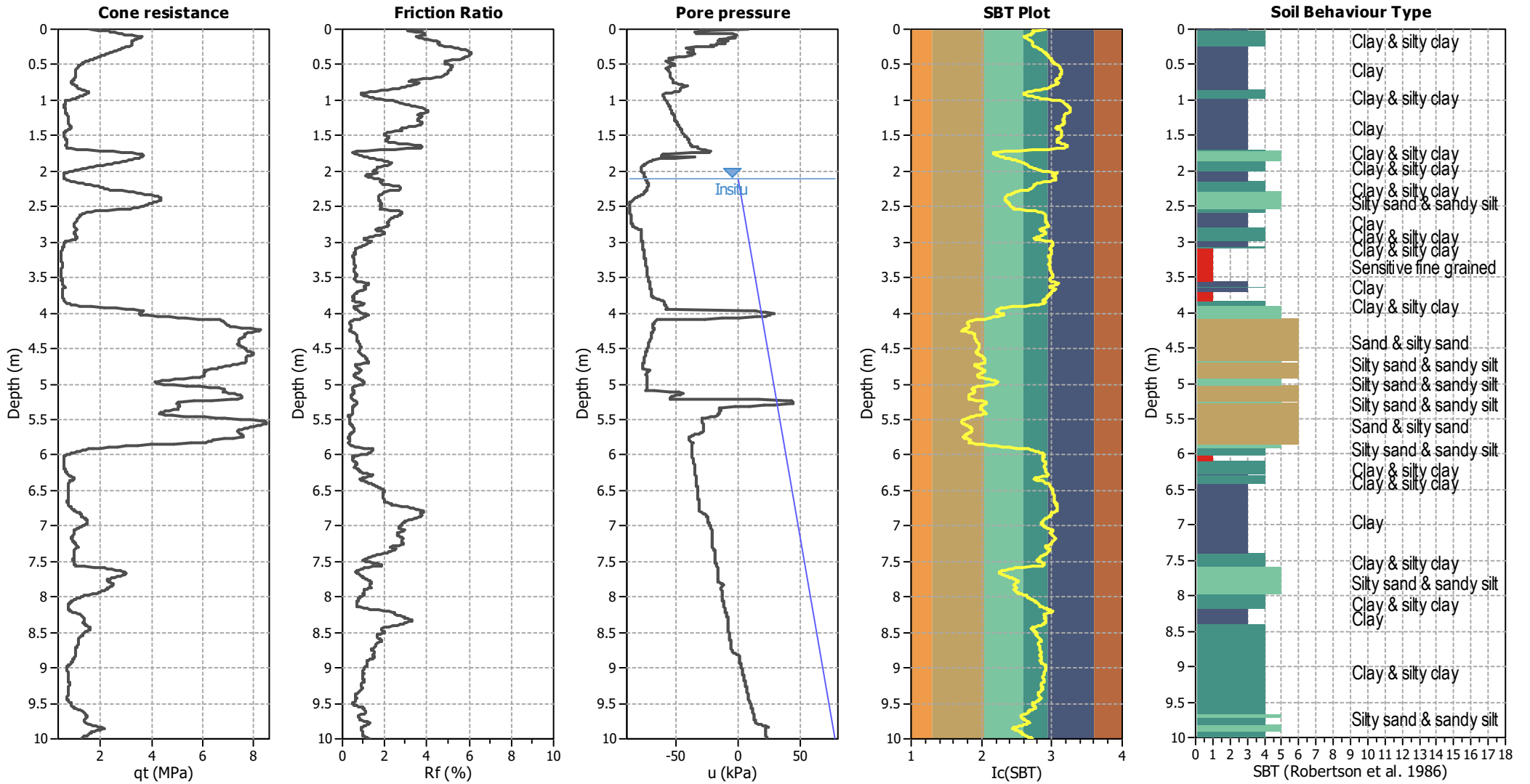
#### Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.20 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_v$ applied:	Yes
Earthquake magnitude $M_w$ :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.20 m	Fill height:	N/A	Limit depth:	10.00 m

#### SBT legend

1. Sensitive fine grained	4. Clayey silt to silty	7. Gravely sand to sand
2. Organic material	5. Silty sand to sandy silt	8. Very stiff sand to
3. Clay to silty clay	6. Clean sand to silty sand	9. Very stiff fine grained

### CPT basic interpretation plots



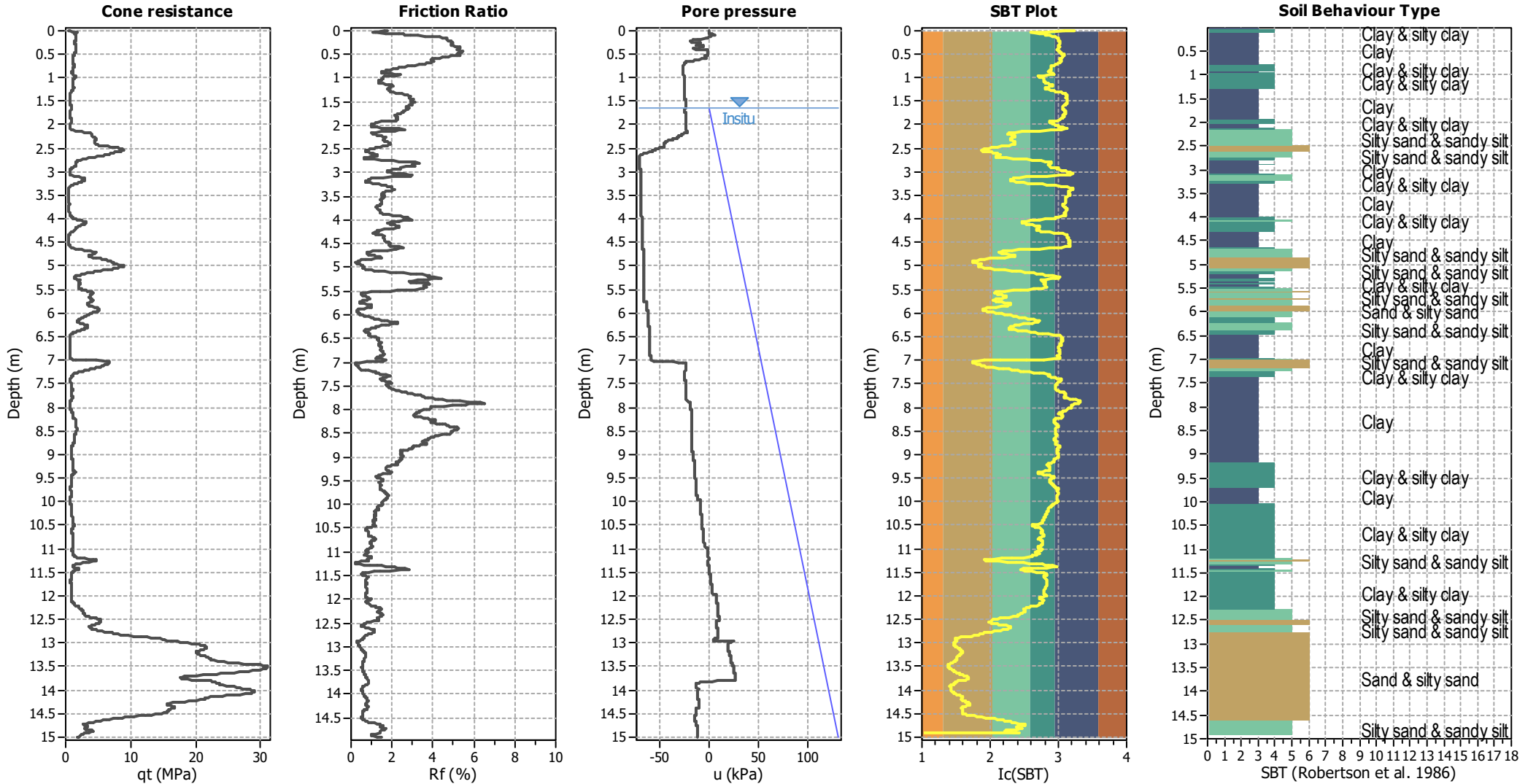
#### Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.10 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_v$ applied:	Yes
Earthquake magnitude $M_w$ :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.10 m	Fill height:	N/A	Limit depth:	10.00 m

#### SBT legend

<span style="color:red">■</span> 1. Sensitive fine grained	<span style="color:teal">■</span> 4. Clayey silt to silty	<span style="color:orange">■</span> 7. Gravely sand to sand
<span style="color:blue">■</span> 2. Organic material	<span style="color:green">■</span> 5. Silty sand to sandy silt	<span style="color:grey">■</span> 8. Very stiff sand to
<span style="color:darkblue">■</span> 3. Clay to silty clay	<span style="color:yellow">■</span> 6. Clean sand to silty sand	<span style="color:lightgrey">■</span> 9. Very stiff fine grained

### CPT basic interpretation plots



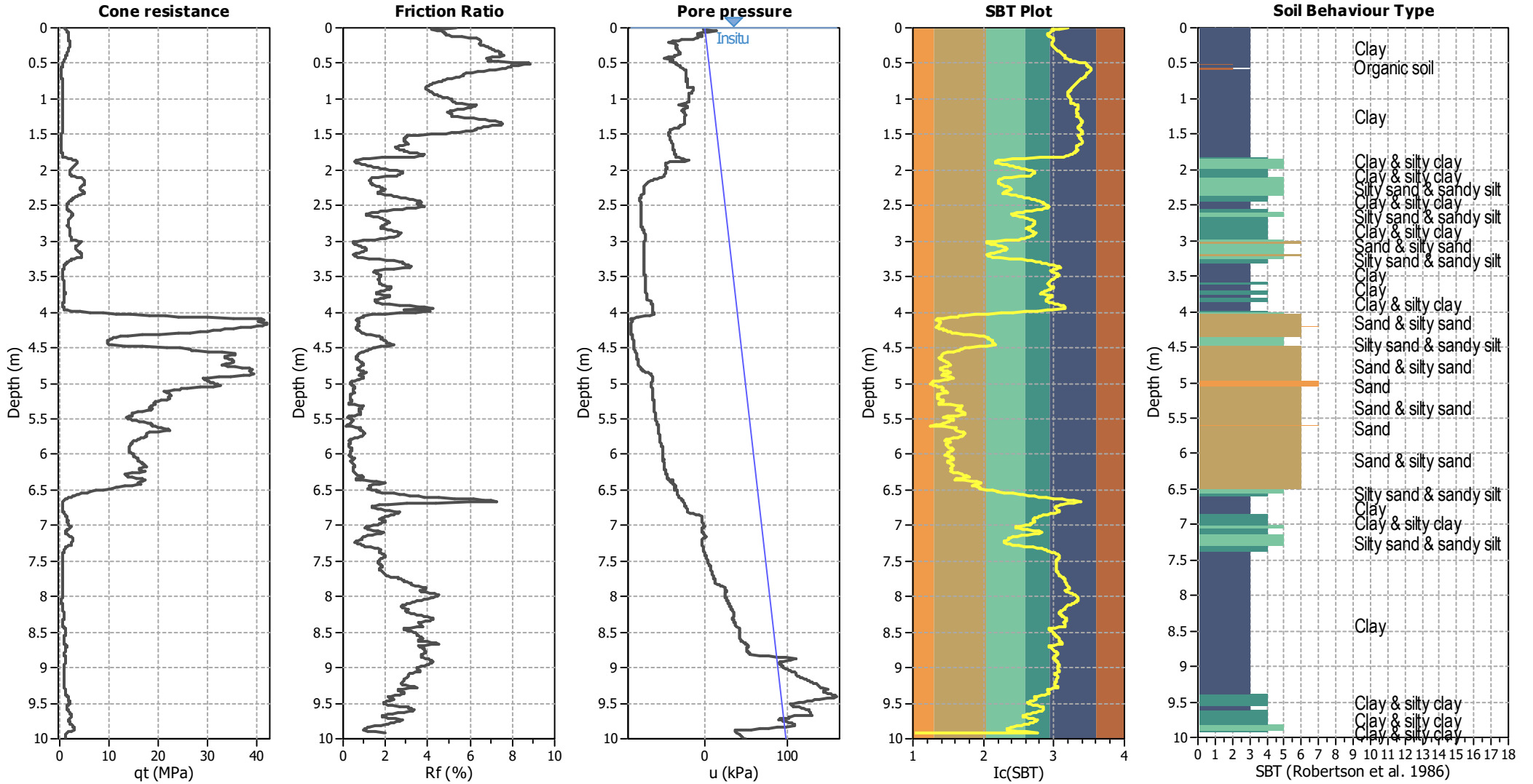
#### Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.65 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K <sub>v</sub> applied:	Yes
Earthquake magnitude M <sub>w</sub> :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.65 m	Fill height:	N/A	Limit depth:	10.00 m

#### SBT legend

1. Sensitive fine grained	4. Clayey silt to silty	7. Gravely sand to sand
2. Organic material	5. Silty sand to sandy silt	8. Very stiff sand to
3. Clay to silty clay	6. Clean sand to silty sand	9. Very stiff fine grained

### CPT basic interpretation plots



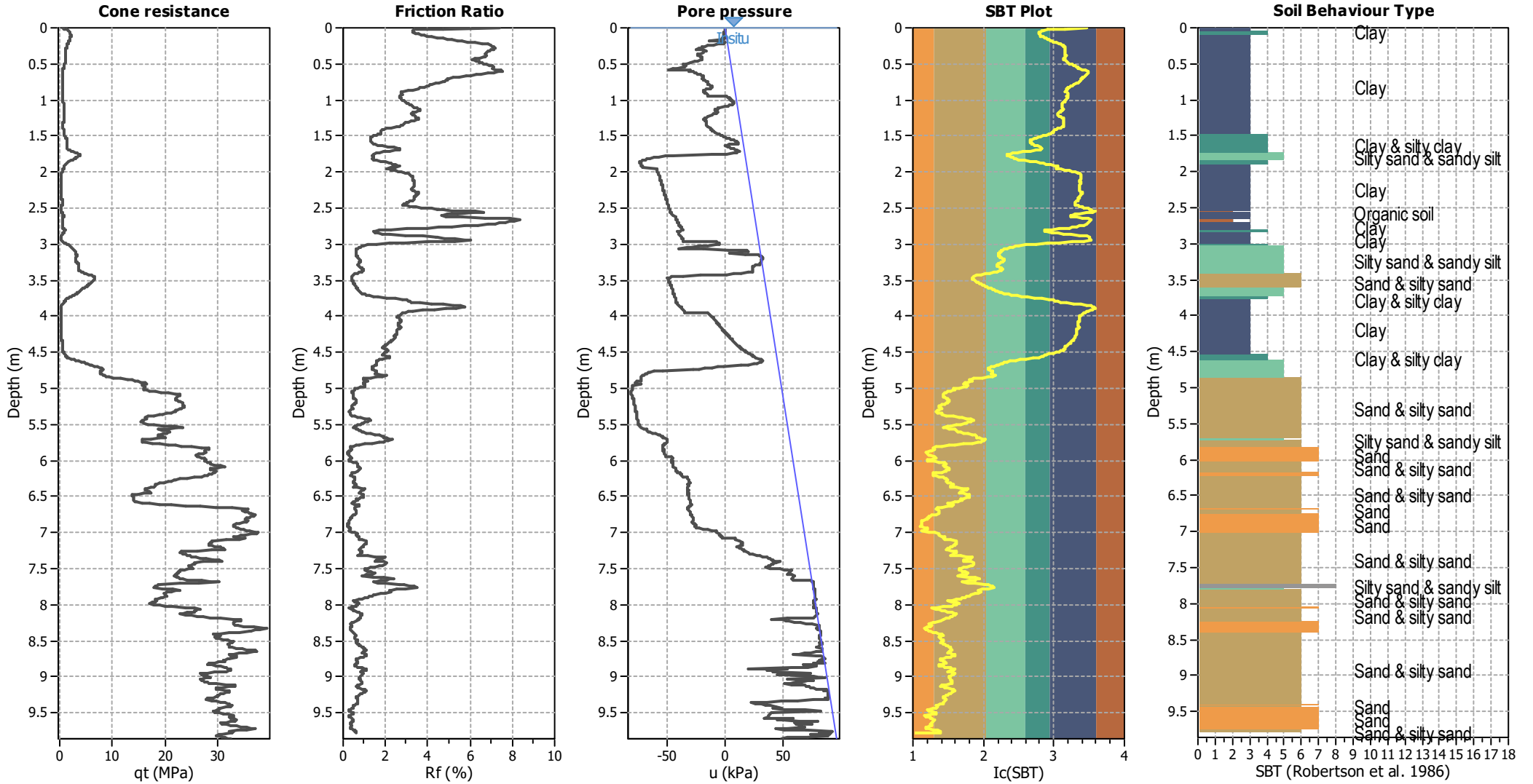
#### Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	0.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_v$ applied:	Yes
Earthquake magnitude $M_w$ :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	0.00 m	Fill height:	N/A	Limit depth:	10.00 m

#### SBT legend

1. Sensitive fine grained	4. Clayey silt to silty	7. Gravely sand to sand
2. Organic material	5. Silty sand to sandy silt	8. Very stiff sand to
3. Clay to silty clay	6. Clean sand to silty sand	9. Very stiff fine grained

### CPT basic interpretation plots



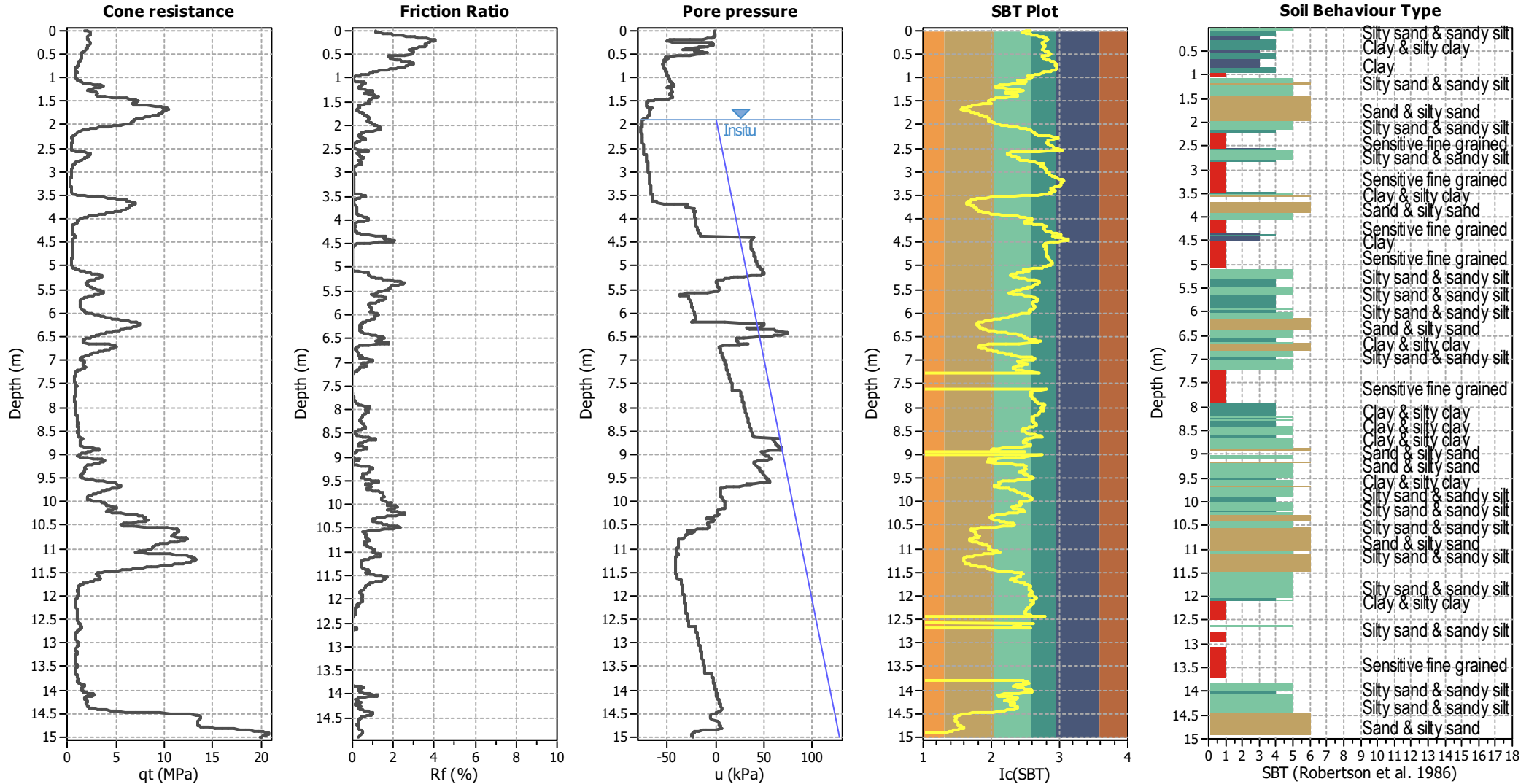
#### Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	0.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_0$ applied:	Yes
Earthquake magnitude $M_w$ :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	0.00 m	Fill height:	N/A	Limit depth:	10.00 m

#### SBT legend

1. Sensitive fine grained	4. Clayey silt to silty	7. Gravely sand to sand
2. Organic material	5. Silty sand to sandy silt	8. Very stiff sand to
3. Clay to silty clay	6. Clean sand to silty sand	9. Very stiff fine grained

### CPT basic interpretation plots



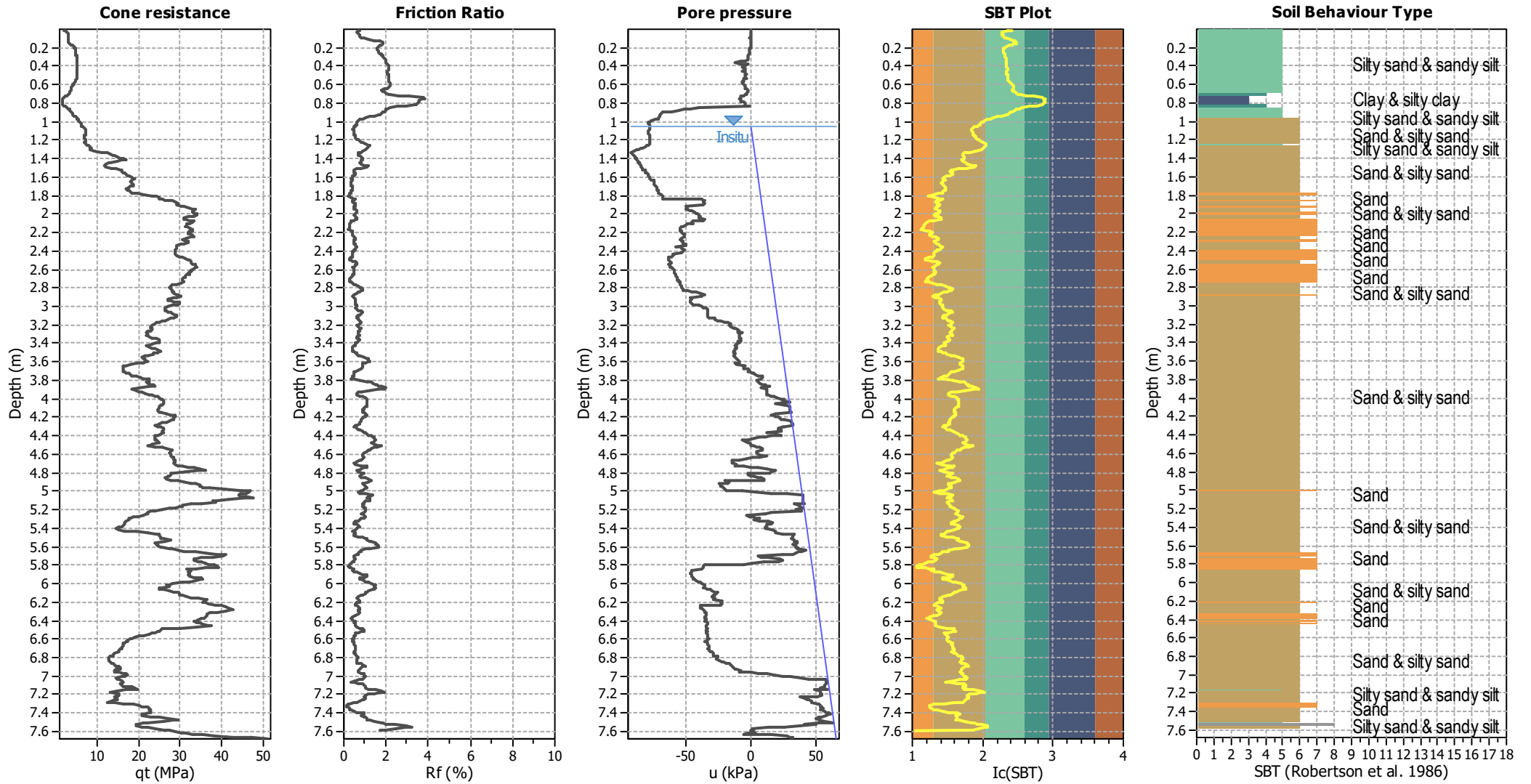
#### Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.90 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_v$ applied:	Yes
Earthquake magnitude $M_w$ :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.90 m	Fill height:	N/A	Limit depth:	10.00 m

#### SBT legend

1. Sensitive fine grained	4. Clayey silt to silty	7. Gravely sand to sand
2. Organic material	5. Silty sand to sandy silt	8. Very stiff sand to
3. Clay to silty clay	6. Clean sand to silty sand	9. Very stiff fine grained

### CPT basic interpretation plots



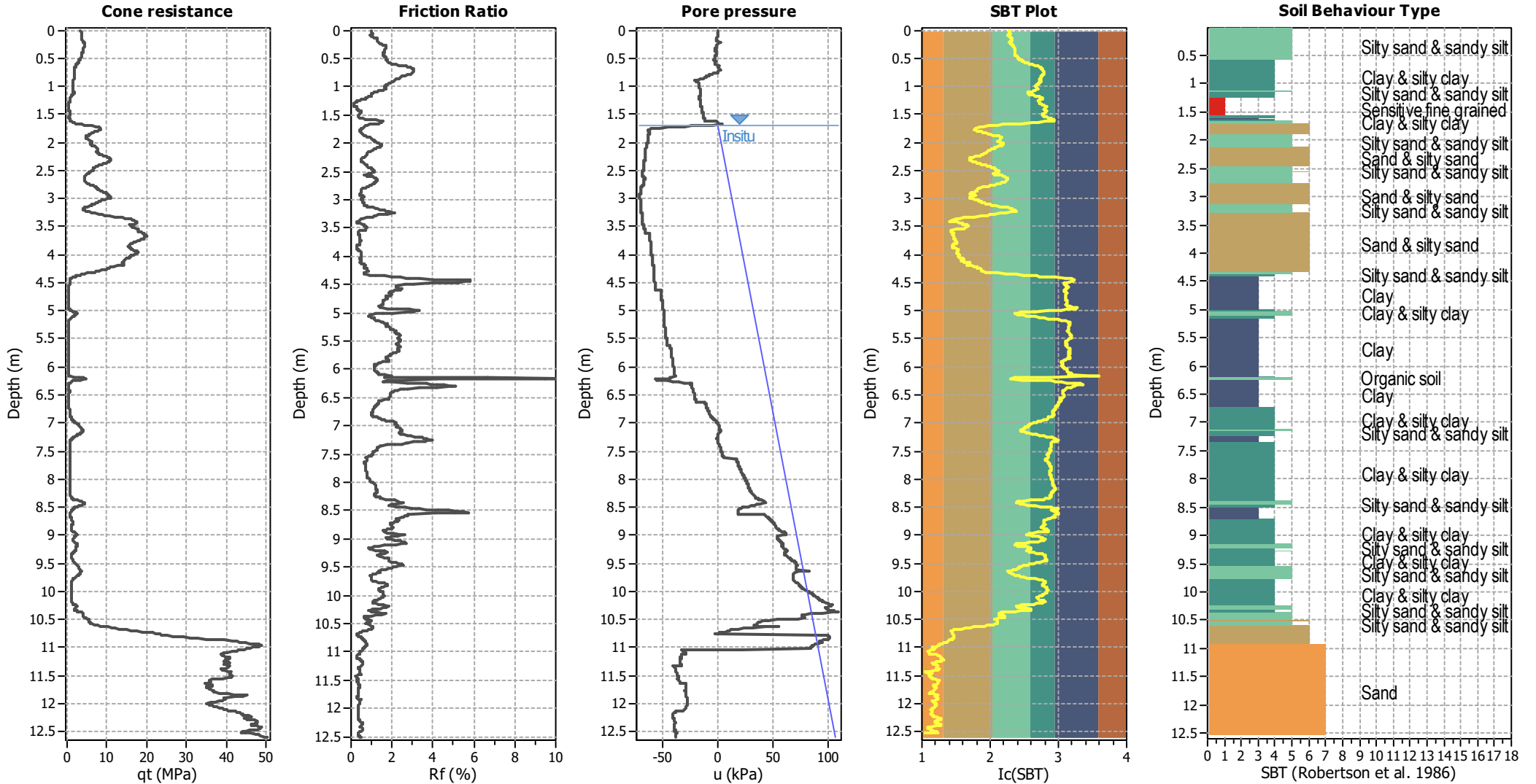
#### Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.05 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K <sub>v</sub> applied:	Yes
Earthquake magnitude M <sub>w</sub> :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.05 m	Fill height:	N/A	Limit depth:	10.00 m

#### SBT legend

1. Sensitive fine grained	4. Clayey silt to silty	7. Gravely sand to sand
2. Organic material	5. Silty sand to sandy silt	8. Very stiff sand to
3. Clay to silty clay	6. Clean sand to silty sand	9. Very stiff fine grained

### CPT basic interpretation plots



#### Input parameters and analysis data

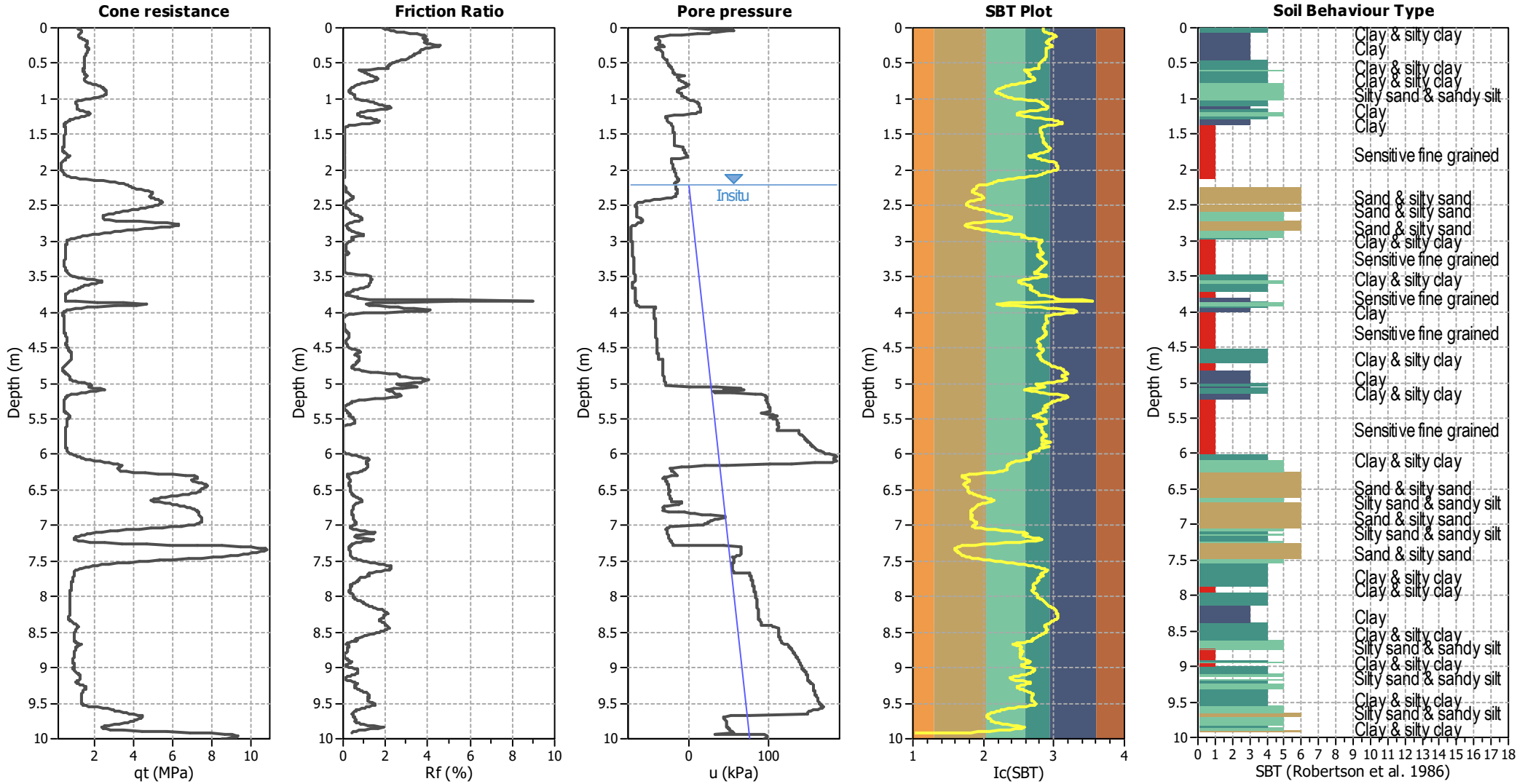
Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_v$ applied:	Yes
Earthquake magnitude $M_w$ :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	10.00 m

#### SBT legend

1. Sensitive fine grained	4. Clayey silt to silty	7. Gravely sand to sand
2. Organic material	5. Silty sand to sandy silt	8. Very stiff sand to
3. Clay to silty clay	6. Clean sand to silty sand	9. Very stiff fine grained



### CPT basic interpretation plots



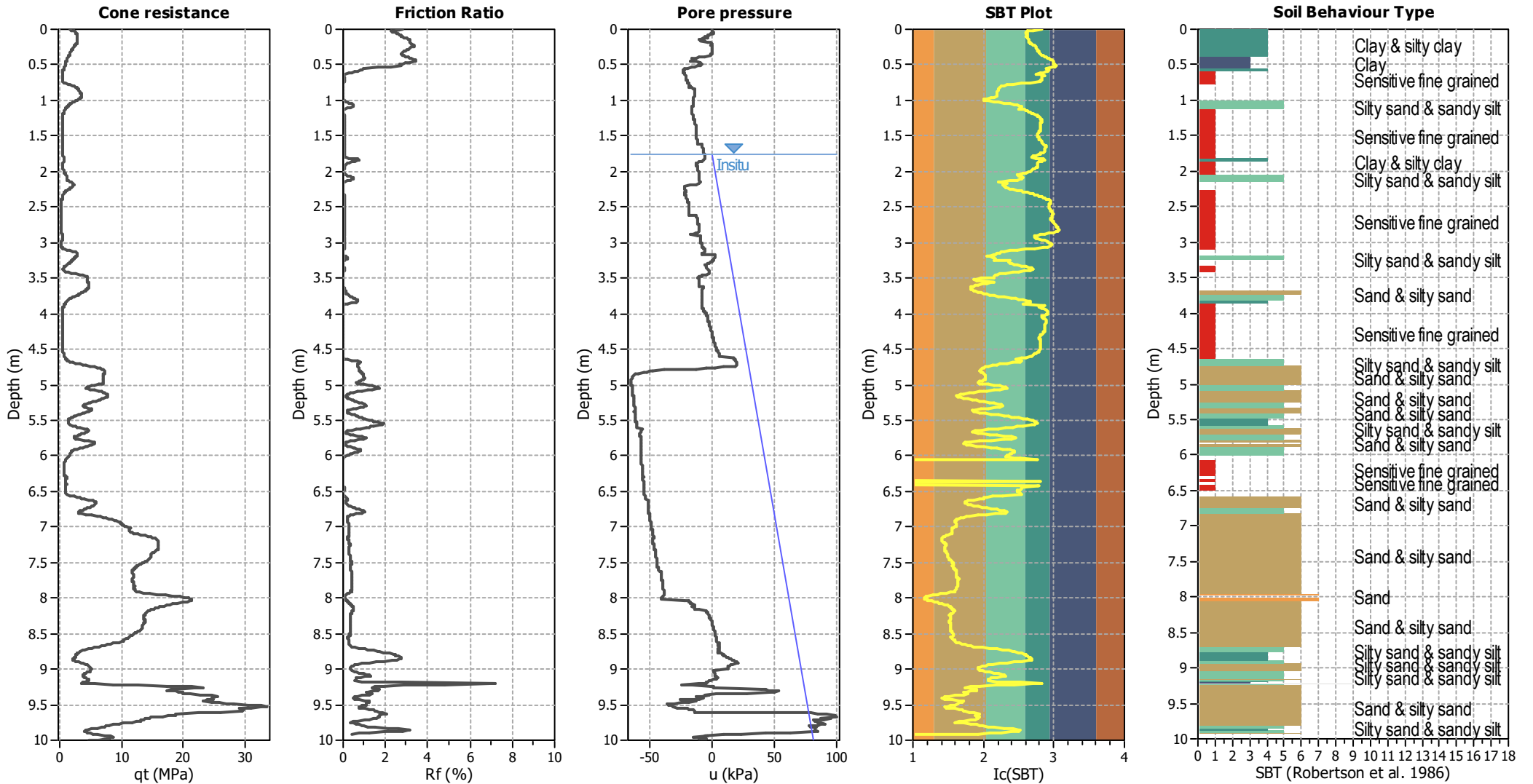
#### Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.20 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K <sub>v</sub> applied:	Yes
Earthquake magnitude M <sub>w</sub> :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.20 m	Fill height:	N/A	Limit depth:	10.00 m

#### SBT legend

<span style="color:red">■</span> 1. Sensitive fine grained	<span style="color:teal">■</span> 4. Clayey silt to silty	<span style="color:orange">■</span> 7. Gravely sand to sand
<span style="color:blue">■</span> 2. Organic material	<span style="color:green">■</span> 5. Silty sand to sandy silt	<span style="color:grey">■</span> 8. Very stiff sand to
<span style="color:purple">■</span> 3. Clay to silty clay	<span style="color:yellow">■</span> 6. Clean sand to silty sand	<span style="color:lightgrey">■</span> 9. Very stiff fine grained

### CPT basic interpretation plots



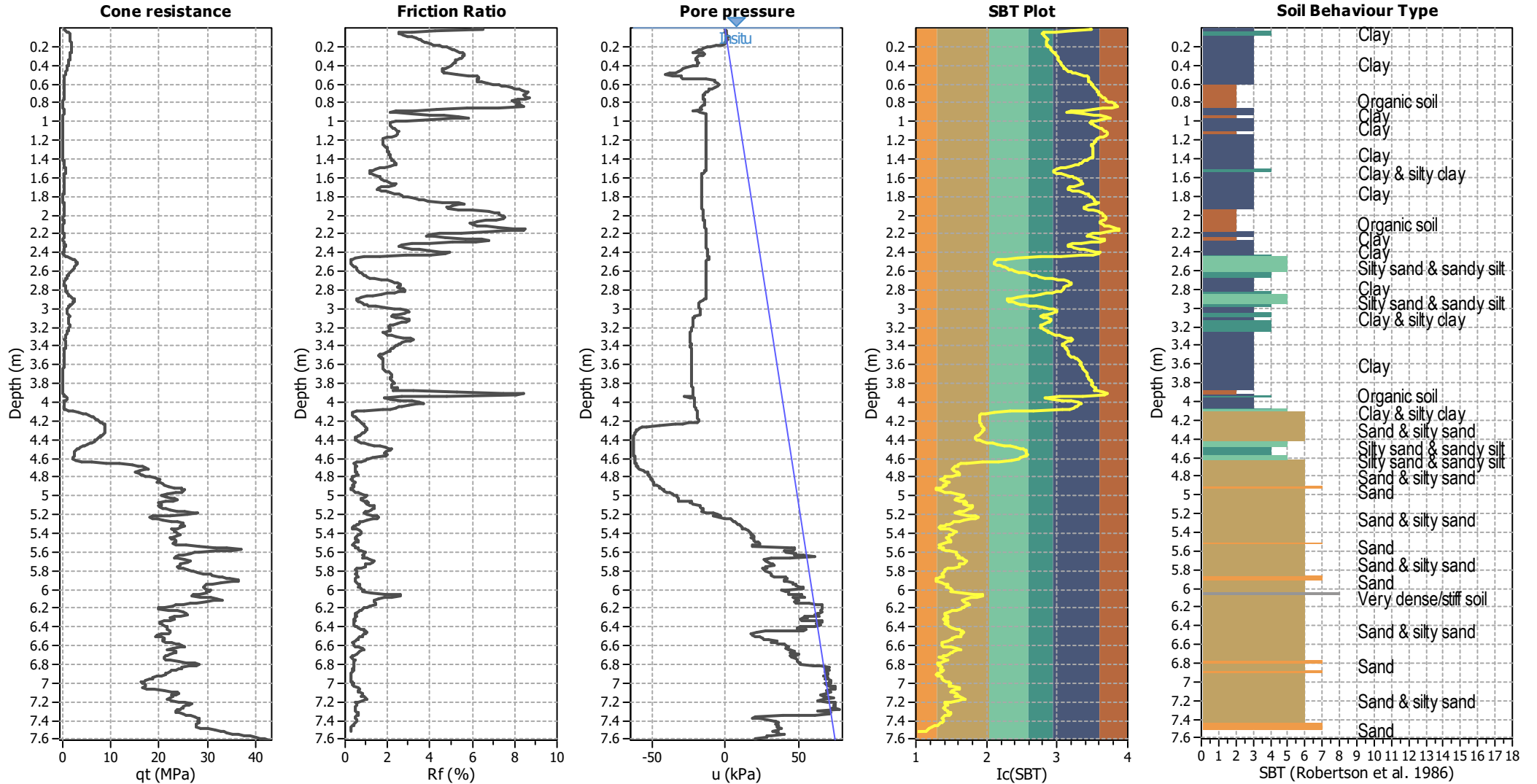
#### Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.75 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K <sub>0</sub> applied:	Yes
Earthquake magnitude M <sub>w</sub> :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.75 m	Fill height:	N/A	Limit depth:	10.00 m

#### SBT legend

1. Sensitive fine grained	4. Clayey silt to silty	7. Gravely sand to sand
2. Organic material	5. Silty sand to sandy silt	8. Very stiff sand to
3. Clay to silty clay	6. Clean sand to silty sand	9. Very stiff fine grained

### CPT basic interpretation plots



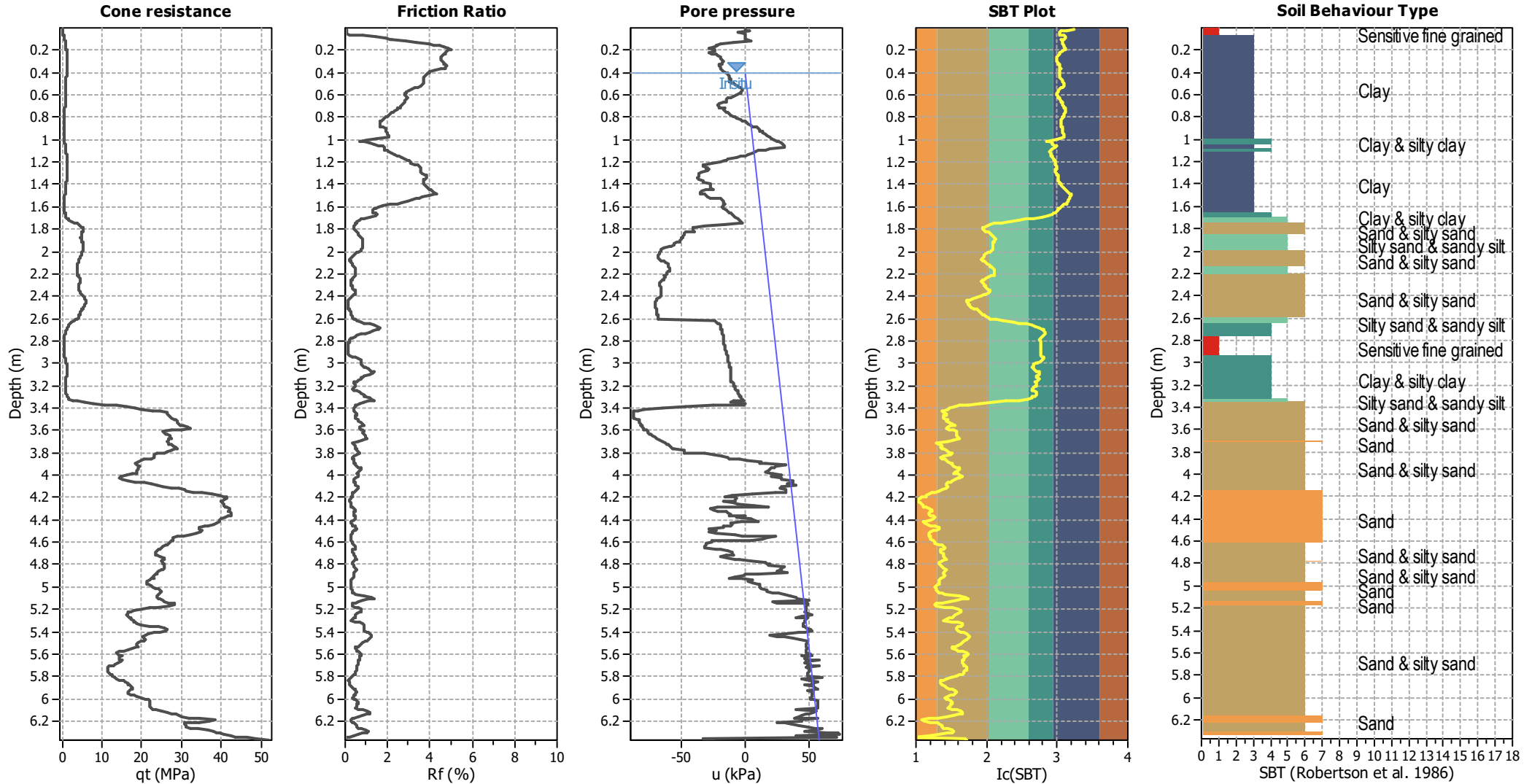
#### Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	0.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_f$ applied:	Yes
Earthquake magnitude $M_w$ :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	0.00 m	Fill height:	N/A	Limit depth:	10.00 m

#### SBT legend

1. Sensitive fine grained	4. Clayey silt to silty	7. Gravely sand to sand
2. Organic material	5. Silty sand to sandy silt	8. Very stiff sand to
3. Clay to silty clay	6. Clean sand to silty sand	9. Very stiff fine grained

### CPT basic interpretation plots



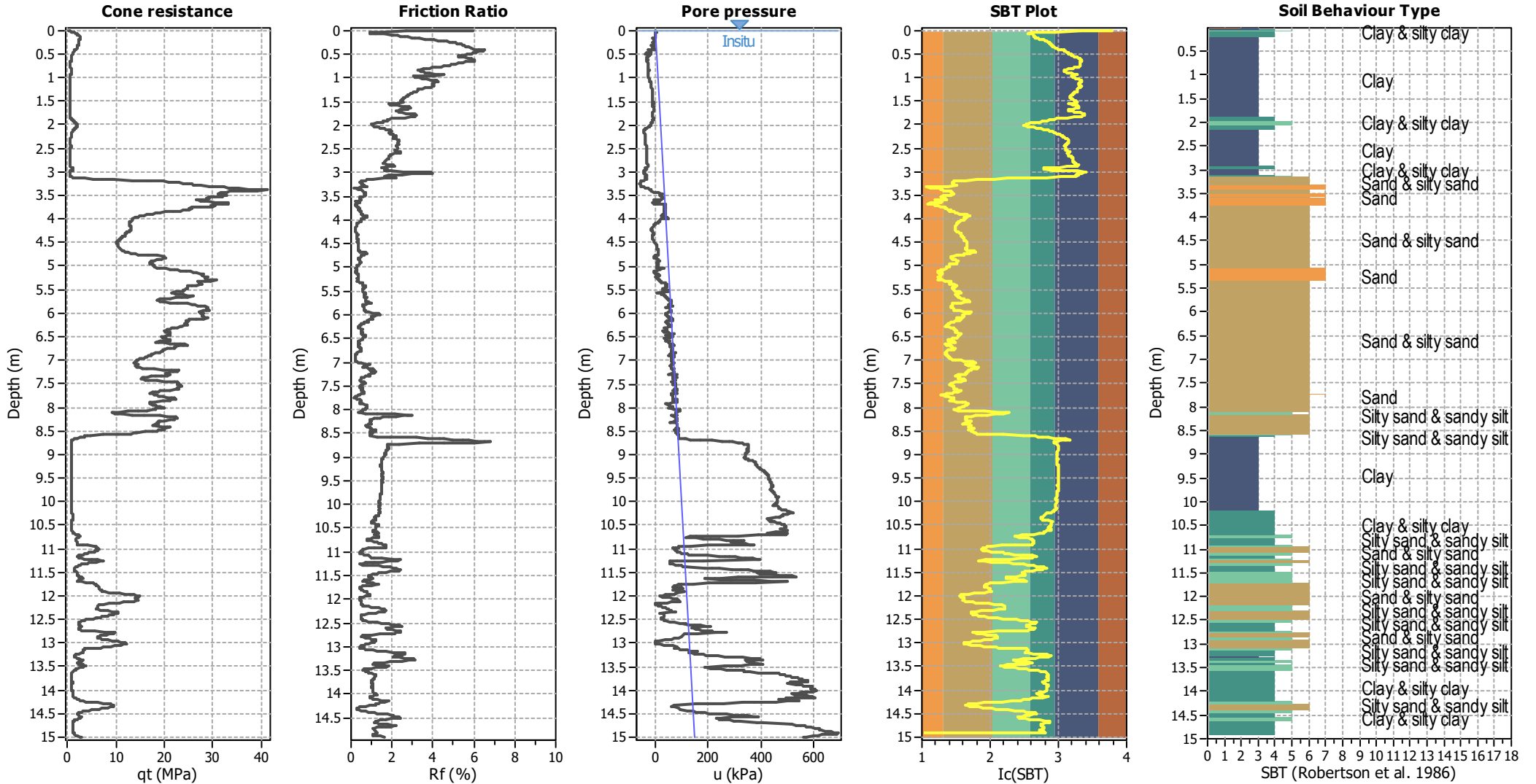
#### Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	0.40 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K <sub>v</sub> applied:	Yes
Earthquake magnitude M <sub>w</sub> :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	0.40 m	Fill height:	N/A	Limit depth:	10.00 m

#### SBT legend

1. Sensitive fine grained	4. Clayey silt to silty	7. Gravely sand to sand
2. Organic material	5. Silty sand to sandy silt	8. Very stiff sand to
3. Clay to silty clay	6. Clean sand to silty sand	9. Very stiff fine grained

### CPT basic interpretation plots



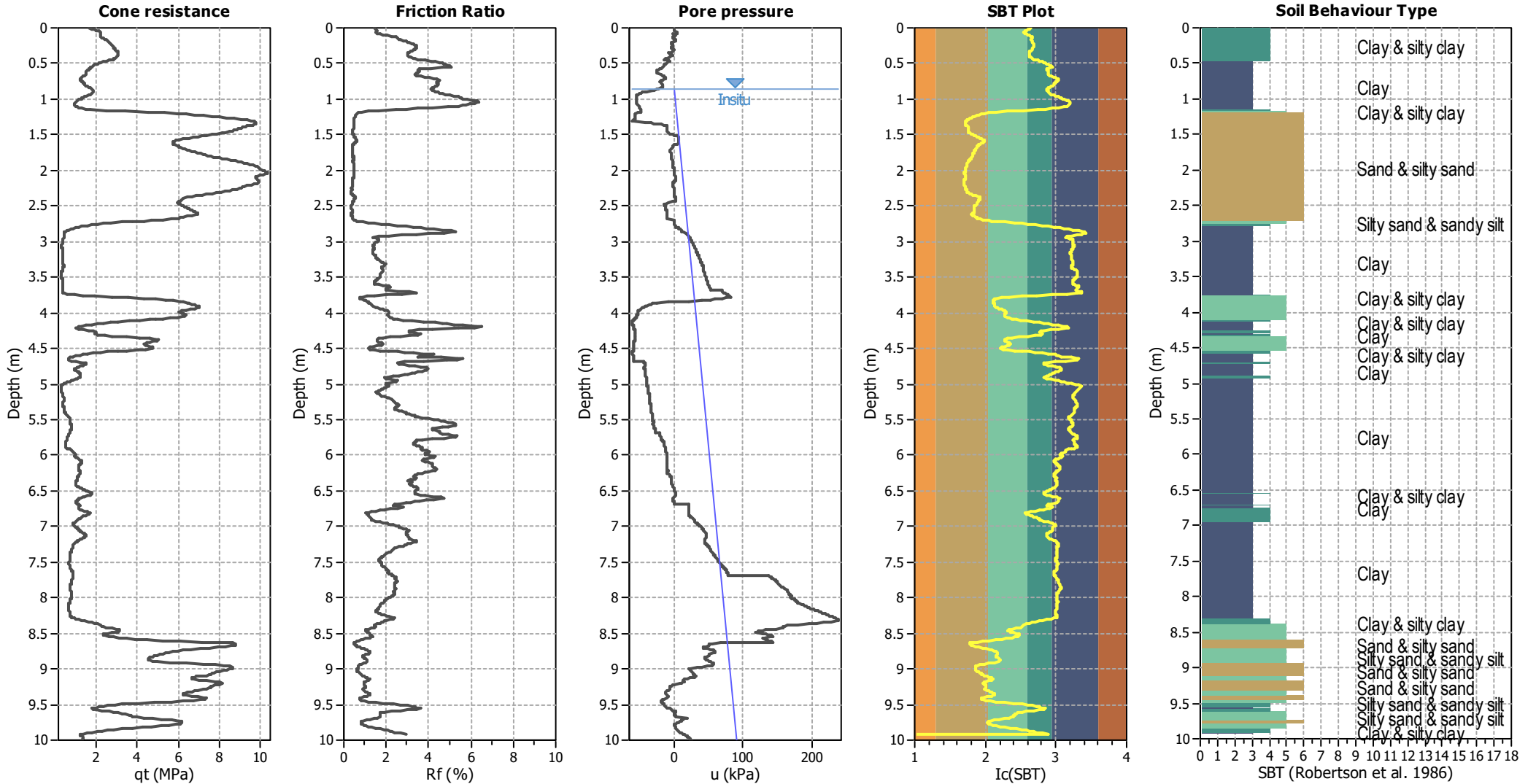
#### Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	0.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_f$ applied:	Yes
Earthquake magnitude $M_w$ :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	0.00 m	Fill height:	N/A	Limit depth:	10.00 m

#### SBT legend

<span style="color:red">■</span> 1. Sensitive fine grained	<span style="color:teal">■</span> 4. Clayey silt to silty	<span style="color:orange">■</span> 7. Gravely sand to sand
<span style="color:blue">■</span> 2. Organic material	<span style="color:green">■</span> 5. Silty sand to sandy silt	<span style="color:grey">■</span> 8. Very stiff sand to
<span style="color:darkblue">■</span> 3. Clay to silty clay	<span style="color:tan">■</span> 6. Clean sand to silty sand	<span style="color:lightgrey">■</span> 9. Very stiff fine grained

### CPT basic interpretation plots



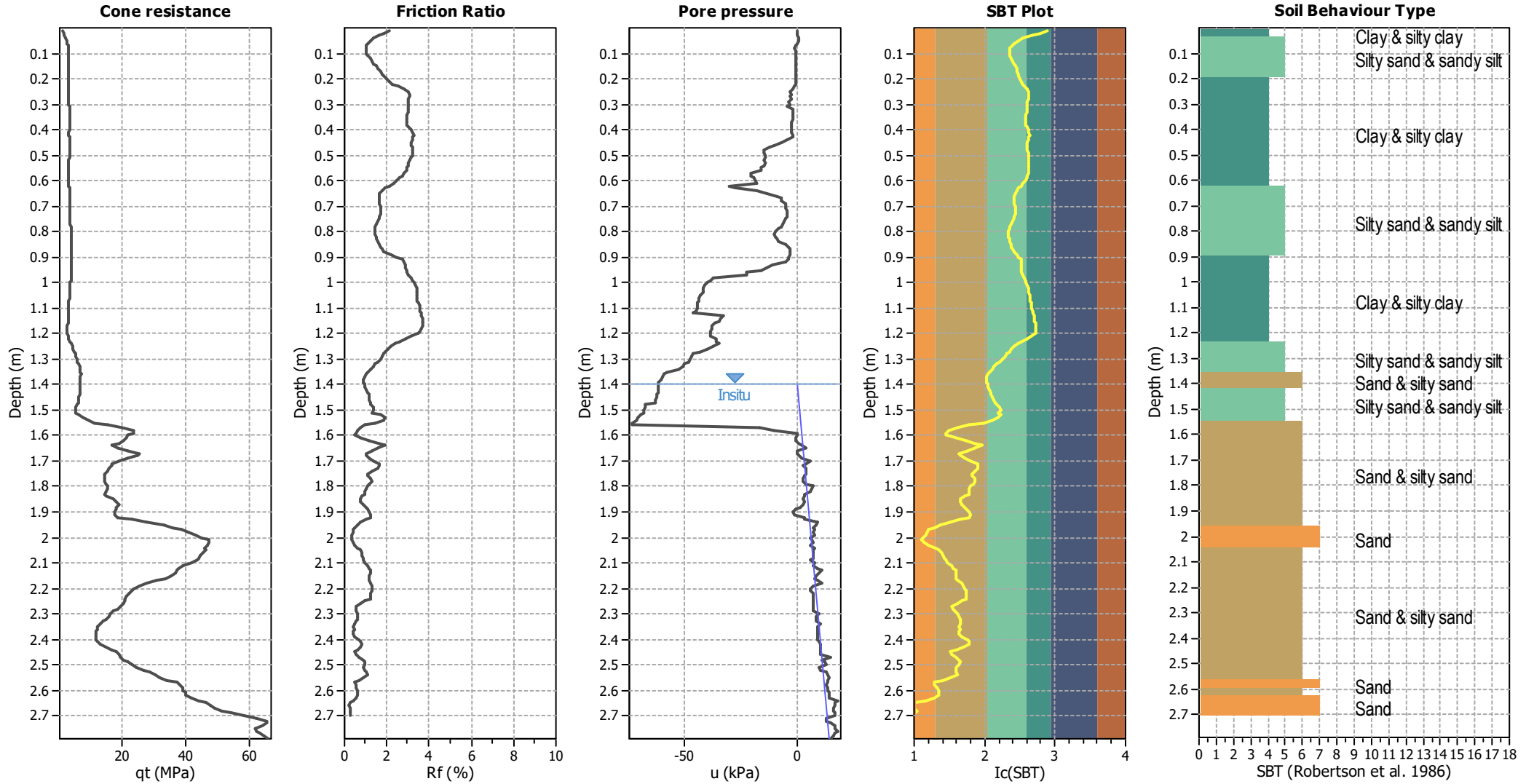
#### Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	0.85 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_v$ applied:	Yes
Earthquake magnitude $M_w$ :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	0.85 m	Fill height:	N/A	Limit depth:	10.00 m

#### SBT legend

1. Sensitive fine grained	4. Clayey silt to silty	7. Gravely sand to sand
2. Organic material	5. Silty sand to sandy silt	8. Very stiff sand to
3. Clay to silty clay	6. Clean sand to silty sand	9. Very stiff fine grained

### CPT basic interpretation plots



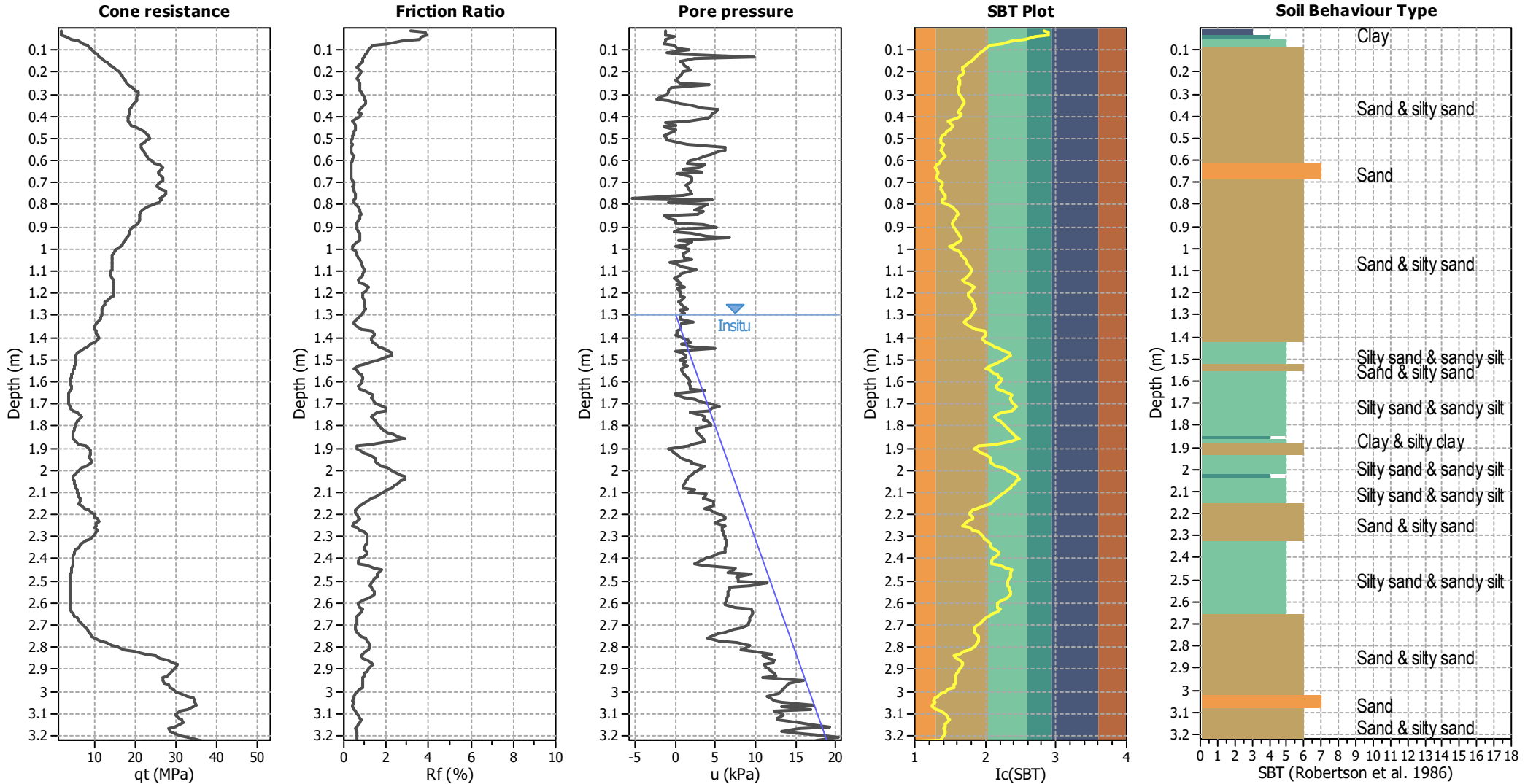
#### Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.40 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_v$ applied:	Yes
Earthquake magnitude $M_w$ :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.40 m	Fill height:	N/A	Limit depth:	10.00 m

#### SBT legend

1. Sensitive fine grained	4. Clayey silt to silty	7. Gravely sand to sand
2. Organic material	5. Silty sand to sandy silt	8. Very stiff sand to
3. Clay to silty clay	6. Clean sand to silty sand	9. Very stiff fine grained

### CPT basic interpretation plots



#### Input parameters and analysis data

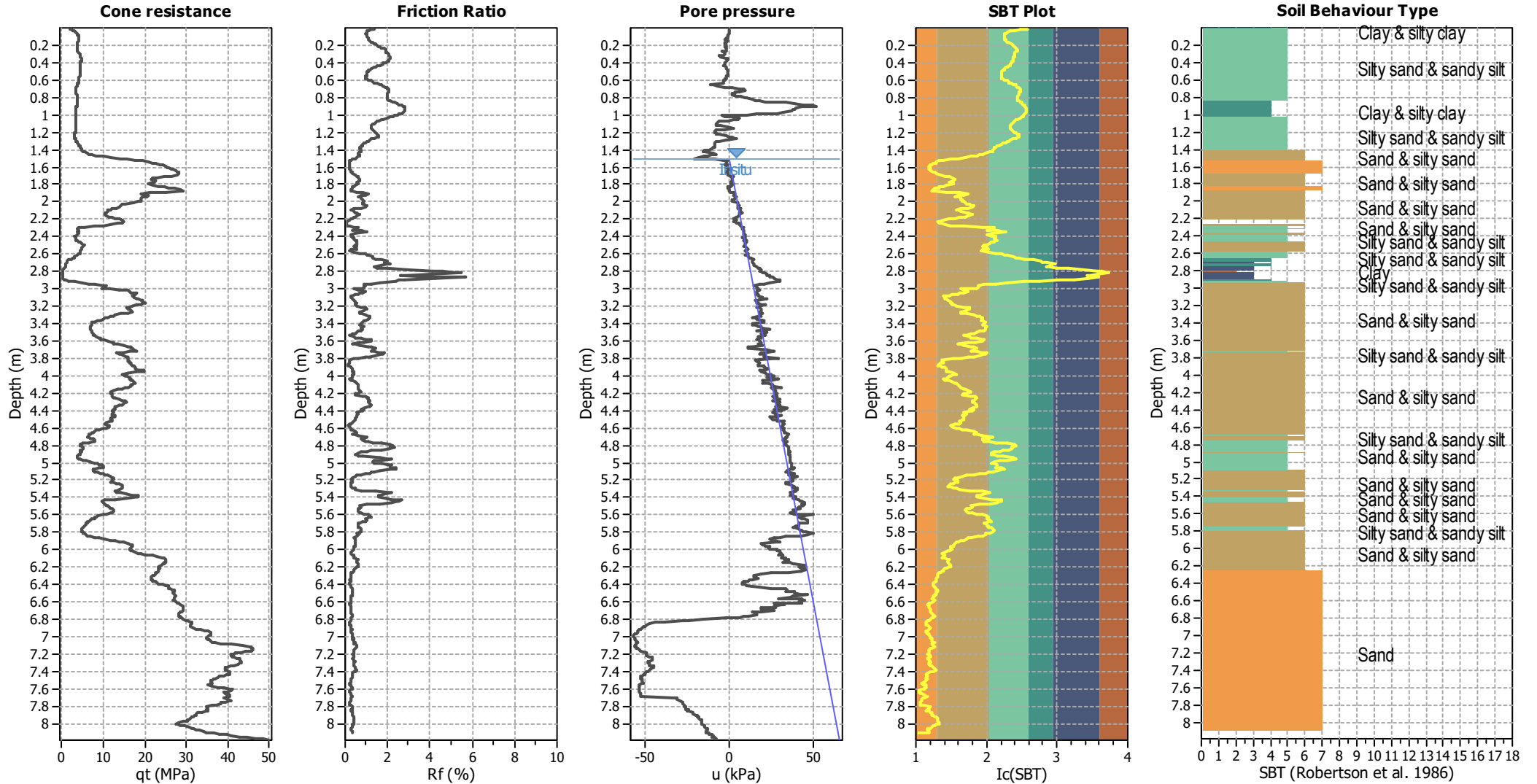
Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.30 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_v$ applied:	Yes
Earthquake magnitude $M_w$ :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.30 m	Fill height:	N/A	Limit depth:	10.00 m

#### SBT legend

<span style="color: red;">■</span> 1. Sensitive fine grained	<span style="color: teal;">■</span> 4. Clayey silt to silty	<span style="color: orange;">■</span> 7. Gravely sand to sand
<span style="color: brown;">■</span> 2. Organic material	<span style="color: lightgreen;">■</span> 5. Silty sand to sandy silt	<span style="color: grey;">■</span> 8. Very stiff sand to
<span style="color: blue;">■</span> 3. Clay to silty clay	<span style="color: tan;">■</span> 6. Clean sand to silty sand	<span style="color: lightgrey;">■</span> 9. Very stiff fine grained



### CPT basic interpretation plots



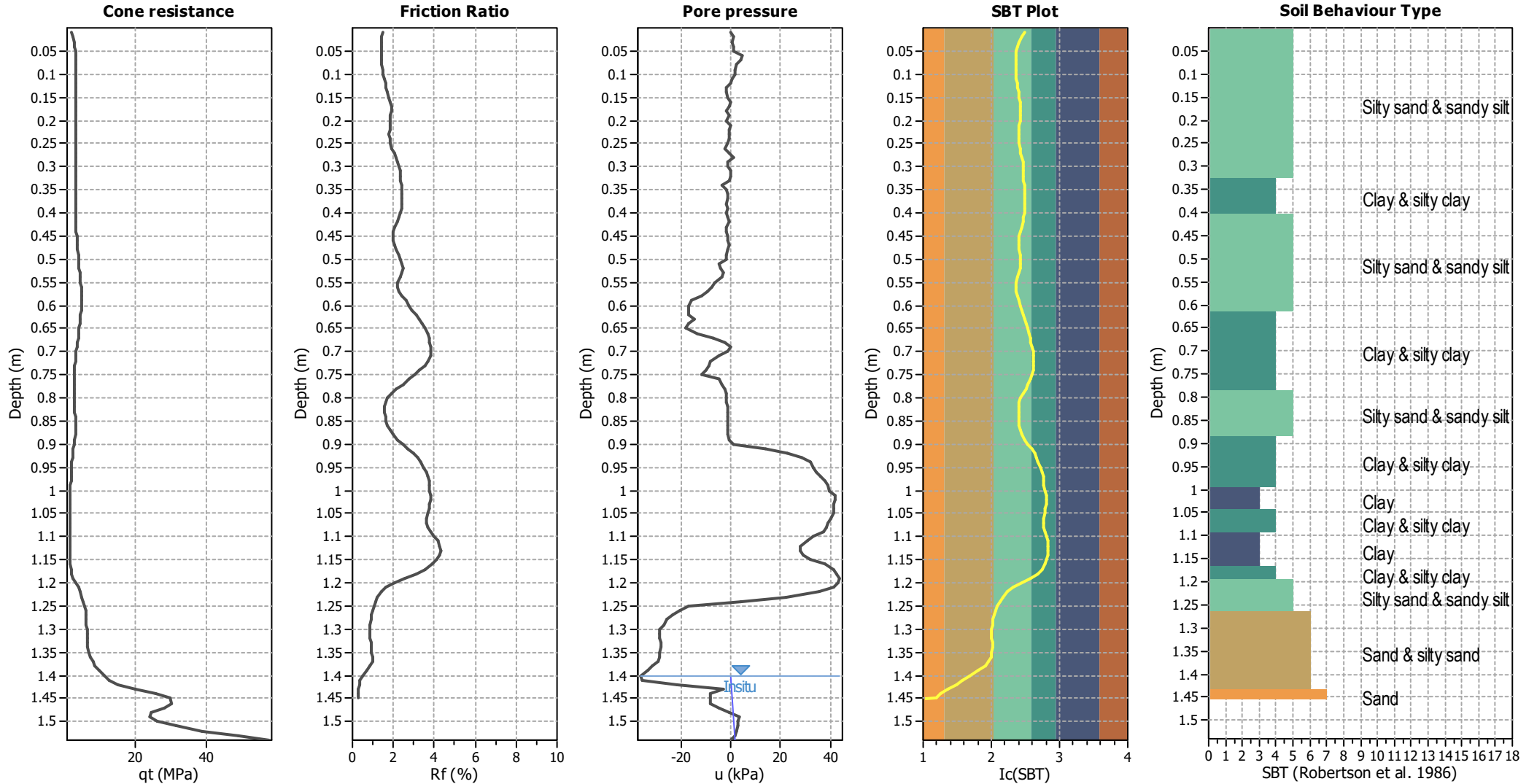
#### Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.50 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_v$ applied:	Yes
Earthquake magnitude $M_w$ :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	10.00 m

#### SBT legend

1. Sensitive fine grained	4. Clayey silt to silty	7. Gravely sand to sand
2. Organic material	5. Silty sand to sandy silt	8. Very stiff sand to
3. Clay to silty clay	6. Clean sand to silty sand	9. Very stiff fine grained

### CPT basic interpretation plots



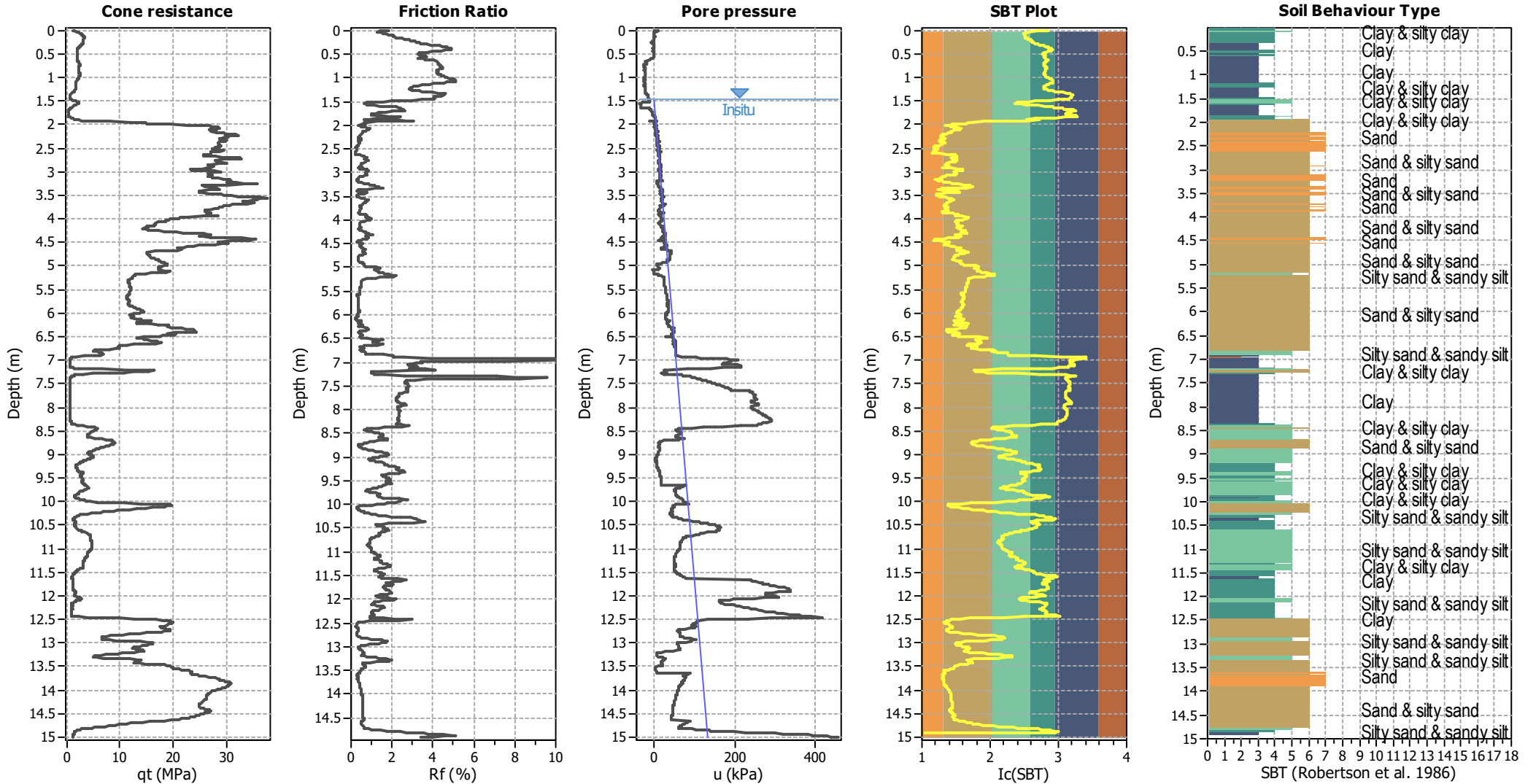
#### Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.40 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K <sub>v</sub> applied:	Yes
Earthquake magnitude M <sub>w</sub> :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.40 m	Fill height:	N/A	Limit depth:	10.00 m

#### SBT legend

1. Sensitive fine grained	4. Clayey silt to silty	7. Gravely sand to sand
2. Organic material	5. Silty sand to sandy silt	8. Very stiff sand to
3. Clay to silty clay	6. Clean sand to silty sand	9. Very stiff fine grained

### CPT basic interpretation plots



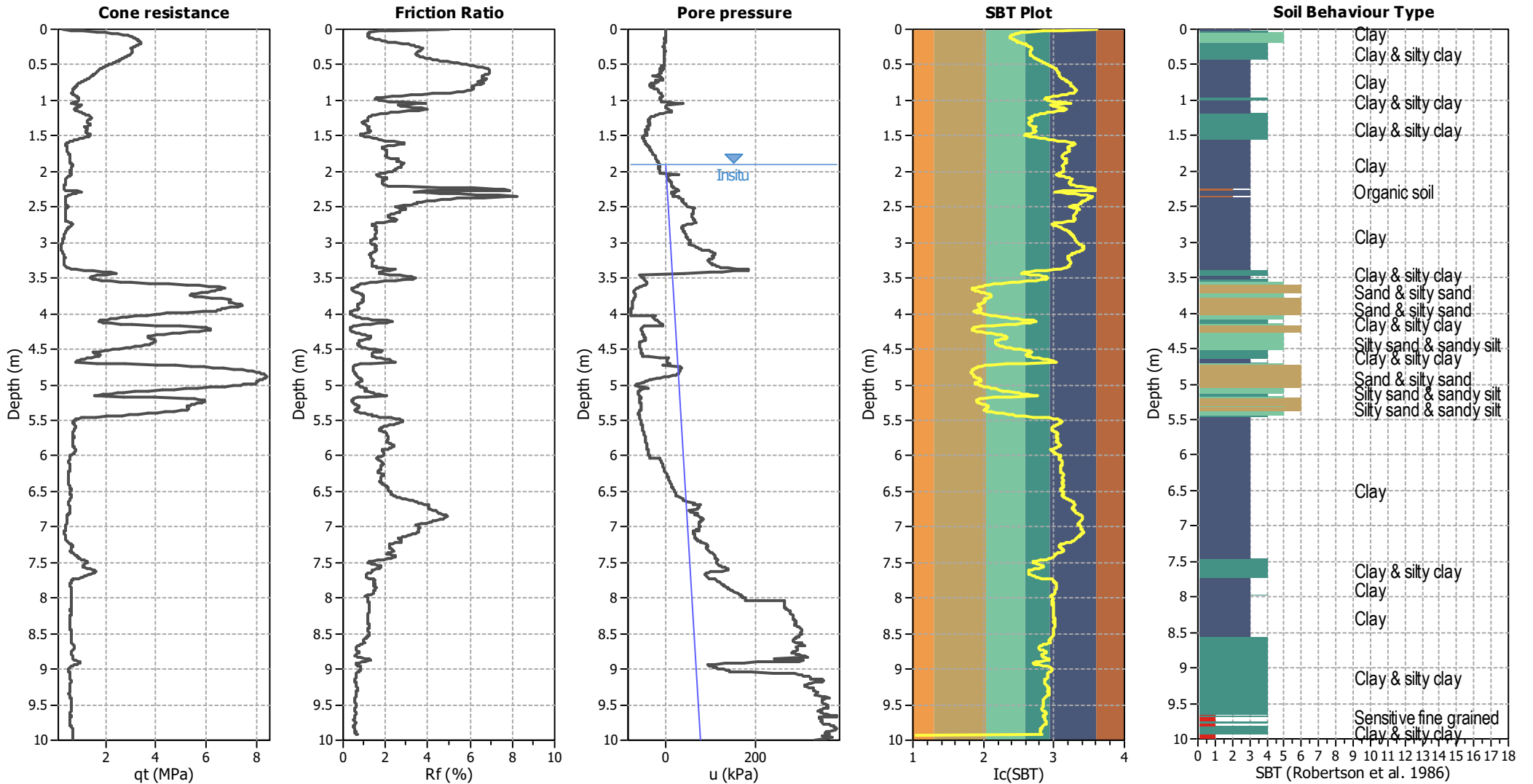
#### Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.45 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K <sub>v</sub> applied:	Yes
Earthquake magnitude M <sub>w</sub> :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.45 m	Fill height:	N/A	Limit depth:	10.00 m

#### SBT legend

1. Sensitive fine grained	4. Clayey silt to silty	7. Gravely sand to sand
2. Organic material	5. Silty sand to sandy silt	8. Very stiff sand to
3. Clay to silty clay	6. Clean sand to silty sand	9. Very stiff fine grained

### CPT basic interpretation plots



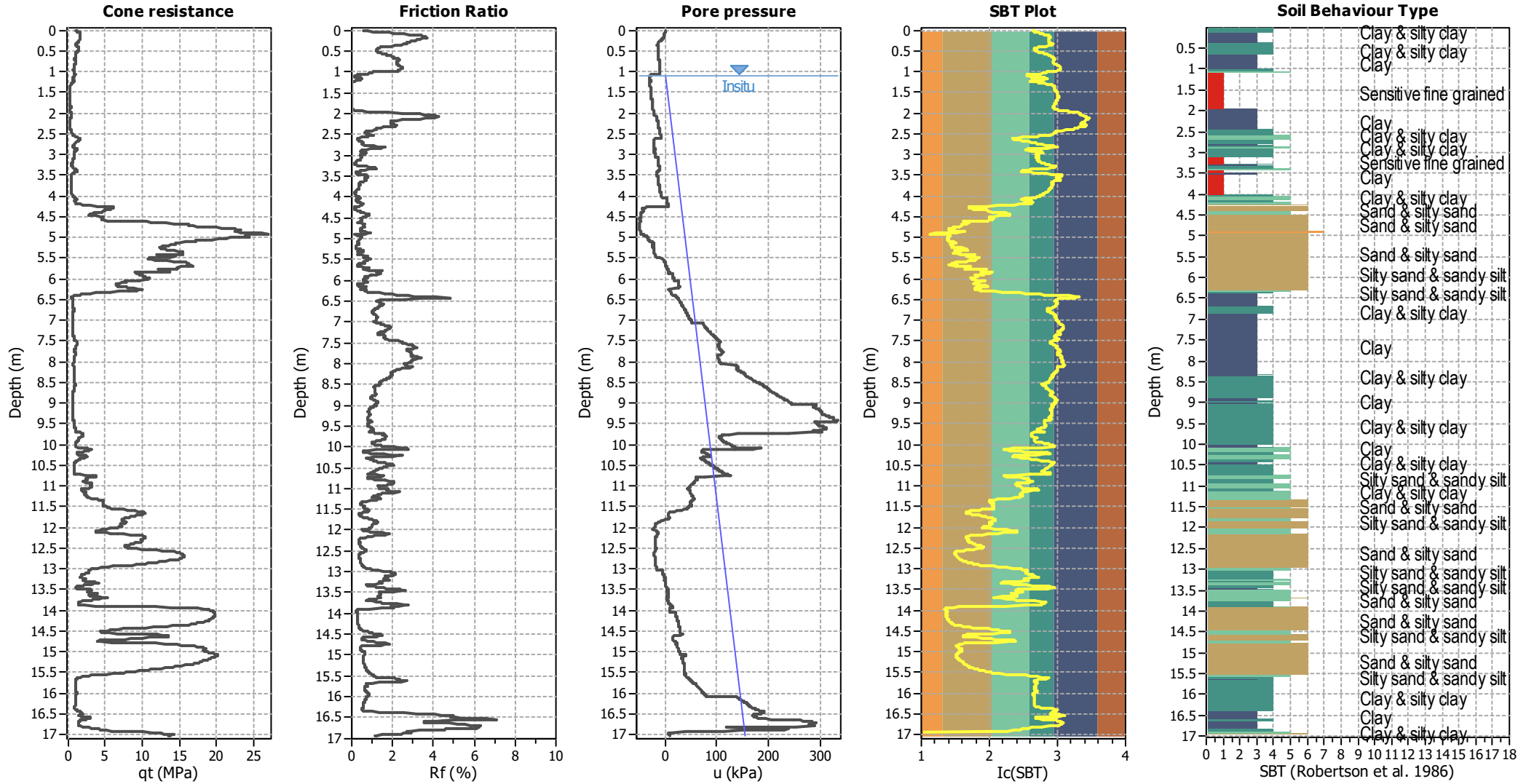
#### Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.90 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_v$ applied:	Yes
Earthquake magnitude $M_w$ :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.90 m	Fill height:	N/A	Limit depth:	10.00 m

#### SBT legend

<span style="color:red">■</span> 1. Sensitive fine grained	<span style="color:teal">■</span> 4. Clayey silt to silty	<span style="color:orange">■</span> 7. Gravely sand to sand
<span style="color:darkred">■</span> 2. Organic material	<span style="color:green">■</span> 5. Silty sand to sandy silt	<span style="color:grey">■</span> 8. Very stiff sand to
<span style="color:blue">■</span> 3. Clay to silty clay	<span style="color:yellow">■</span> 6. Clean sand to silty sand	<span style="color:lightgrey">■</span> 9. Very stiff fine grained

### CPT basic interpretation plots



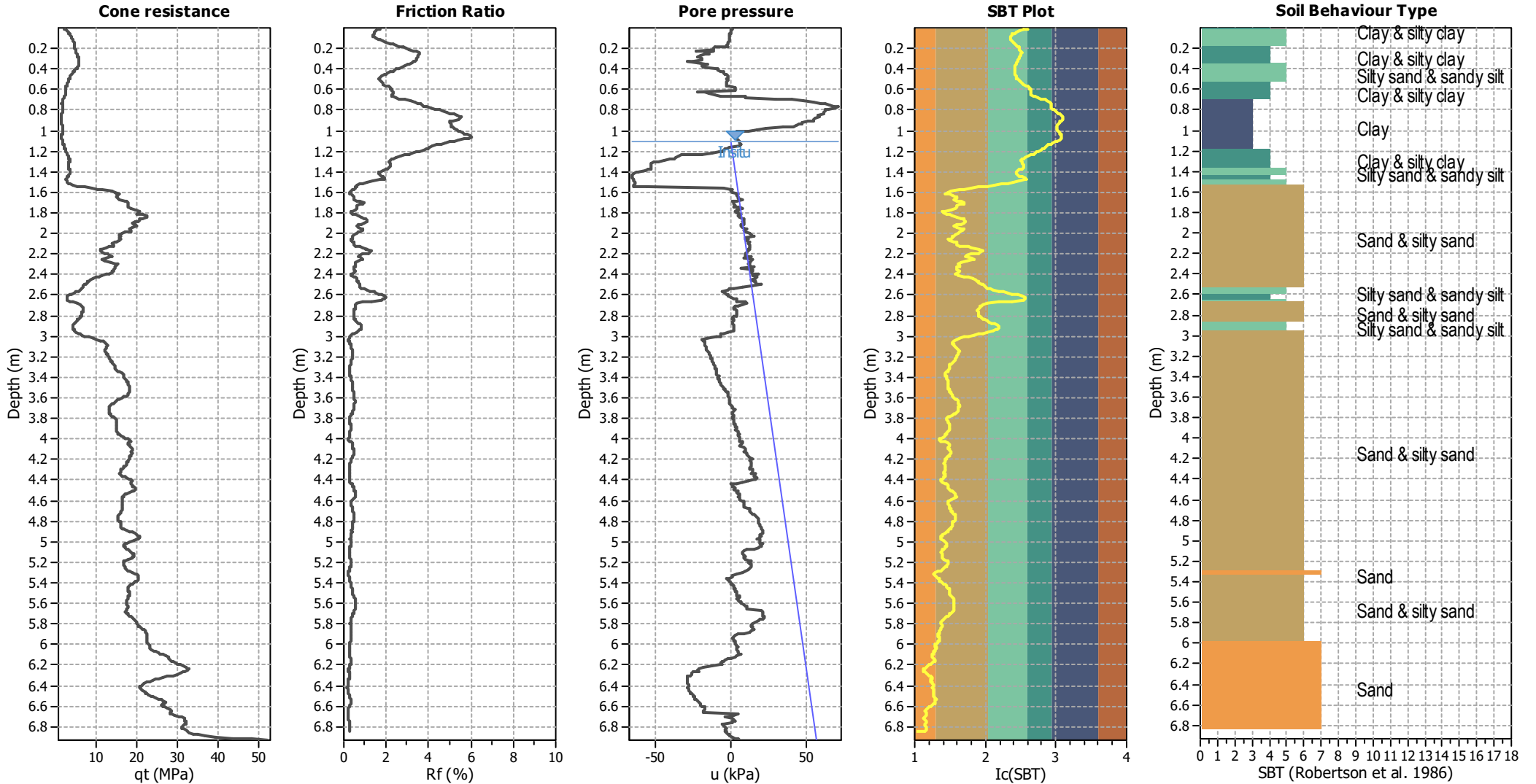
#### Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.10 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K <sub>v</sub> applied:	Yes
Earthquake magnitude M <sub>w</sub> :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.10 m	Fill height:	N/A	Limit depth:	10.00 m

#### SBT legend

1. Sensitive fine grained	4. Clayey silt to silty	7. Gravely sand to sand
2. Organic material	5. Silty sand to sandy silt	8. Very stiff sand to
3. Clay to silty clay	6. Clean sand to silty sand	9. Very stiff fine grained

### CPT basic interpretation plots



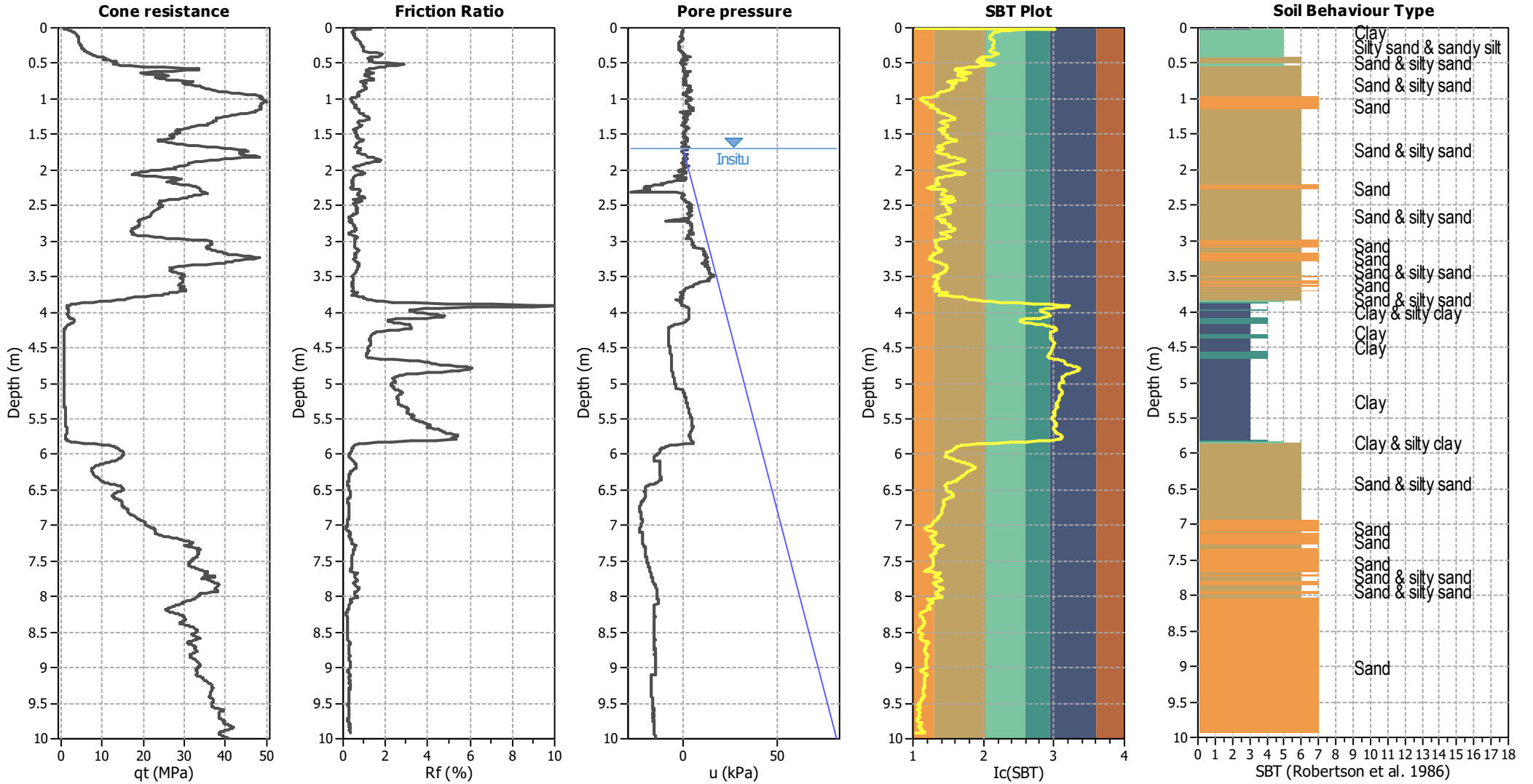
#### Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.10 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_v$ applied:	Yes
Earthquake magnitude $M_w$ :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.10 m	Fill height:	N/A	Limit depth:	10.00 m

#### SBT legend

<span style="color: red;">■</span> 1. Sensitive fine grained	<span style="color: teal;">■</span> 4. Clayey silt to silty	<span style="color: orange;">■</span> 7. Gravely sand to sand
<span style="color: brown;">■</span> 2. Organic material	<span style="color: lightgreen;">■</span> 5. Silty sand to sandy silt	<span style="color: grey;">■</span> 8. Very stiff sand to
<span style="color: blue;">■</span> 3. Clay to silty clay	<span style="color: tan;">■</span> 6. Clean sand to silty sand	<span style="color: lightgrey;">■</span> 9. Very stiff fine grained

### CPT basic interpretation plots



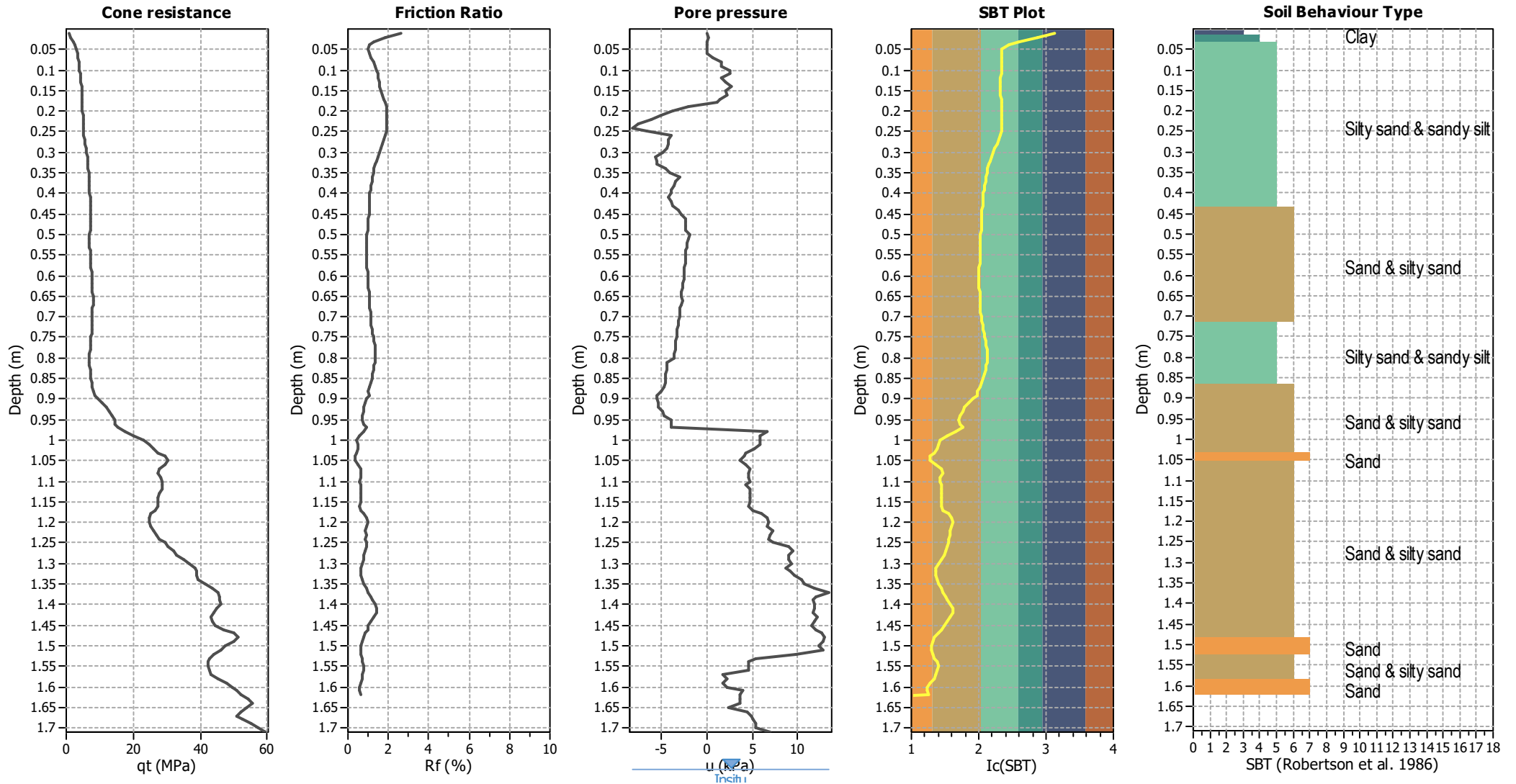
#### Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_f$ applied:	Yes
Earthquake magnitude $M_w$ :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	10.00 m

#### SBT legend

1. Sensitive fine grained	4. Clayey silt to silty	7. Gravely sand to sand
2. Organic material	5. Silty sand to sandy silt	8. Very stiff sand to
3. Clay to silty clay	6. Clean sand to silty sand	9. Very stiff fine grained

### CPT basic interpretation plots



#### Input parameters and analysis data

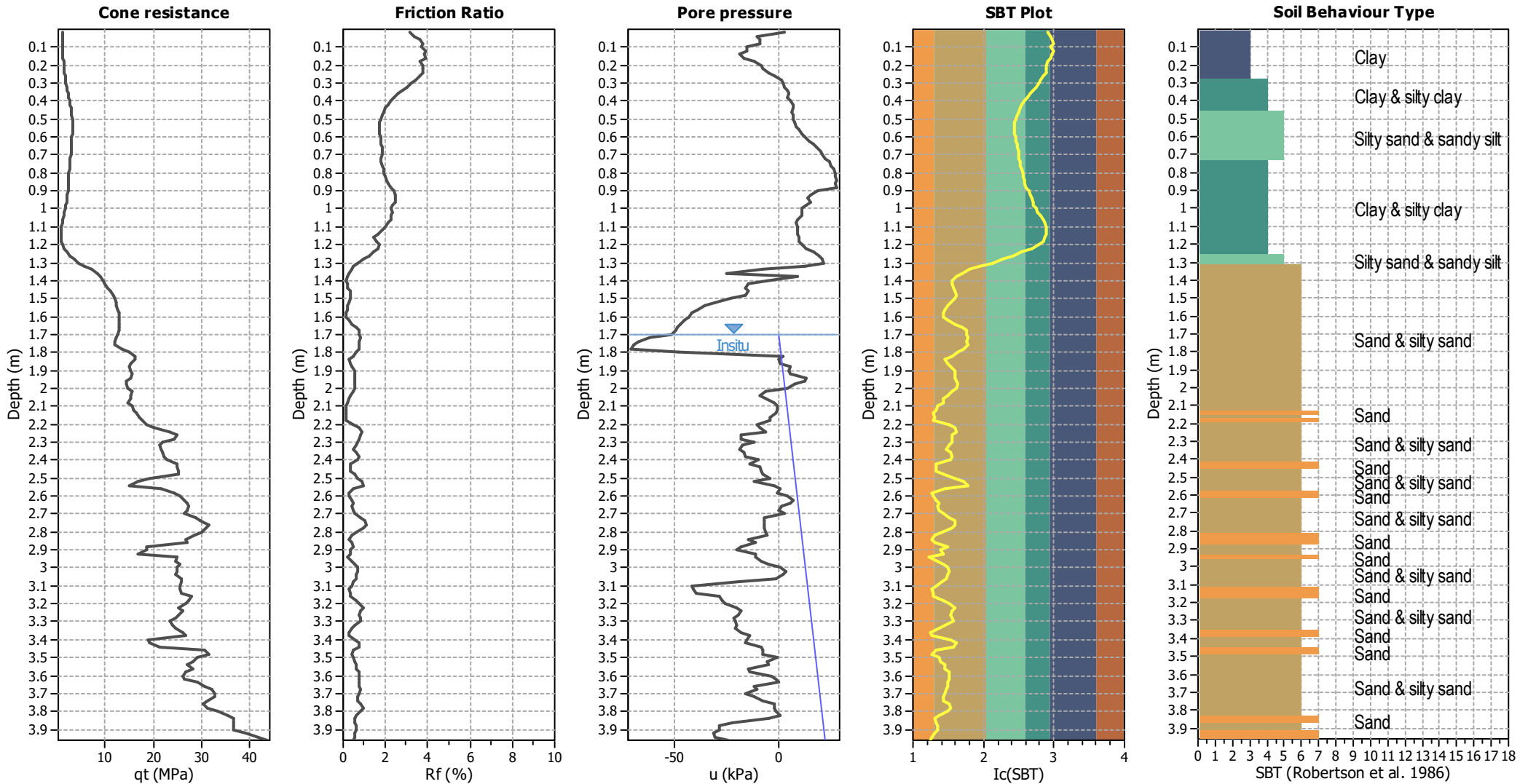
Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.80 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_v$ applied:	Yes
Earthquake magnitude $M_w$ :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.80 m	Fill height:	N/A	Limit depth:	10.00 m

#### SBT legend

1. Sensitive fine grained	4. Clayey silt to silty	7. Gravely sand to sand
2. Organic material	5. Silty sand to sandy silt	8. Very stiff sand to
3. Clay to silty clay	6. Clean sand to silty sand	9. Very stiff fine grained



### CPT basic interpretation plots



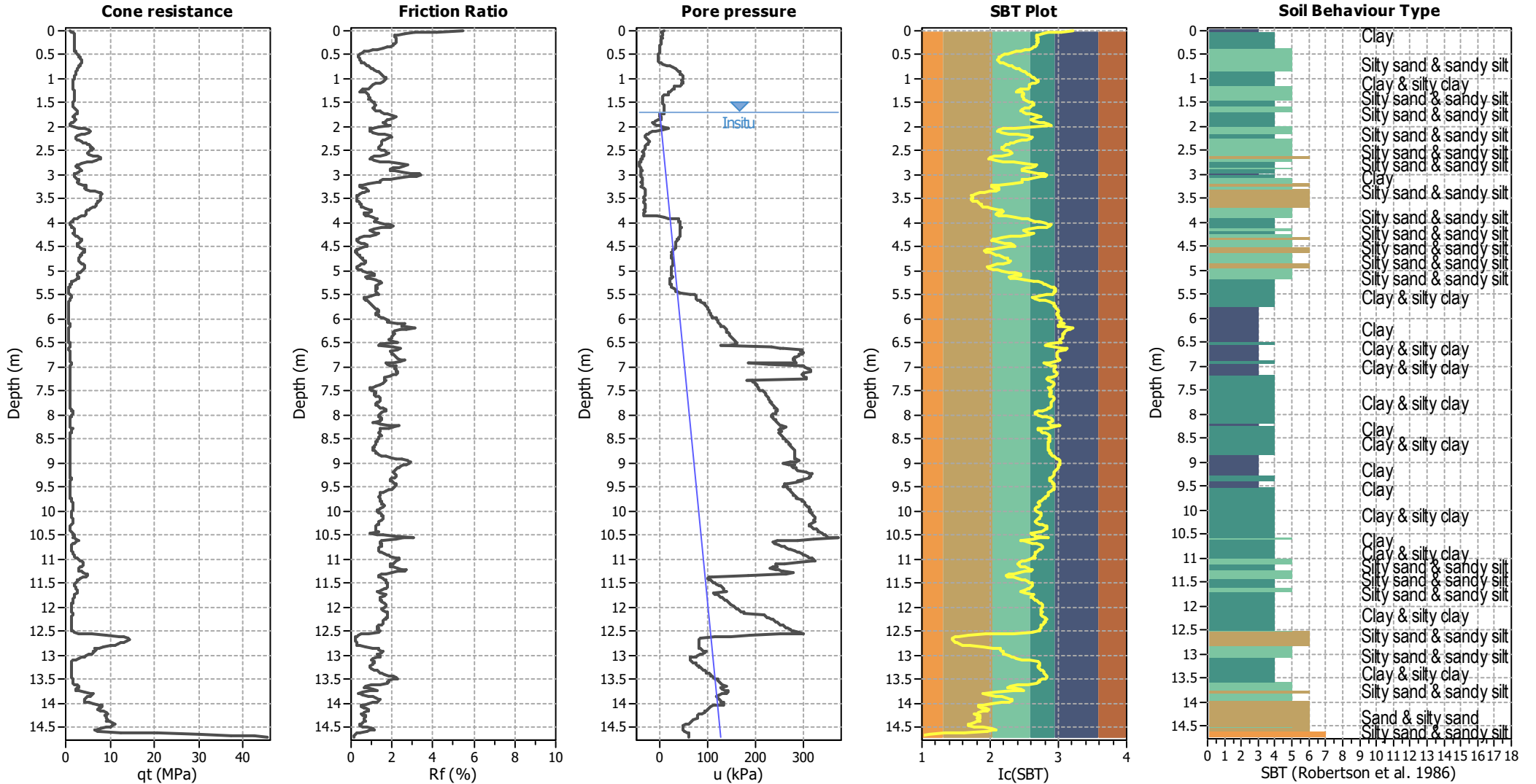
#### Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_f$ applied:	Yes
Earthquake magnitude $M_w$ :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	10.00 m

#### SBT legend

1. Sensitive fine grained	4. Clayey silt to silty	7. Gravely sand to sand
2. Organic material	5. Silty sand to sandy silt	8. Very stiff sand to
3. Clay to silty clay	6. Clean sand to silty sand	9. Very stiff fine grained

### CPT basic interpretation plots



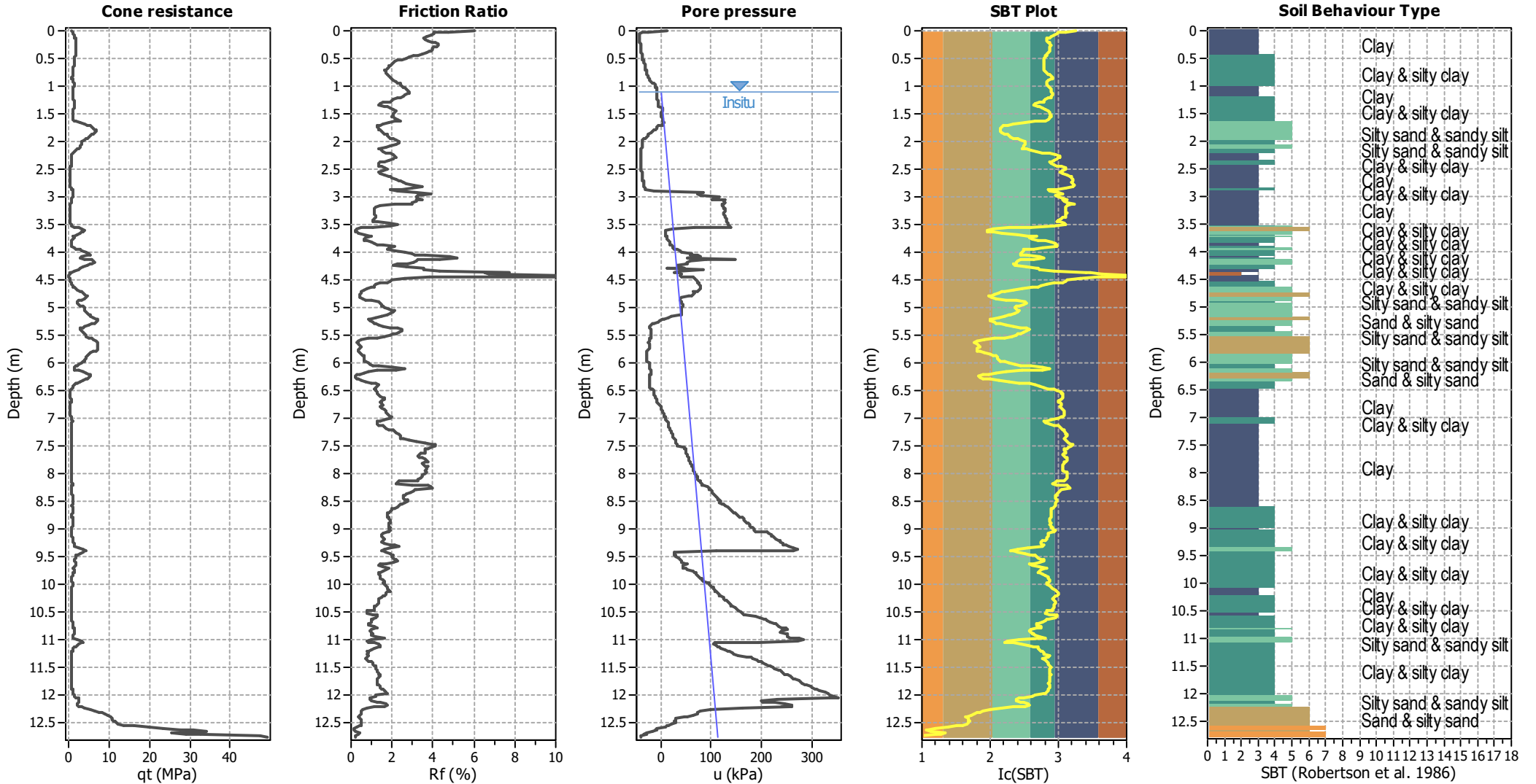
#### Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K <sub>v</sub> applied:	Yes
Earthquake magnitude M <sub>w</sub> :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	10.00 m

#### SBT legend

1. Sensitive fine grained	4. Clayey silt to silty	7. Gravely sand to sand
2. Organic material	5. Silty sand to sandy silt	8. Very stiff sand to
3. Clay to silty clay	6. Clean sand to silty sand	9. Very stiff fine grained

### CPT basic interpretation plots



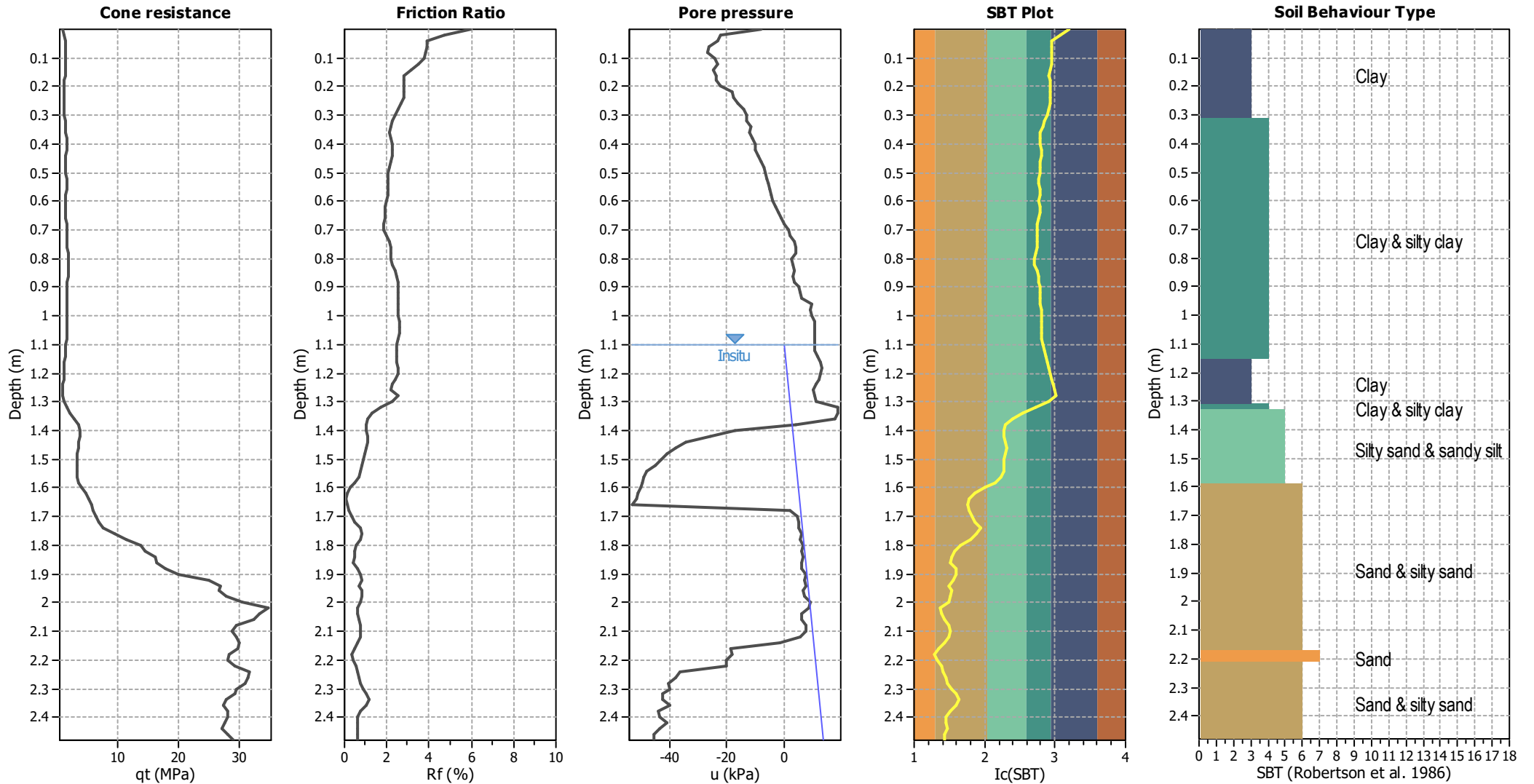
#### Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.10 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_v$ applied:	Yes
Earthquake magnitude $M_w$ :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.10 m	Fill height:	N/A	Limit depth:	10.00 m

#### SBT legend

1. Sensitive fine grained	4. Clayey silt to silty	7. Gravely sand to sand
2. Organic material	5. Silty sand to sandy silt	8. Very stiff sand to
3. Clay to silty clay	6. Clean sand to silty sand	9. Very stiff fine grained

### CPT basic interpretation plots



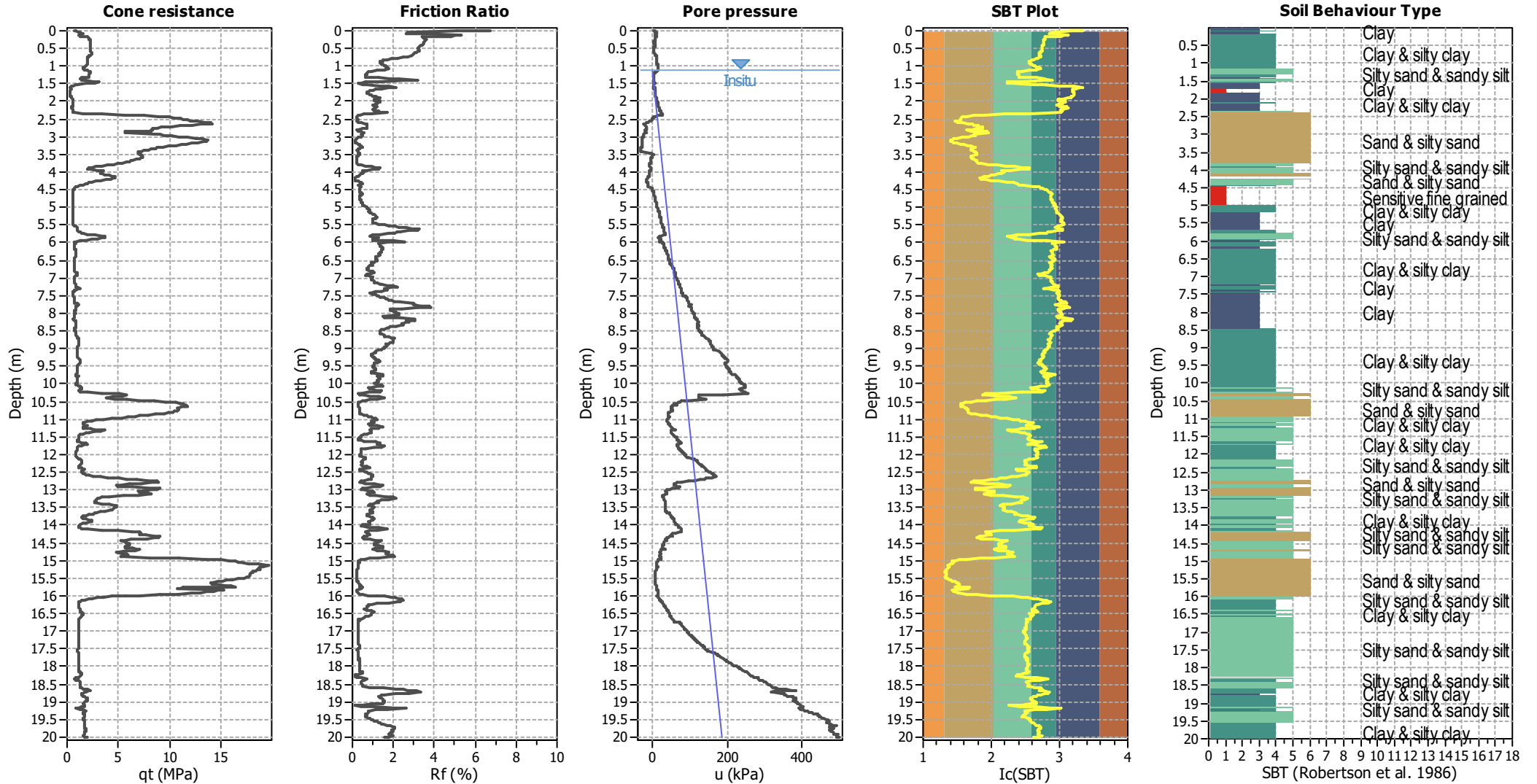
#### Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.10 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K <sub>v</sub> applied:	Yes
Earthquake magnitude M <sub>w</sub> :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.10 m	Fill height:	N/A	Limit depth:	10.00 m

#### SBT legend

1. Sensitive fine grained	4. Clayey silt to silty	7. Gravely sand to sand
2. Organic material	5. Silty sand to sandy silt	8. Very stiff sand to
3. Clay to silty clay	6. Clean sand to silty sand	9. Very stiff fine grained

### CPT basic interpretation plots



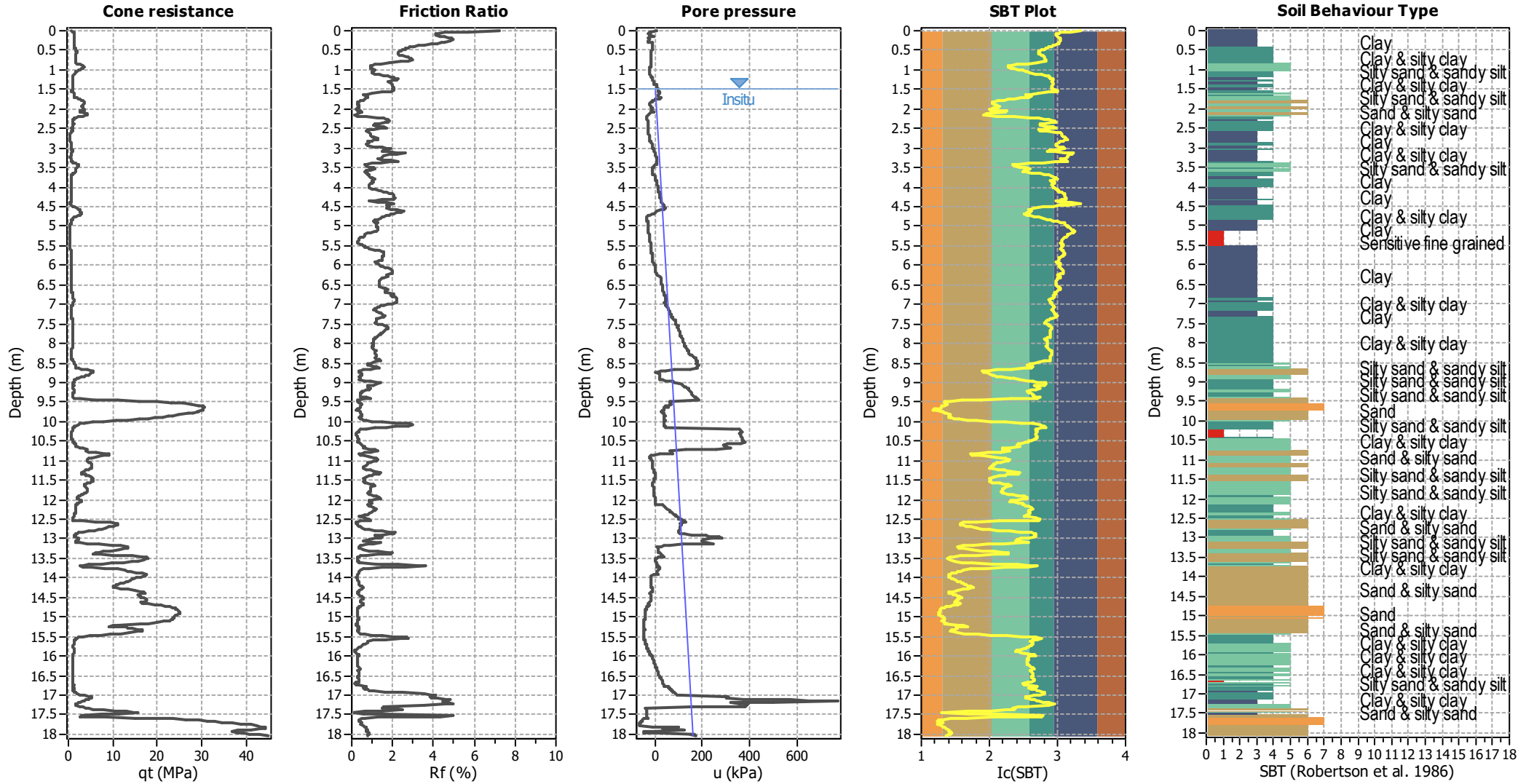
#### Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.10 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K <sub>0</sub> applied:	Yes
Earthquake magnitude M <sub>w</sub> :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.10 m	Fill height:	N/A	Limit depth:	10.00 m

#### SBT legend

1. Sensitive fine grained	4. Clayey silt to silty	7. Gravely sand to sand
2. Organic material	5. Silty sand to sandy silt	8. Very stiff sand to
3. Clay to silty clay	6. Clean sand to silty sand	9. Very stiff fine grained

### CPT basic interpretation plots



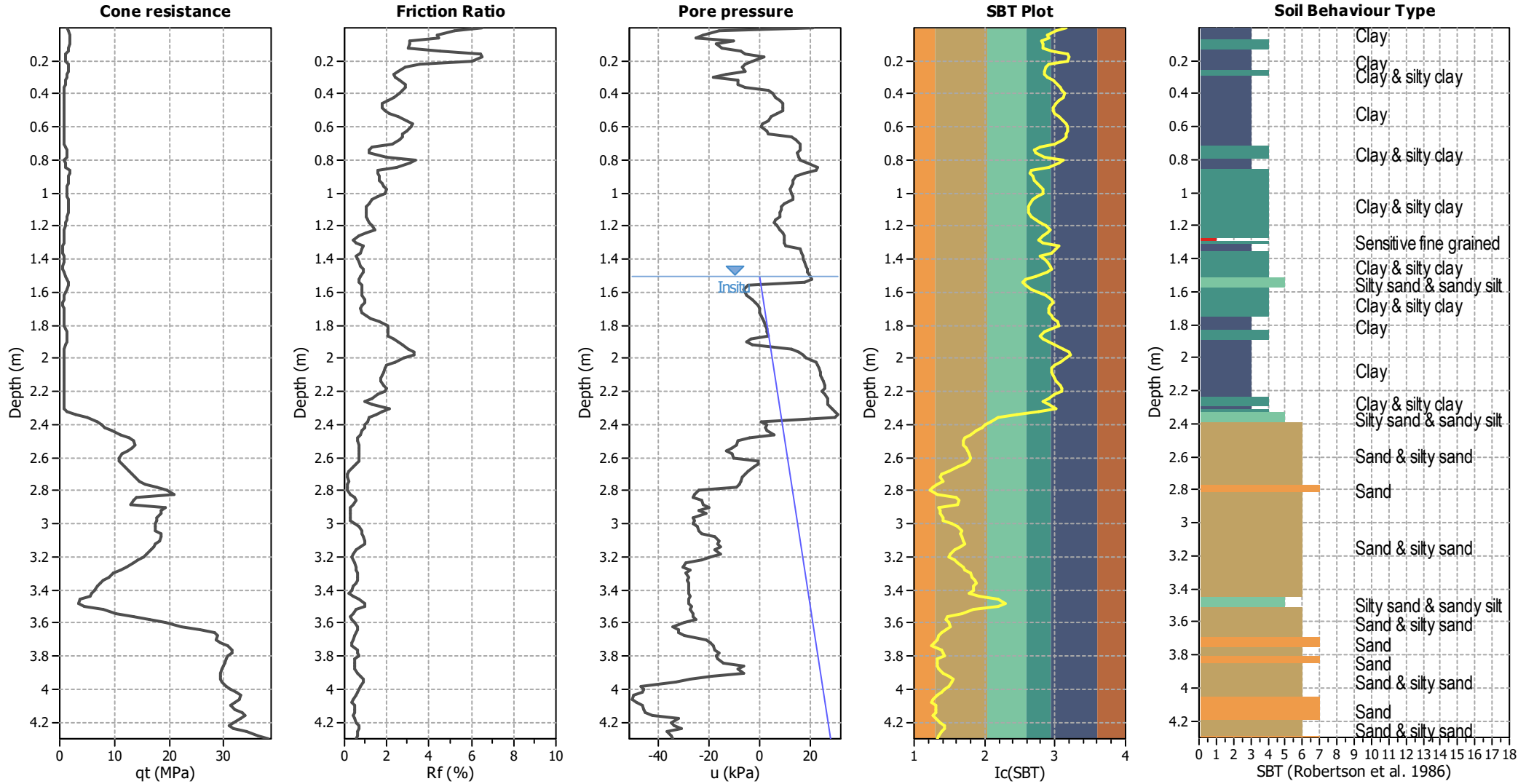
#### Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.50 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_v$ applied:	Yes
Earthquake magnitude $M_w$ :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	10.00 m

#### SBT legend

<span style="color:red">■</span> 1. Sensitive fine grained	<span style="color:green">■</span> 4. Clayey silt to silty	<span style="color:orange">■</span> 7. Gravely sand to sand
<span style="color:brown">■</span> 2. Organic material	<span style="color:lightgreen">■</span> 5. Silty sand to sandy silt	<span style="color:grey">■</span> 8. Very stiff sand to
<span style="color:blue">■</span> 3. Clay to silty clay	<span style="color:tan">■</span> 6. Clean sand to silty sand	<span style="color:lightgrey">■</span> 9. Very stiff fine grained

### CPT basic interpretation plots



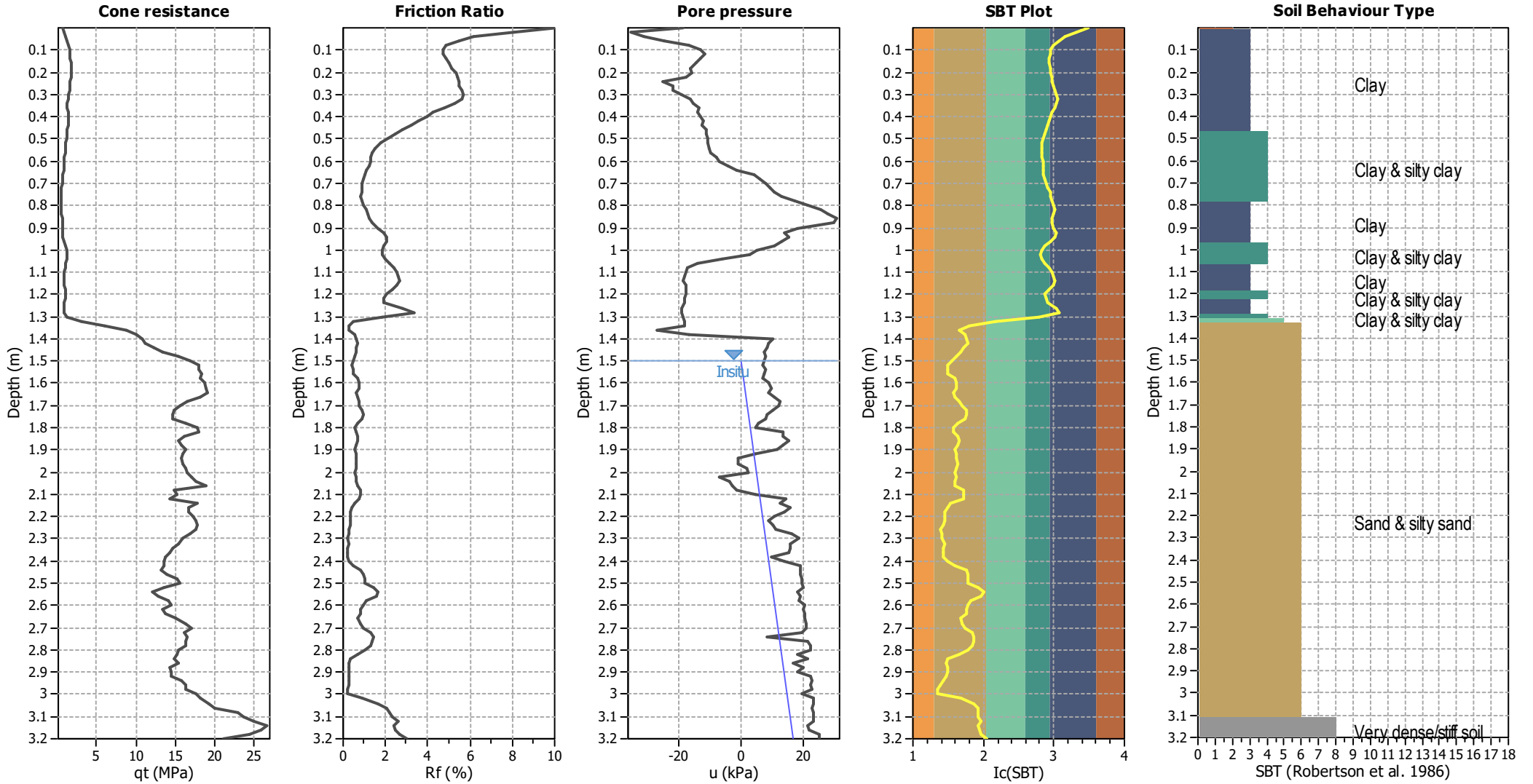
#### Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.50 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_v$ applied:	Yes
Earthquake magnitude $M_w$ :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	10.00 m

#### SBT legend

<span style="color: red;">■</span> 1. Sensitive fine grained	<span style="color: teal;">■</span> 4. Clayey silt to silty	<span style="color: orange;">■</span> 7. Gravely sand to sand
<span style="color: brown;">■</span> 2. Organic material	<span style="color: lightgreen;">■</span> 5. Silty sand to sandy silt	<span style="color: grey;">■</span> 8. Very stiff sand to
<span style="color: blue;">■</span> 3. Clay to silty clay	<span style="color: tan;">■</span> 6. Clean sand to silty sand	<span style="color: lightgrey;">■</span> 9. Very stiff fine grained

### CPT basic interpretation plots



#### Input parameters and analysis data

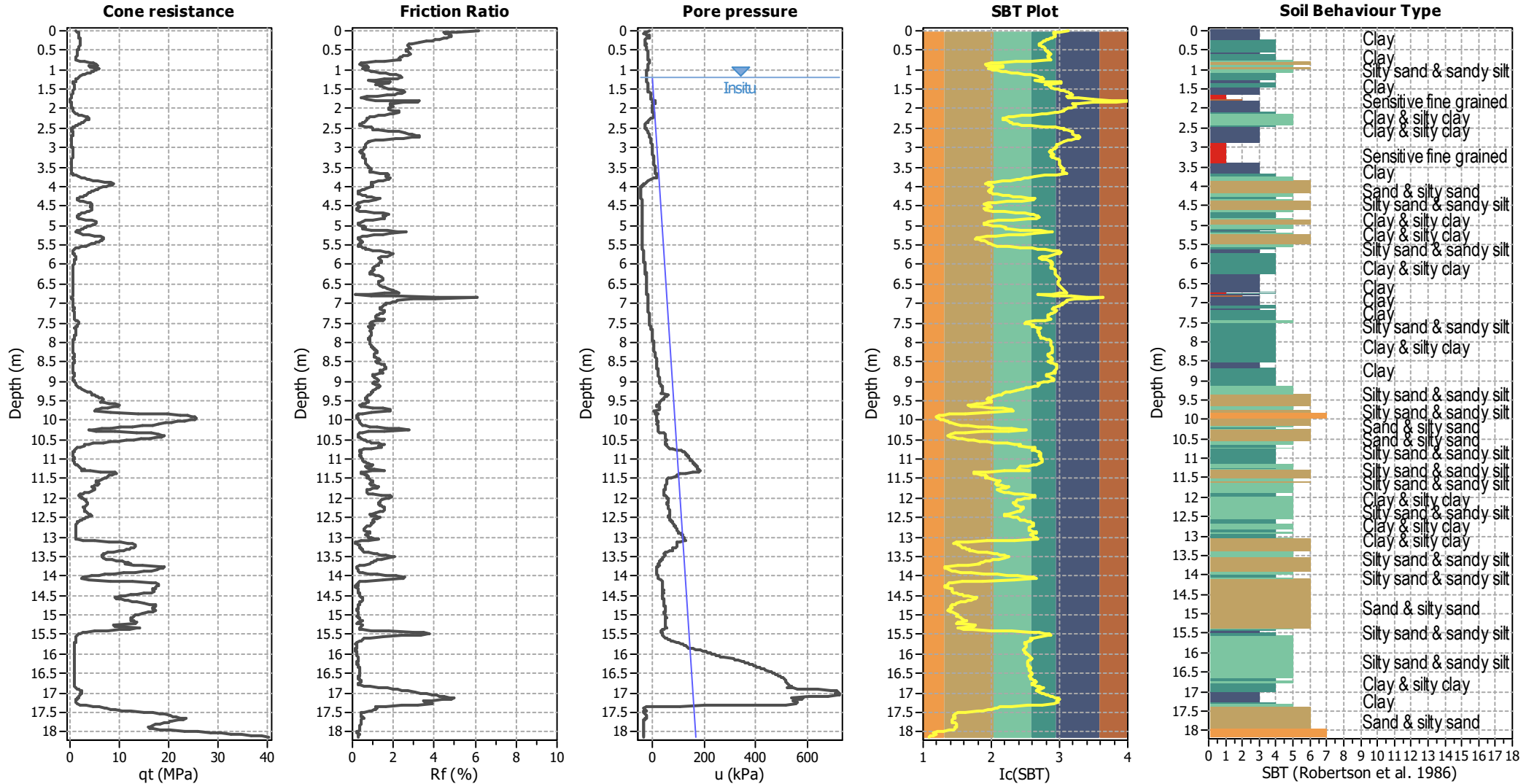
Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.50 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K <sub>0</sub> applied:	Yes
Earthquake magnitude M <sub>w</sub> :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	10.00 m

#### SBT legend

1. Sensitive fine grained	4. Clayey silt to silty	7. Gravely sand to sand
2. Organic material	5. Silty sand to sandy silt	8. Very stiff sand to
3. Clay to silty clay	6. Clean sand to silty sand	9. Very stiff fine grained



### CPT basic interpretation plots



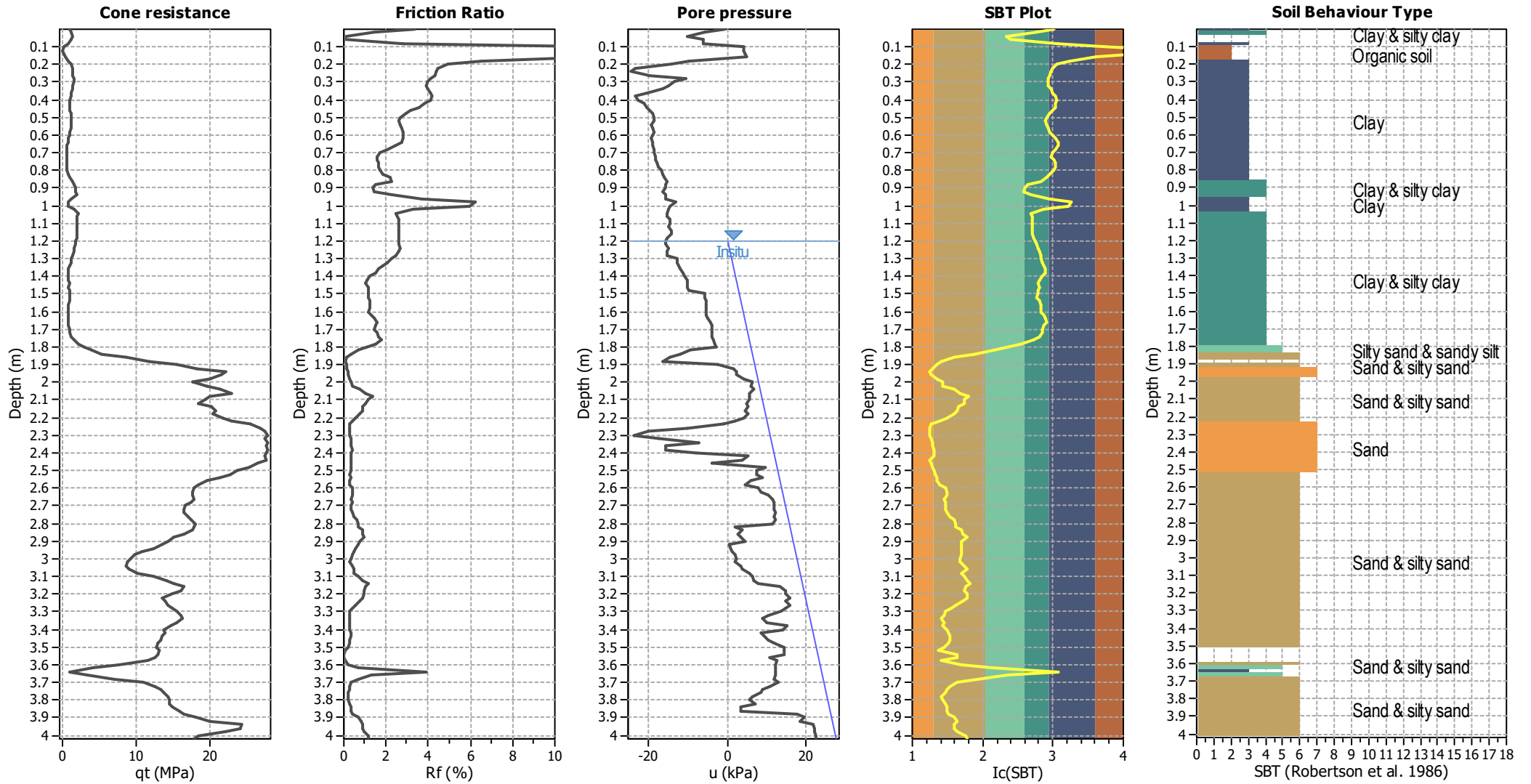
#### Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.20 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_v$ applied:	Yes
Earthquake magnitude $M_w$ :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.20 m	Fill height:	N/A	Limit depth:	10.00 m

#### SBT legend

<span style="color:red">■</span> 1. Sensitive fine grained	<span style="color:teal">■</span> 4. Clayey silt to silty	<span style="color:orange">■</span> 7. Gravely sand to sand
<span style="color:blue">■</span> 2. Organic material	<span style="color:green">■</span> 5. Silty sand to sandy silt	<span style="color:grey">■</span> 8. Very stiff sand to
<span style="color:darkblue">■</span> 3. Clay to silty clay	<span style="color:yellow">■</span> 6. Clean sand to silty sand	<span style="color:lightgrey">■</span> 9. Very stiff fine grained

### CPT basic interpretation plots



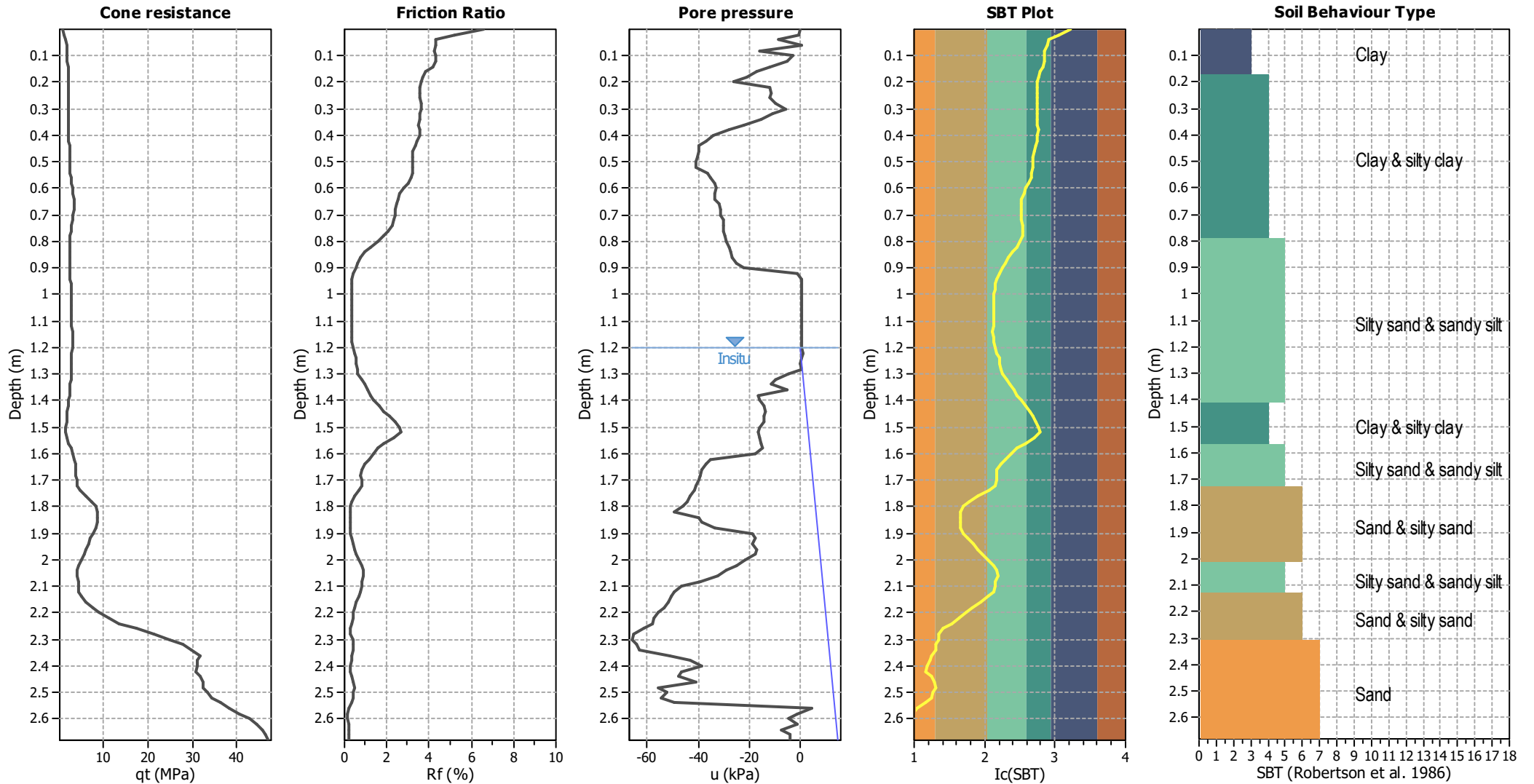
#### Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.20 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_0$ applied:	Yes
Earthquake magnitude $M_w$ :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.20 m	Fill height:	N/A	Limit depth:	10.00 m

#### SBT legend

1. Sensitive fine grained	4. Clayey silt to silty	7. Gravely sand to sand
2. Organic material	5. Silty sand to sandy silt	8. Very stiff sand to
3. Clay to silty clay	6. Clean sand to silty sand	9. Very stiff fine grained

### CPT basic interpretation plots



#### Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.20 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_p$ applied:	Yes
Earthquake magnitude $M_w$ :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.20 m	Fill height:	N/A	Limit depth:	10.00 m

#### SBT legend

1. Sensitive fine grained	4. Clayey silt to silty	7. Gravely sand to sand
2. Organic material	5. Silty sand to sandy silt	8. Very stiff sand to
3. Clay to silty clay	6. Clean sand to silty sand	9. Very stiff fine grained

## **APPENDIX 4:** Liquefaction Analysis Results

## Summary of Liquefaction Analysis Results and Inferred Technical Category

CPT #	Termination Depth	Assumed Groundwater Level	Calculated Settlements <sup>1</sup>			Inferred Technical Category
			SLS2 <sup>2</sup>	ILS	ULS	
CPT-01	2.5 m	2.1 m	0 mm			Insufficient data
CPT-02	1.3 m	1.5 m	0 mm			Insufficient data
CPT-03	10 m	1.3 m	65 mm	80 mm	100 mm	TC3 minor to moderate
CPT-04	4.4 m	1.25 m	< 10 mm		15 mm	Insufficient data
CPT-05	15 m	0.85 m	10 mm	15 mm	20 mm	TC1
CPT-06	3.6 m	0.2 m	< 10 mm			Insufficient data
CPT-07	10 m	0 m	45 mm	50 mm	50 mm	TC2
CPT-08	6.7 m	0 m	35 mm	35 mm	40 mm	Likely TC2
CPT-09	10 m	0.2 m	80 mm	100 mm	105 mm	TC3 minor to moderate
CPT-10	8.4 m	0.2 m	30 mm	35 mm	40 mm	Likely TC2
CPT-11	5 m	0 m	40 mm	45 mm	45 mm	Insufficient data
CPT-12	10 m	0.6 m	55 mm	75 mm	85 mm	TC3 minor to moderate
CPT-13	10 m	2.5 m	30 mm	45 mm	55 mm	TC2
CPT-14	15 m	2.65 m	25 mm	45 mm	55 mm	TC2
CPT-15	7.4 m	2.2 m	< 10 mm		20 mm	Likely TC1
CPT-16	1.1 m	2 m	0 mm			Insufficient data
CPT-17	2.5 m	1.85 m	0 mm			Insufficient data

CPT #	Termination Depth	Assumed Groundwater Level	Calculated Settlements <sup>1</sup>			Inferred Technical Category
			SLS <sup>2</sup>	ILS	ULS	
CPT-18	14.7 m	2.2 m	35 mm	55 mm	70 mm	TC2
CPT-19	10 m	2.1 m	45 mm	60 mm	75 mm	TC2
CPT-20	15 m	1.65 m	50 mm	60 mm	70 mm	TC2
CPT-21	10 m	0 m	45 mm	50 mm	50 mm	TC2
CPT-22	9.8 m	0 m	25 mm	30 mm	30 mm	TC2
CPT-23	15 m	1.9 m	145 mm	160 mm	160 mm	TC3 potentially significant
CPT-24	7.6 m	1.05 m	0 mm	< 10 mm		Likely TC1
CPT-25	12.6 m	1.7 m	25 mm	30 mm	50 mm	TC2
CPT-26	10 m	2.2 m	80 mm	95 mm	105 mm	TC3 minor to moderate
CPT-27	10 m	1.75 m	100 mm	120 mm	130 mm	TC3 potentially significant
CPT-28	7.6 m	0 m	20 mm	20 mm	25 mm	Likely TC2
CPT-29	6.3 m	0.4 m	45 mm	45 mm	45 mm	Likely TC2
CPT-30	15 m	0 m	< 10 mm	10 mm	15 mm	TC1
CPT-31	10 m	0.85 m	40 mm	55 mm	70 mm	TC2
CPT-32	2.7 m	1.4 m	0 mm		< 10 mm	Insufficient data
CPT-33	3.1 m	1.4 m	< 10 mm		20 mm	Insufficient data
CPT-34	8.1 m	1.5 m	15 mm	25 mm	40 mm	Likely TC2
CPT-35	1.5 m	1.4 m	0 mm			Insufficient data
CPT-36	15 m	1.45 m	30 mm	40 mm	60 mm	TC2

CPT #	Termination Depth	Assumed Groundwater Level	Calculated Settlements <sup>1</sup>			Inferred Technical Category
			SLS2 <sup>2</sup>	ILS	ULS	
CPT-37	10 m	1.9 m	30 mm	45 mm	50 mm	TC2
CPT-38	17 m	1.1 m	50 mm	55 mm	60 mm	TC2
CPT-39	6.9 m	1.1 m	<10 mm	10 mm	20 mm	Likely TC2
CPT-40	10 m	1.7 m	<10 mm		15 mm	TC1
CPT-41	1.7 m	1.8 m	0 mm			Insufficient data
ES-CPT-01 <sup>3</sup>	3.9 m	1.7 m	<10 mm			Insufficient data
ES-CPT-02	14.7 m	1.7 m	45 mm	60 mm	80 mm	TC2
ES-CPT-03	12.7 m	1.1 m	55 mm	65 mm	75 mm	TC3 minor to moderate
ES-CPT-04	2.4 m	1.1 m	< 10 mm		10 mm	Insufficient data
ES-CPT-05	20 m	1.1 m	35 mm	45 mm	55 mm	TC2
ES-CPT-06	18 m	1.5 m	45 mm	55 mm	60 mm	TC2
ES-CPT-07	4.3 m	1.5 m	<10 mm		10 mm	Insufficient data
ES-CPT-08	3.2 m	1.5 m	0 mm	<10 mm		Insufficient data
ES-CPT-09	18.1 m	1.2 m	75 mm	85 mm	90 mm	TC3 minor to moderate
ES-CPT-10	4 m	1.2 m	< 10 mm			Insufficient data
ES-CPT-11	2.6 m	1.2 m	<10 mm		20 mm	Insufficient data

<sup>1</sup>For an undeveloped site. Settlements beneath buildings are likely to be different. Only the upper 10.0 metres of the profile are considered in accordance with Section 12 of the MBIE Guidance Document.

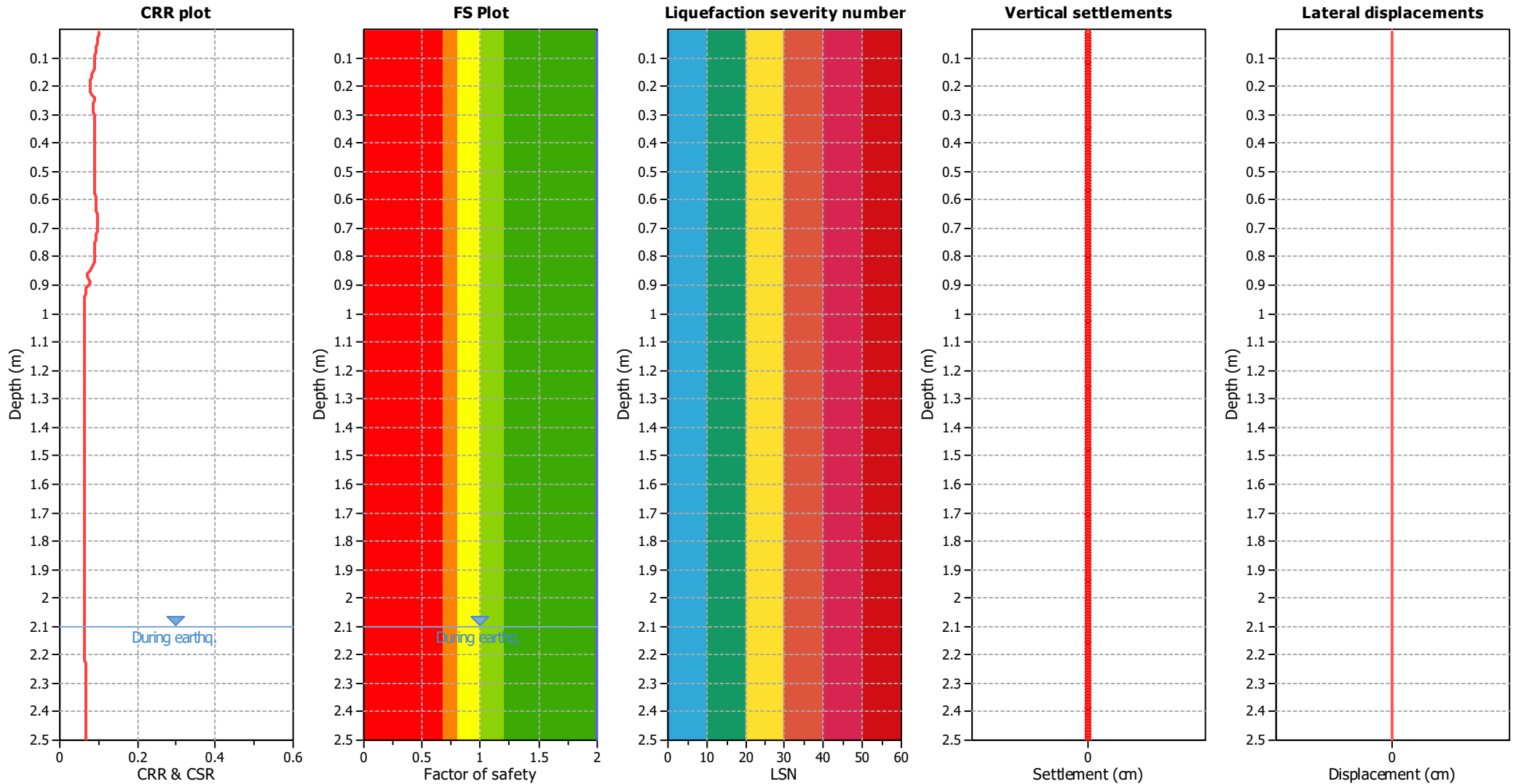
<sup>2</sup>Only the SLS2 case was considered as it resulted in a higher liquefaction potential than SLS1. It was therefore considered the critical SLS case.

<sup>3</sup>CPTs denoted at ES-CPT-XX are from the 2020 Elliot Sinclair investigation. The data used in our analysis was sourced from NZGD.

## **APPENDIX 5:** Liquefaction Analysis Outputs



### Liquefaction analysis overall plots



#### Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (earthq.):	2.10 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_d$ applied:	Yes
Earthquake magnitude $M_w$ :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.10 m	Fill height:	N/A	Limit depth:	10.00 m

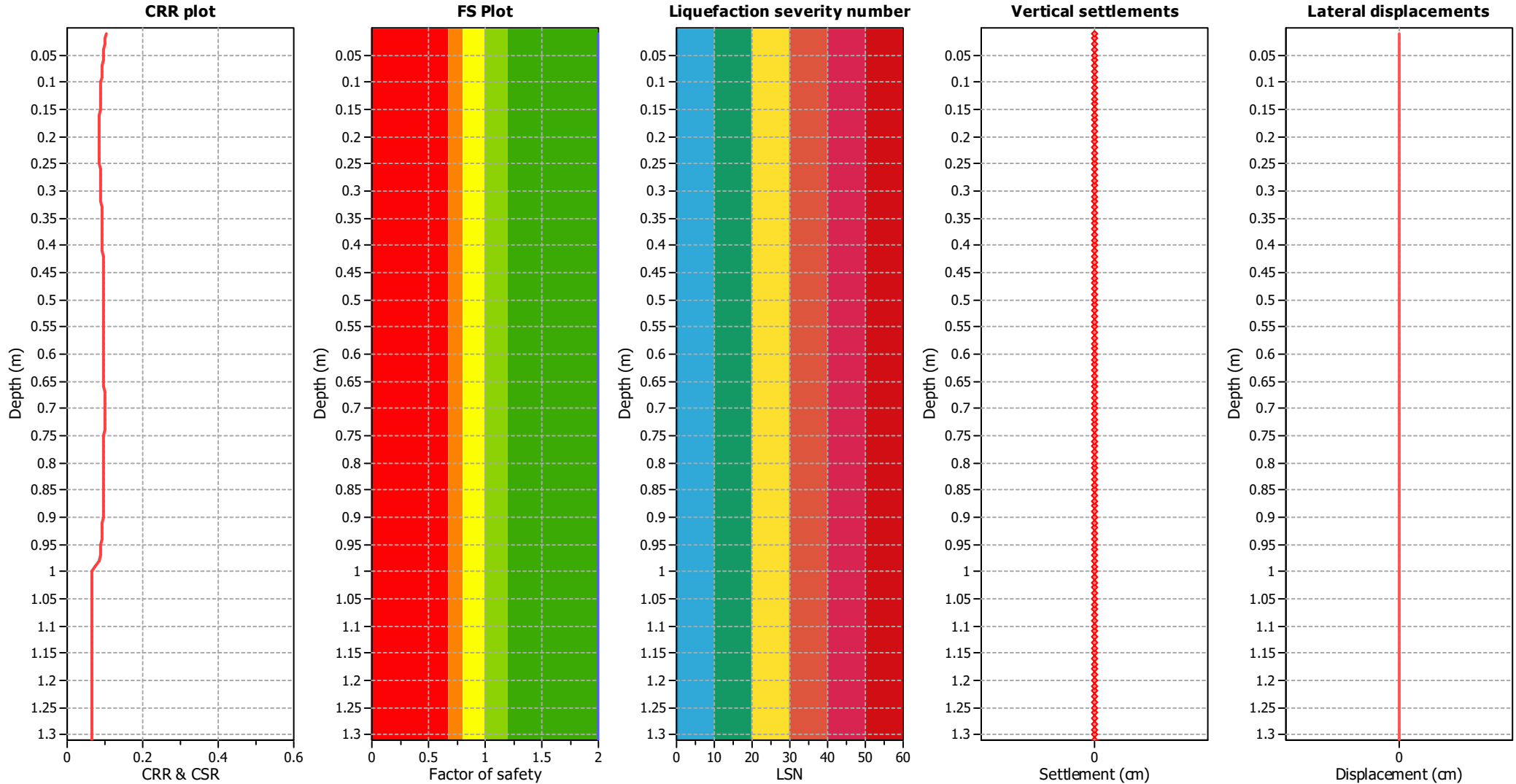
#### F.S. color scheme

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

#### LSN color scheme

- Severe damage
- Major expression of liquefaction
- Moderate to severe exp. of liquefaction
- Moderate expression of liquefaction
- Minor expression of liquefaction
- Little to no expression of liquefaction

### Liquefaction analysis overall plots



#### Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.10 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_{\sigma}$ applied:	Yes
Earthquake magnitude $M_w$ :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.10 m	Fill height:	N/A	Limit depth:	10.00 m

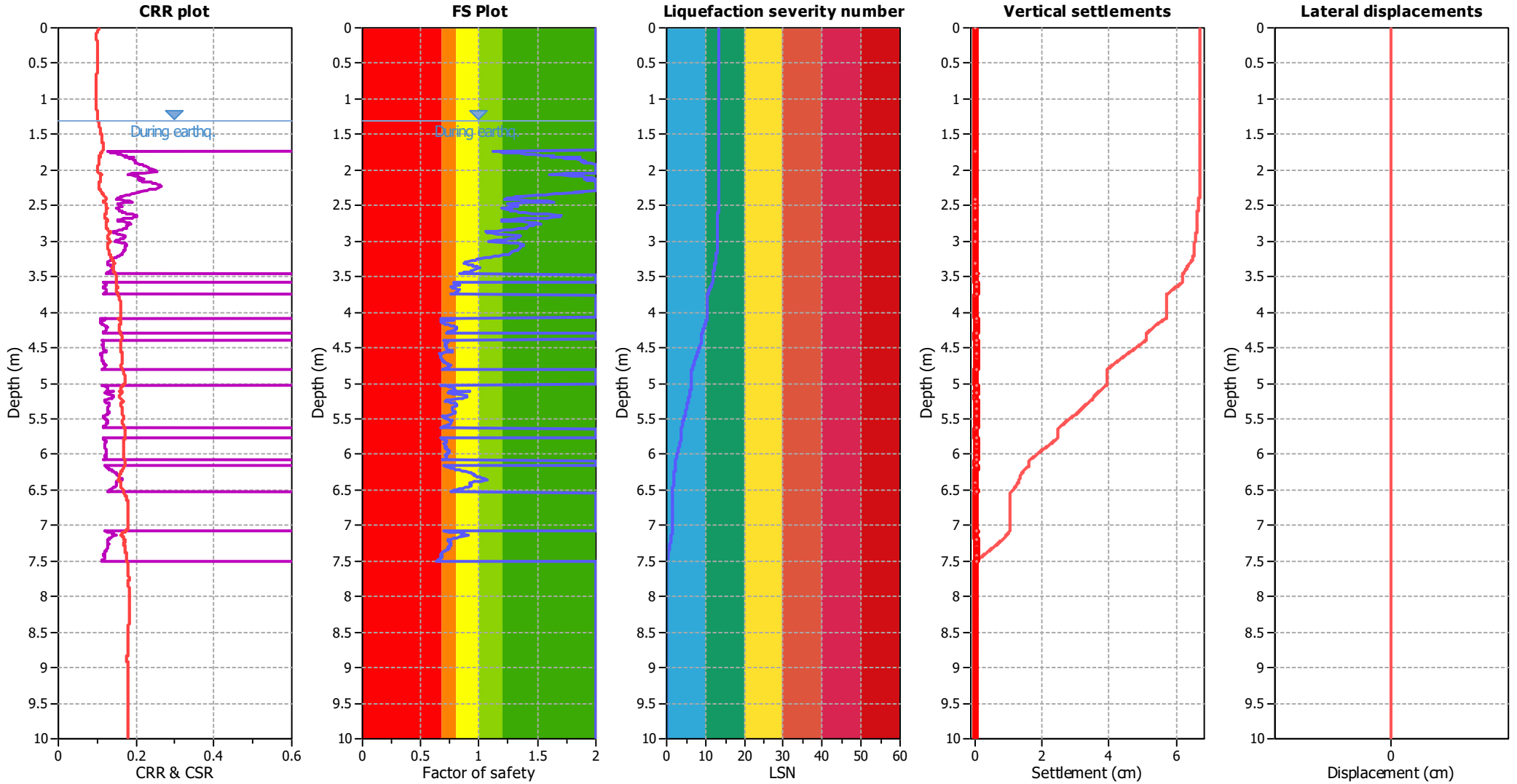
#### F.S. color scheme

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

#### LSN color scheme

- Severe damage
- Major expression of liquefaction
- Moderate to severe exp. of liquefaction
- Moderate expression of liquefaction
- Minor expression of liquefaction
- Little to no expression of liquefaction

### Liquefaction analysis overall plots



**Input parameters and analysis data**

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.30 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_d$ applied:	Yes
Earthquake magnitude $M_w$ :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.30 m	Fill height:	N/A	Limit depth:	10.00 m

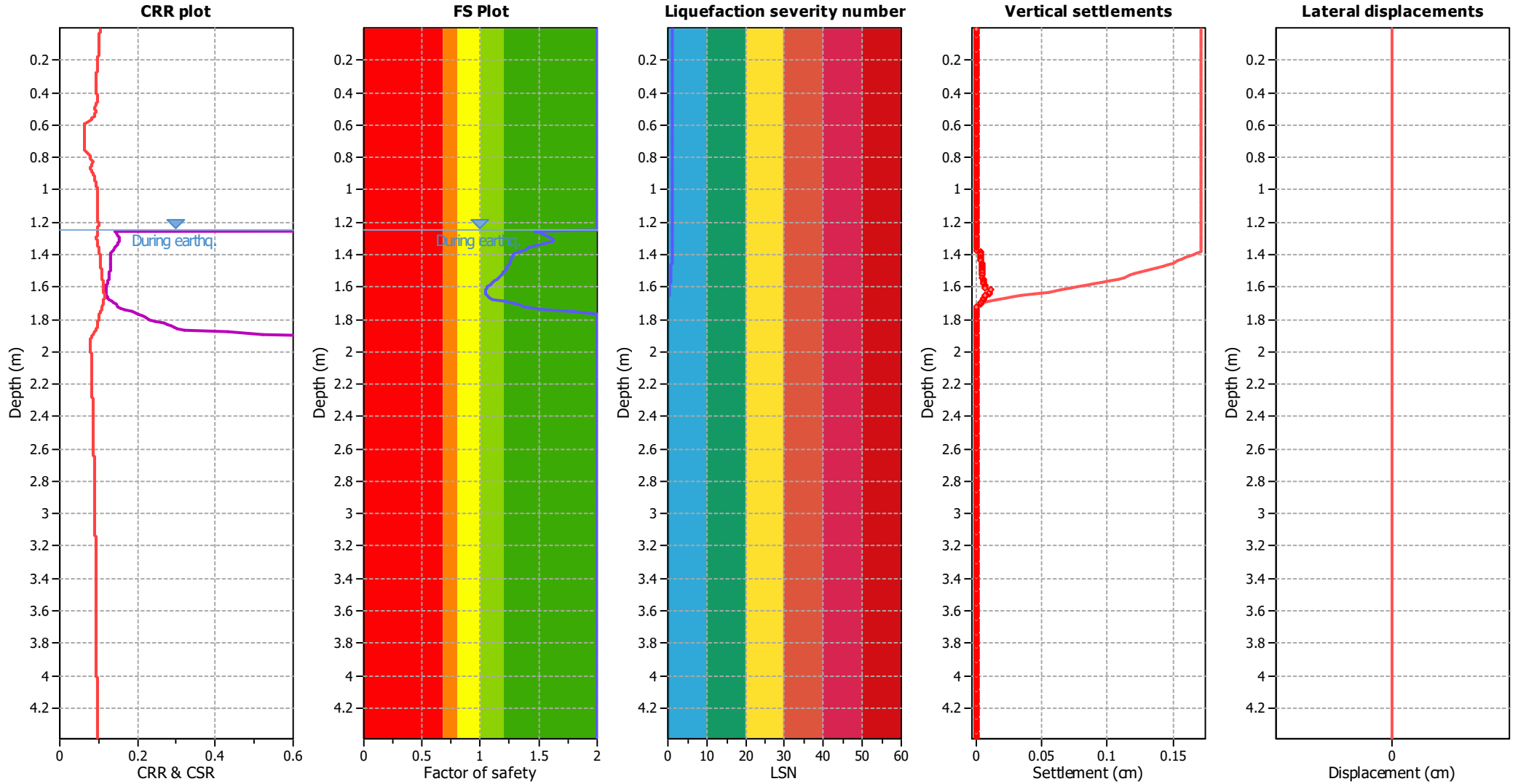
**F.S. color scheme**

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

**LSN color scheme**

- Severe damage
- Major expression of liquefaction
- Moderate to severe exp. of liquefaction
- Moderate expression of liquefaction
- Minor expression of liquefaction
- Little to no expression of liquefaction

### Liquefaction analysis overall plots



**Input parameters and analysis data**

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.25 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_f$ applied:	Yes
Earthquake magnitude $M_w$ :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.25 m	Fill height:	N/A	Limit depth:	10.00 m

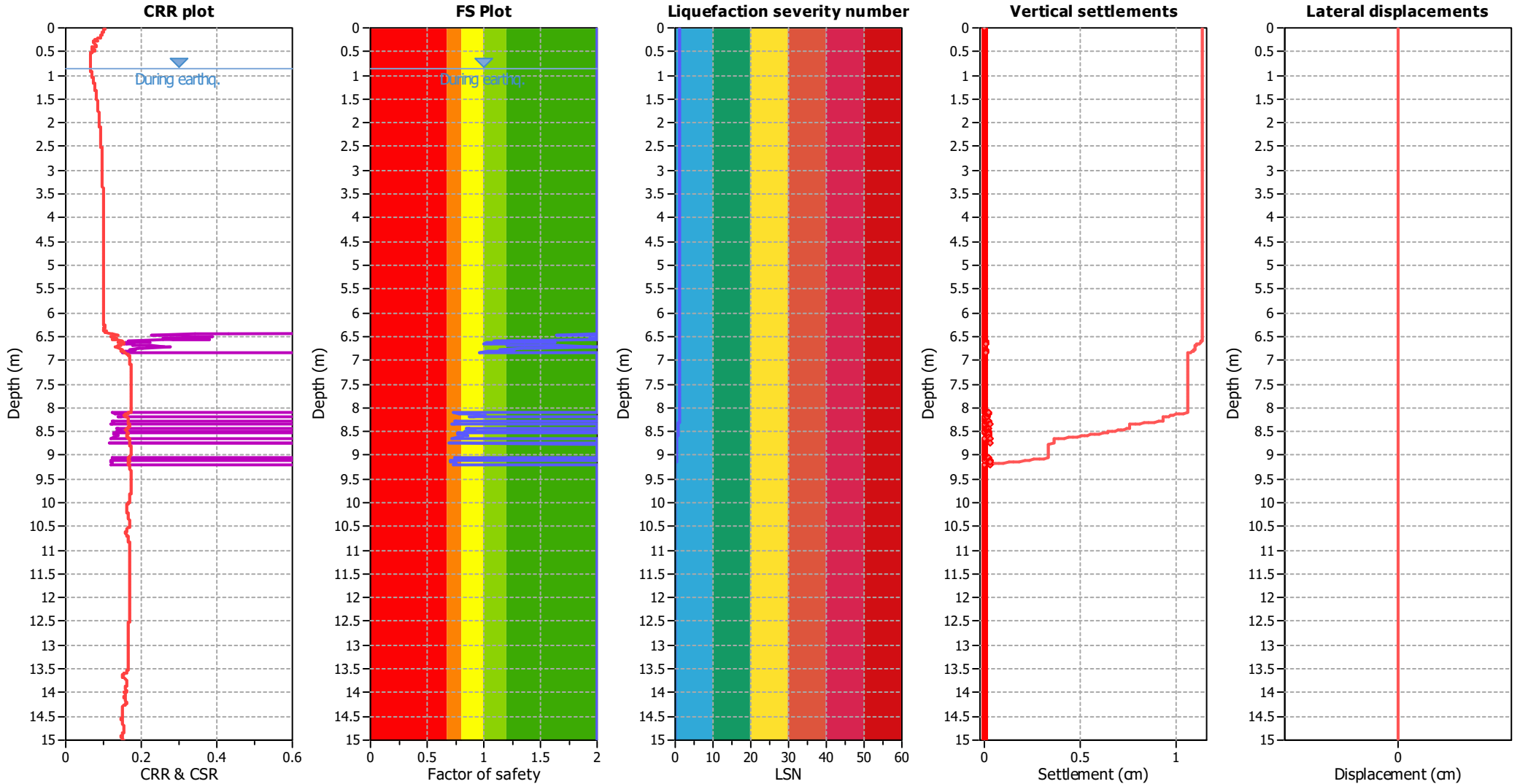
**F.S. color scheme**

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

**LSN color scheme**

- Severe damage
- Major expression of liquefaction
- Moderate to severe exp. of liquefaction
- Moderate expression of liquefaction
- Minor expression of liquefaction
- Little to no expression of liquefaction

### Liquefaction analysis overall plots



**Input parameters and analysis data**

Analysis method:	B&I (2014)	Depth to GWT (earthq.):	0.85 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_f$ applied:	Yes
Earthquake magnitude $M_w$ :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	0.85 m	Fill height:	N/A	Limit depth:	10.00 m

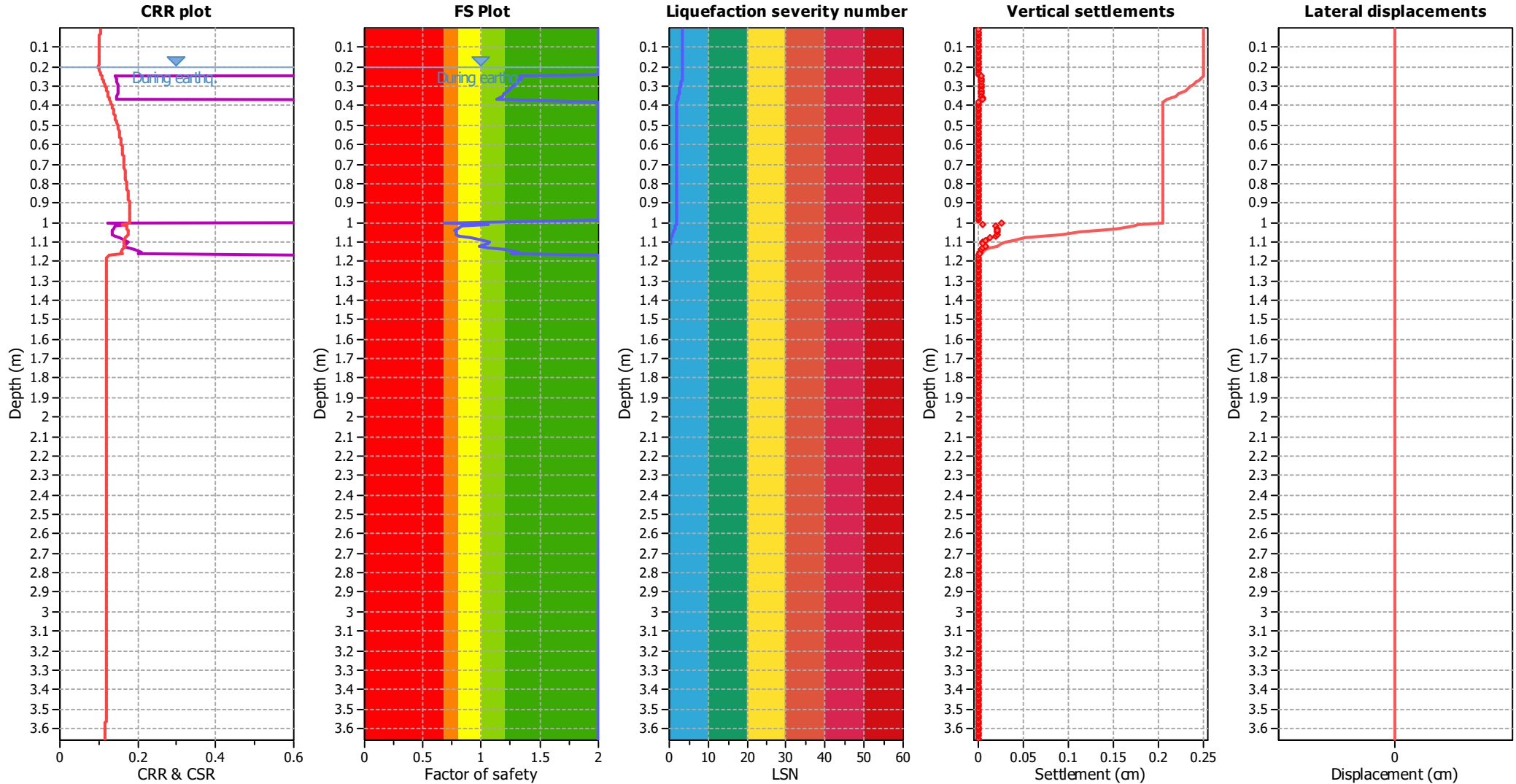
**F.S. color scheme**

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

**LSN color scheme**

- Severe damage
- Major expression of liquefaction
- Moderate to severe exp. of liquefaction
- Moderate expression of liquefaction
- Minor expression of liquefaction
- Little to no expression of liquefaction

### Liquefaction analysis overall plots



**Input parameters and analysis data**

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	0.20 m
Fines correction method:	B&I (2014)	Average results interval:	3
Points to test:	Based on Ic value	Ic cut-off value:	2.60
Earthquake magnitude $M_w$ :	6.00	Unit weight calculation:	Based on SBT
Peak ground acceleration:	0.19	Use fill:	No
Depth to water table (insitu):	0.20 m	Fill height:	N/A

Fill weight:	N/A
Transition detect. applied:	No
$K_\sigma$ applied:	Yes
Clay like behavior applied:	Sands only
Limit depth applied:	Yes
Limit depth:	10.00 m

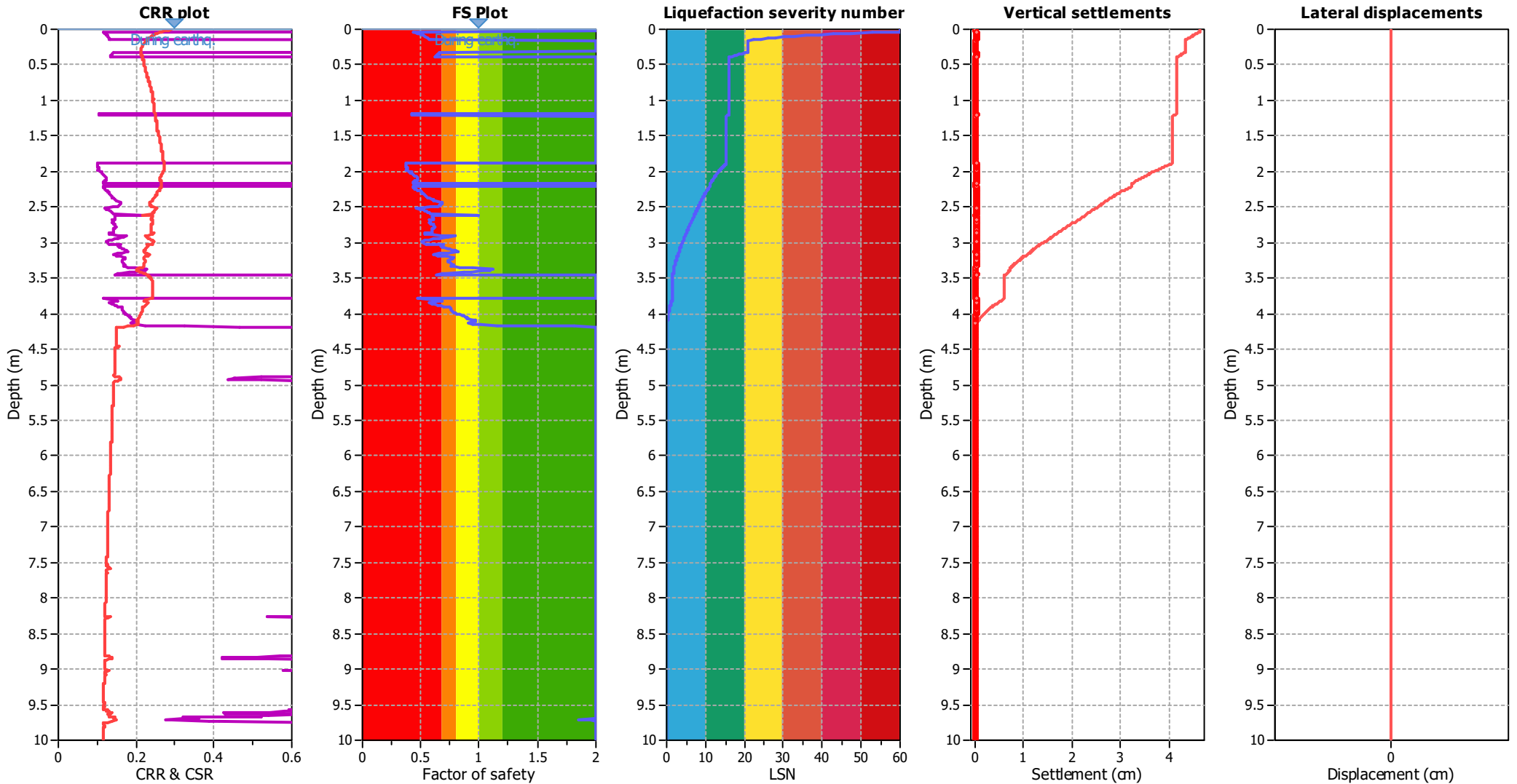
**F.S. color scheme**

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

**LSN color scheme**

- Severe damage
- Major expression of liquefaction
- Moderate to severe exp. of liquefaction
- Moderate expression of liquefaction
- Minor expression of liquefaction
- Little to no expression of liquefaction

### Liquefaction analysis overall plots



#### Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	0.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_d$ applied:	Yes
Earthquake magnitude $M_w$ :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	0.00 m	Fill height:	N/A	Limit depth:	10.00 m

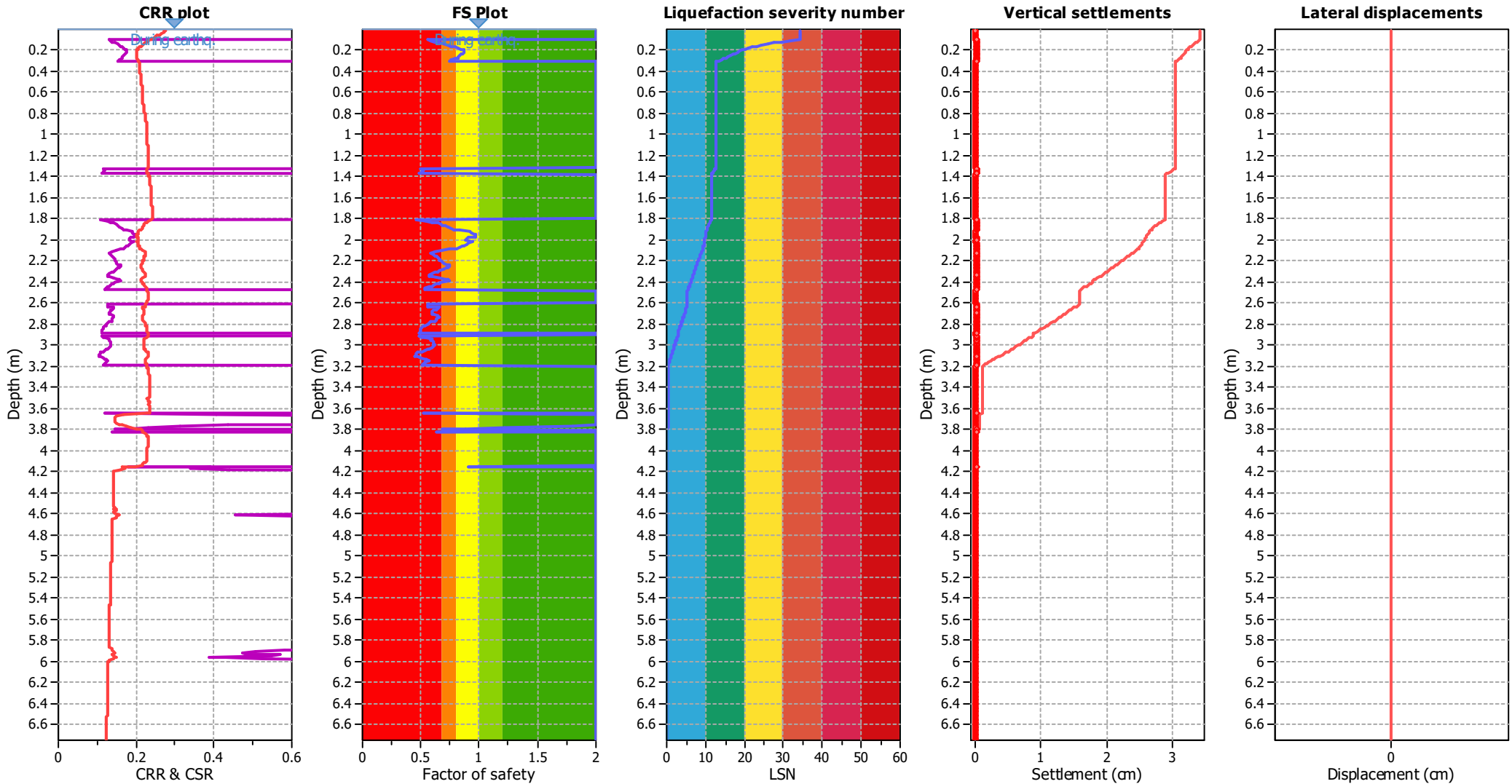
#### F.S. color scheme

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

#### LSN color scheme

- Severe damage
- Major expression of liquefaction
- Moderate to severe exp. of liquefaction
- Moderate expression of liquefaction
- Minor expression of liquefaction
- Little to no expression of liquefaction

### Liquefaction analysis overall plots



**Input parameters and analysis data**

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	0.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_v$ applied:	Yes
Earthquake magnitude $M_w$ :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	0.00 m	Fill height:	N/A	Limit depth:	10.00 m

**F.S. color scheme**

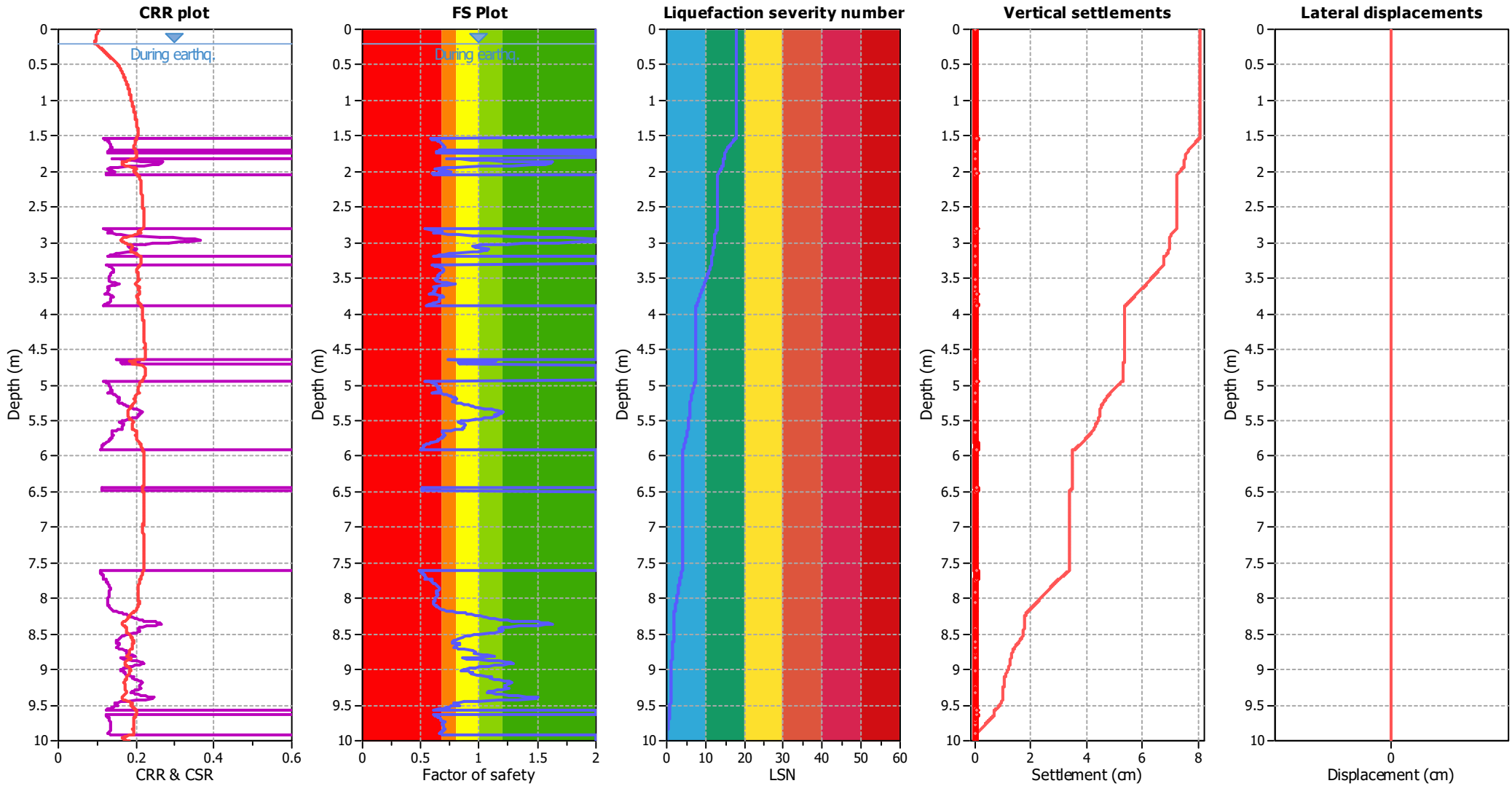
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

**LSN color scheme**

- Severe damage
- Major expression of liquefaction
- Moderate to severe exp. of liquefaction
- Moderate expression of liquefaction
- Minor expression of liquefaction
- Little to no expression of liquefaction



### Liquefaction analysis overall plots



**Input parameters and analysis data**

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	0.20 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_d$ applied:	Yes
Earthquake magnitude $M_w$ :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	0.20 m	Fill height:	N/A	Limit depth:	10.00 m

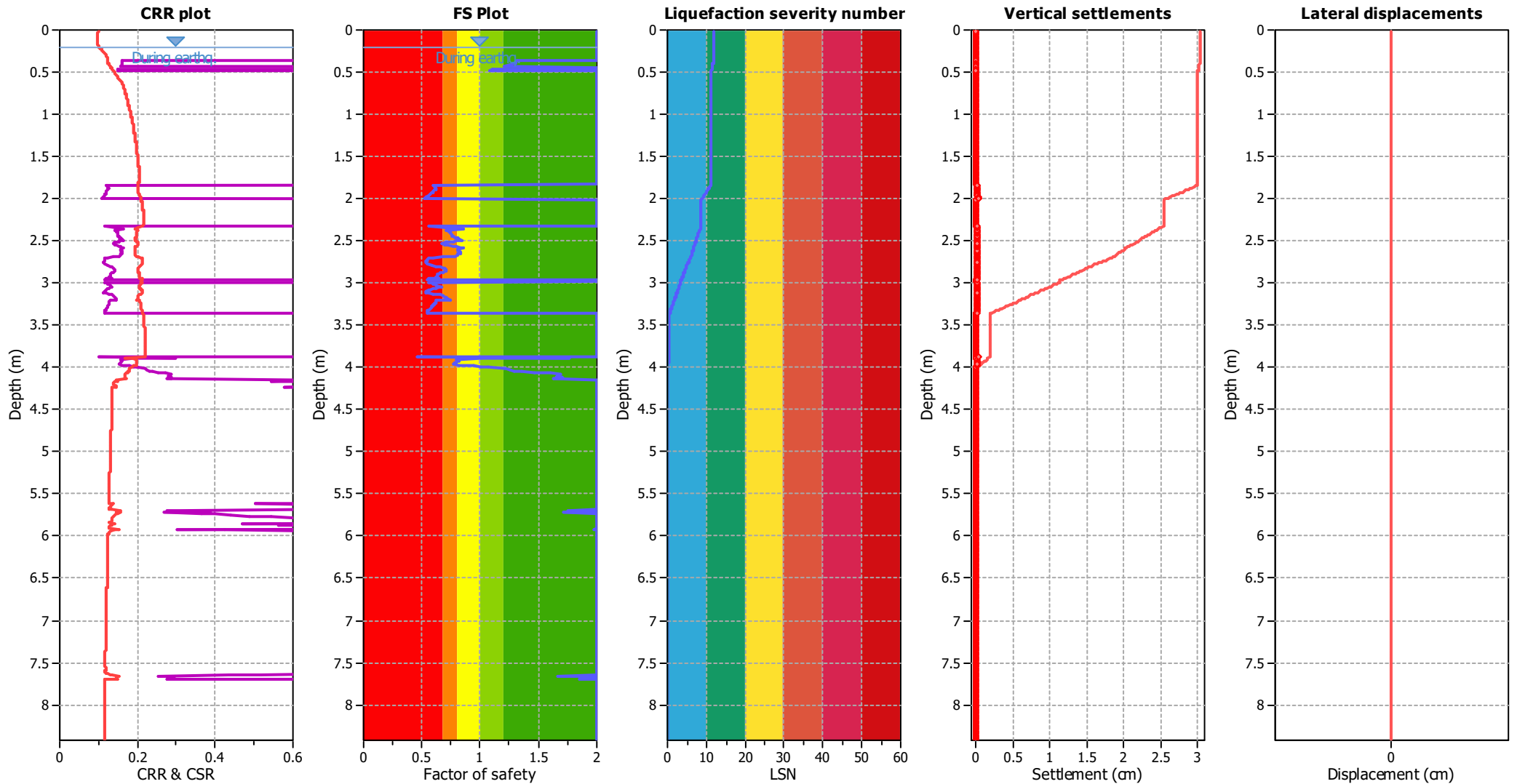
**F.S. color scheme**

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

**LSN color scheme**

- Severe damage
- Major expression of liquefaction
- Moderate to severe exp. of liquefaction
- Moderate expression of liquefaction
- Minor expression of liquefaction
- Little to no expression of liquefaction

### Liquefaction analysis overall plots



**Input parameters and analysis data**

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	0.20 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_{\sigma}$ applied:	Yes
Earthquake magnitude $M_w$ :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	0.20 m	Fill height:	N/A	Limit depth:	10.00 m

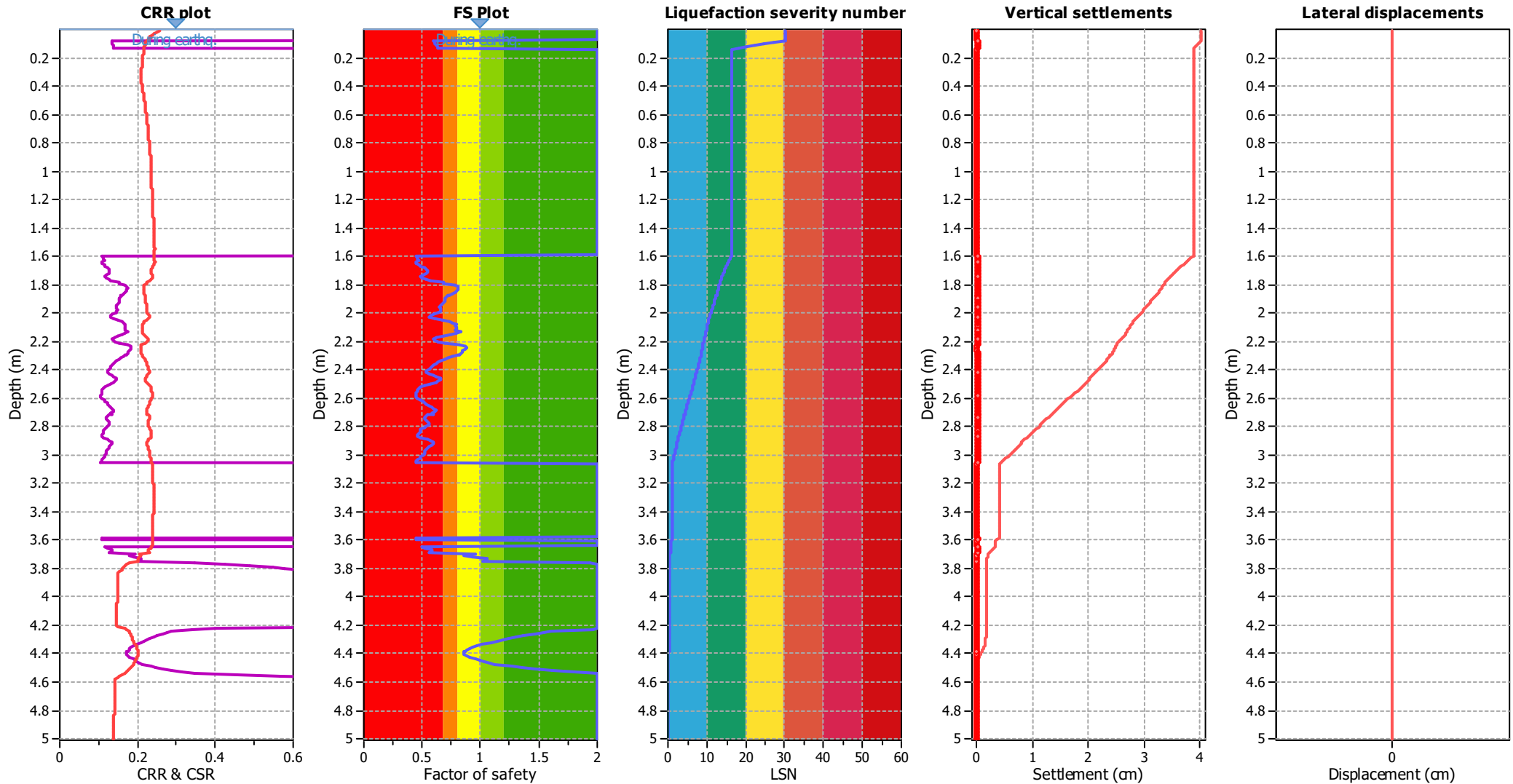
**F.S. color scheme**

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

**LSN color scheme**

- Severe damage
- Major expression of liquefaction
- Moderate to severe exp. of liquefaction
- Moderate expression of liquefaction
- Minor expression of liquefaction
- Little to no expression of liquefaction

### Liquefaction analysis overall plots



**Input parameters and analysis data**

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	0.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_{\sigma}$ applied:	Yes
Earthquake magnitude $M_w$ :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	0.00 m	Fill height:	N/A	Limit depth:	10.00 m

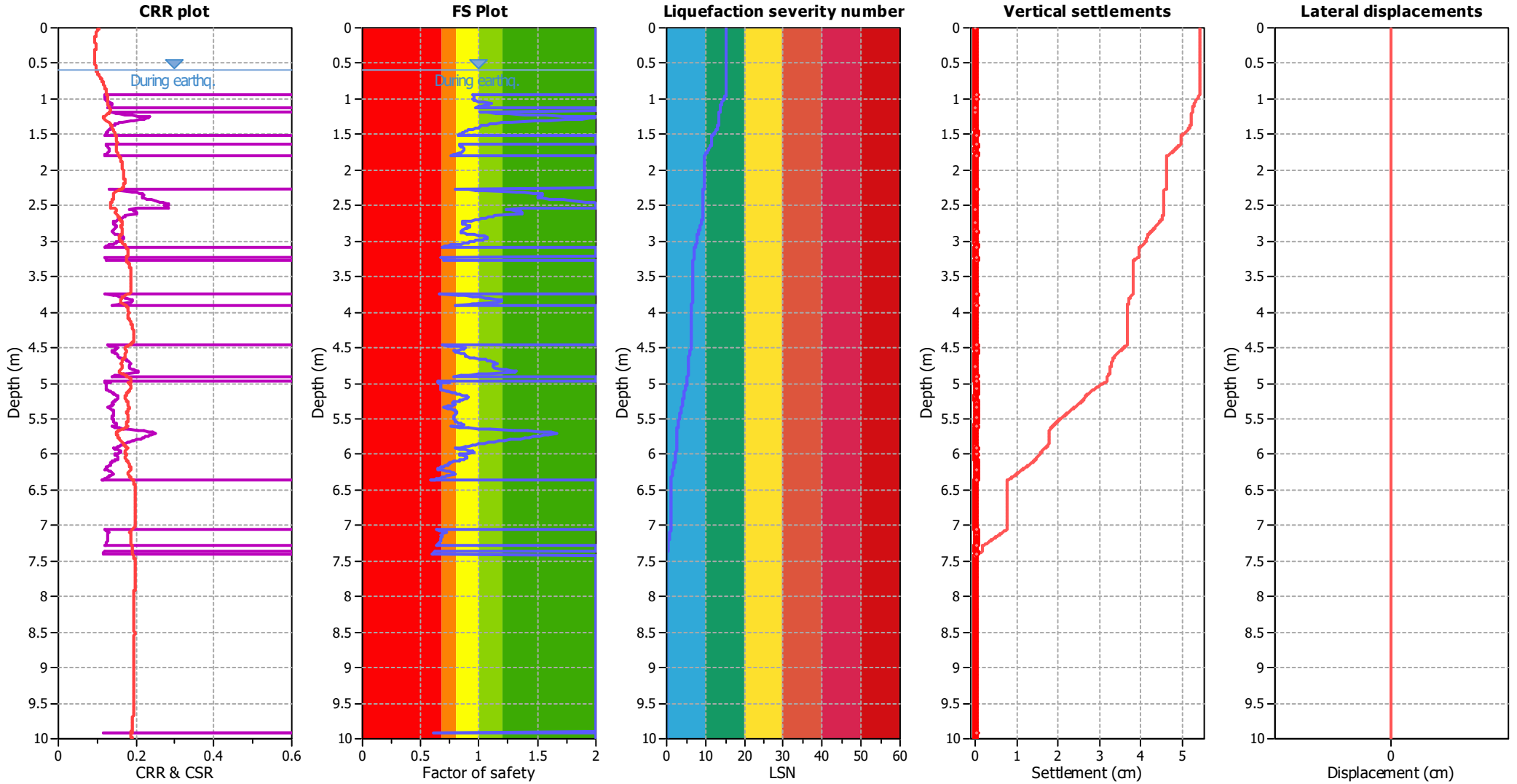
**F.S. color scheme**

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

**LSN color scheme**

- Severe damage
- Major expression of liquefaction
- Moderate to severe exp. of liquefaction
- Moderate expression of liquefaction
- Minor expression of liquefaction
- Little to no expression of liquefaction

### Liquefaction analysis overall plots



**Input parameters and analysis data**

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	0.60 m
Fines correction method:	B&I (2014)	Average results interval:	3
Points to test:	Based on Ic value	Ic cut-off value:	2.60
Earthquake magnitude $M_w$ :	6.00	Unit weight calculation:	Based on SBT
Peak ground acceleration:	0.19	Use fill:	No
Depth to water table (insitu):	0.60 m	Fill height:	N/A

Fill weight:	N/A
Transition detect. applied:	No
$K_\sigma$ applied:	Yes
Clay like behavior applied:	Sands only
Limit depth applied:	Yes
Limit depth:	10.00 m

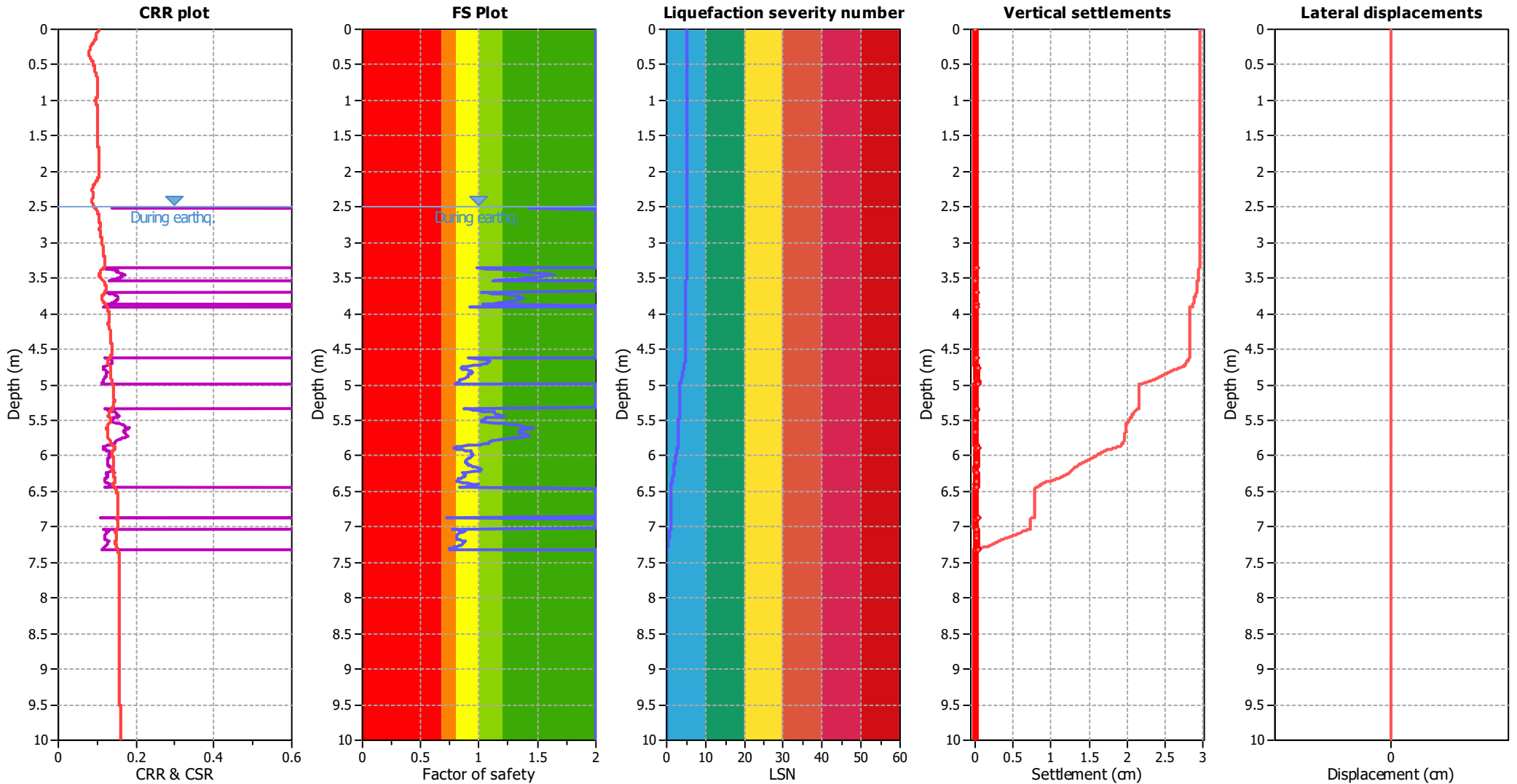
**F.S. color scheme**

<span style="color: red;">■</span>	Almost certain it will liquefy
<span style="color: orange;">■</span>	Very likely to liquefy
<span style="color: yellow;">■</span>	Liquefaction and no liq. are equally likely
<span style="color: lightgreen;">■</span>	Unlike to liquefy
<span style="color: green;">■</span>	Almost certain it will not liquefy

**LSN color scheme**

<span style="color: red;">■</span>	Severe damage
<span style="color: darkred;">■</span>	Major expression of liquefaction
<span style="color: brown;">■</span>	Moderate to severe exp. of liquefaction
<span style="color: orange;">■</span>	Moderate expression of liquefaction
<span style="color: yellow;">■</span>	Minor expression of liquefaction
<span style="color: lightblue;">■</span>	Little to no expression of liquefaction

### Liquefaction analysis overall plots



#### Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.50 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_D$ applied:	Yes
Earthquake magnitude $M_w$ :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.50 m	Fill height:	N/A	Limit depth:	10.00 m

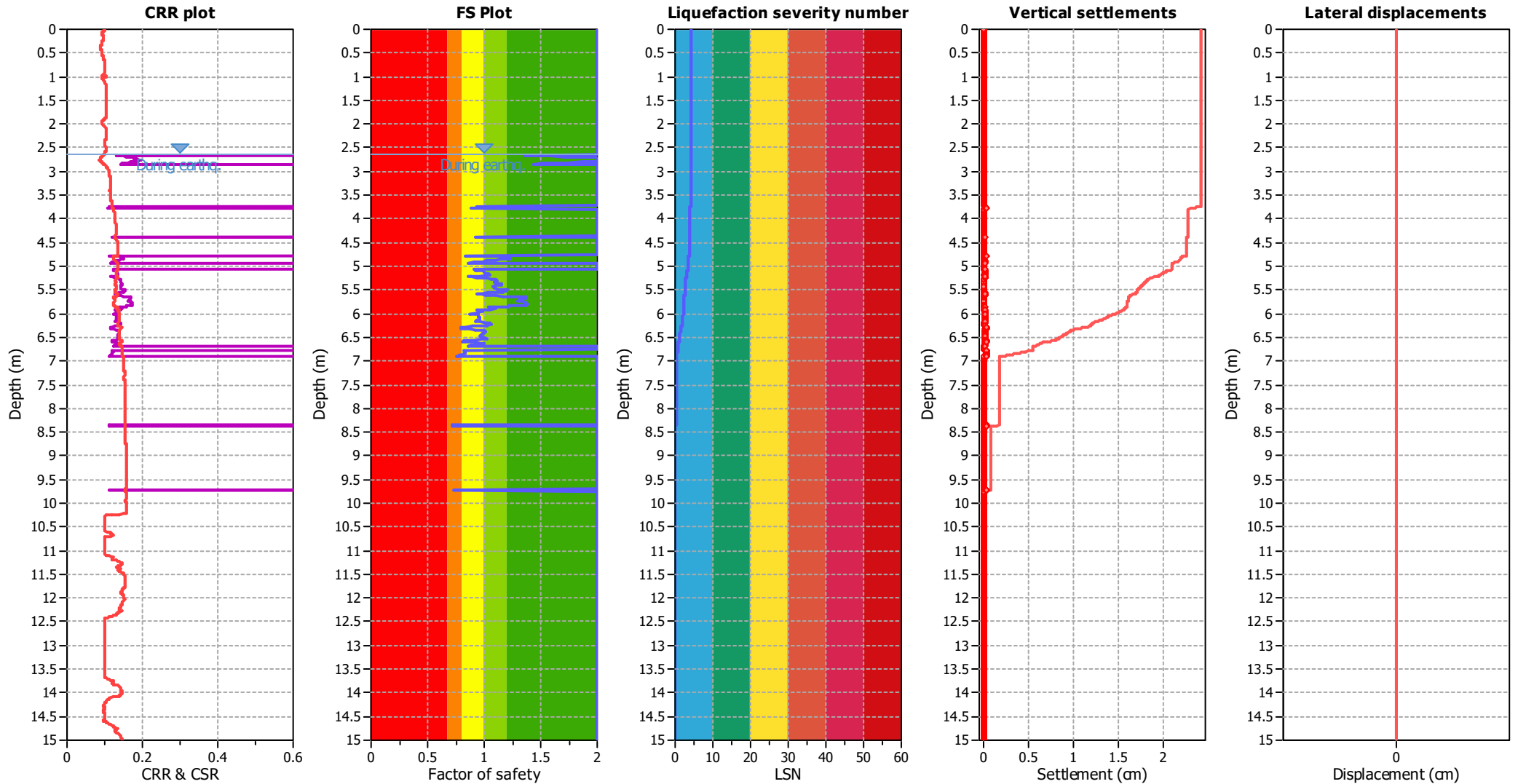
#### F.S. color scheme

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

#### LSN color scheme

- Severe damage
- Major expression of liquefaction
- Moderate to severe exp. of liquefaction
- Moderate expression of liquefaction
- Minor expression of liquefaction
- Little to no expression of liquefaction

### Liquefaction analysis overall plots



#### Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.65 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_f$ applied:	Yes
Earthquake magnitude $M_w$ :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.65 m	Fill height:	N/A	Limit depth:	10.00 m

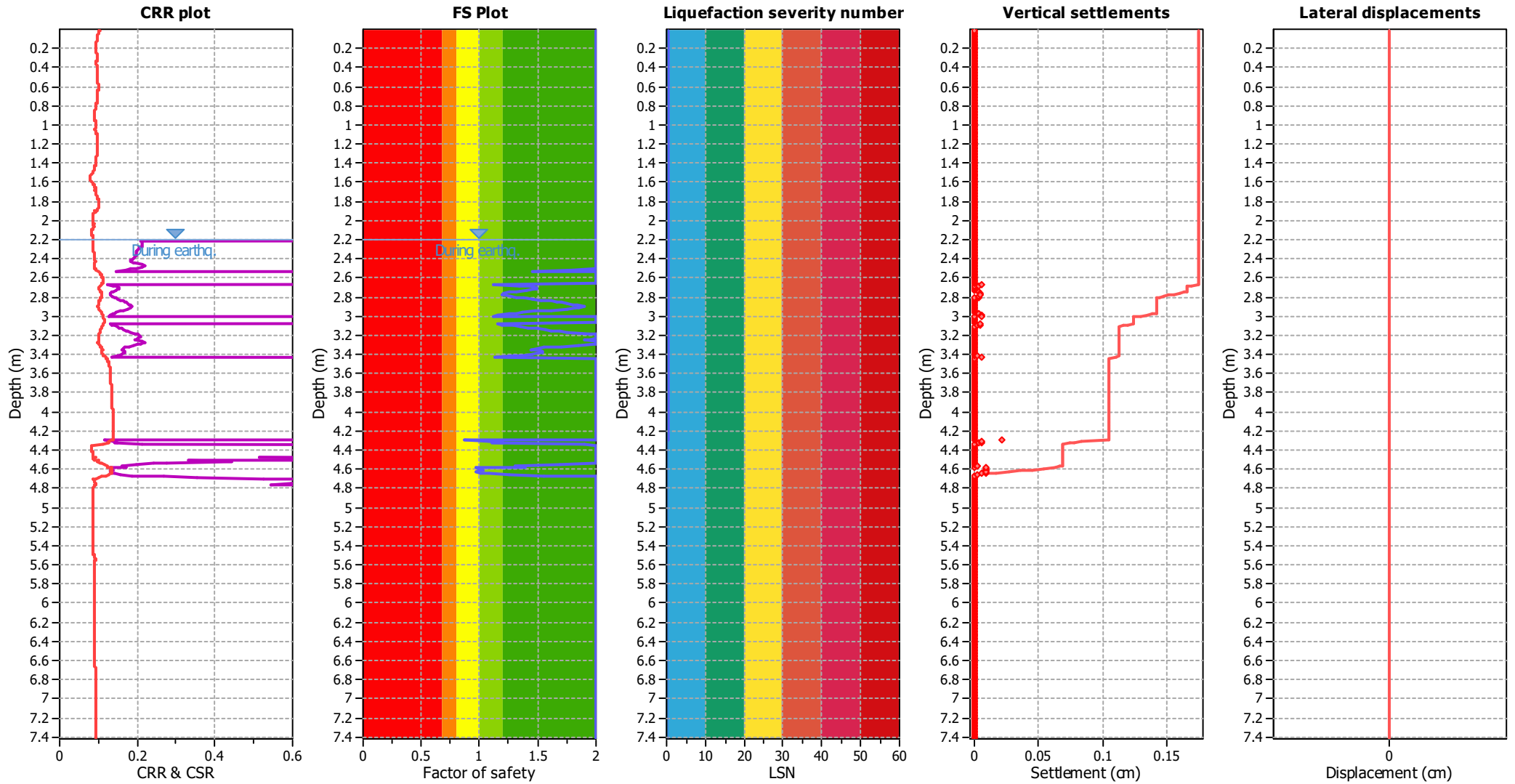
#### F.S. color scheme

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

#### LSN color scheme

- Severe damage
- Major expression of liquefaction
- Moderate to severe exp. of liquefaction
- Moderate expression of liquefaction
- Minor expression of liquefaction
- Little to no expression of liquefaction

### Liquefaction analysis overall plots



**Input parameters and analysis data**

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.20 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_v$ applied:	Yes
Earthquake magnitude $M_w$ :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.20 m	Fill height:	N/A	Limit depth:	10.00 m

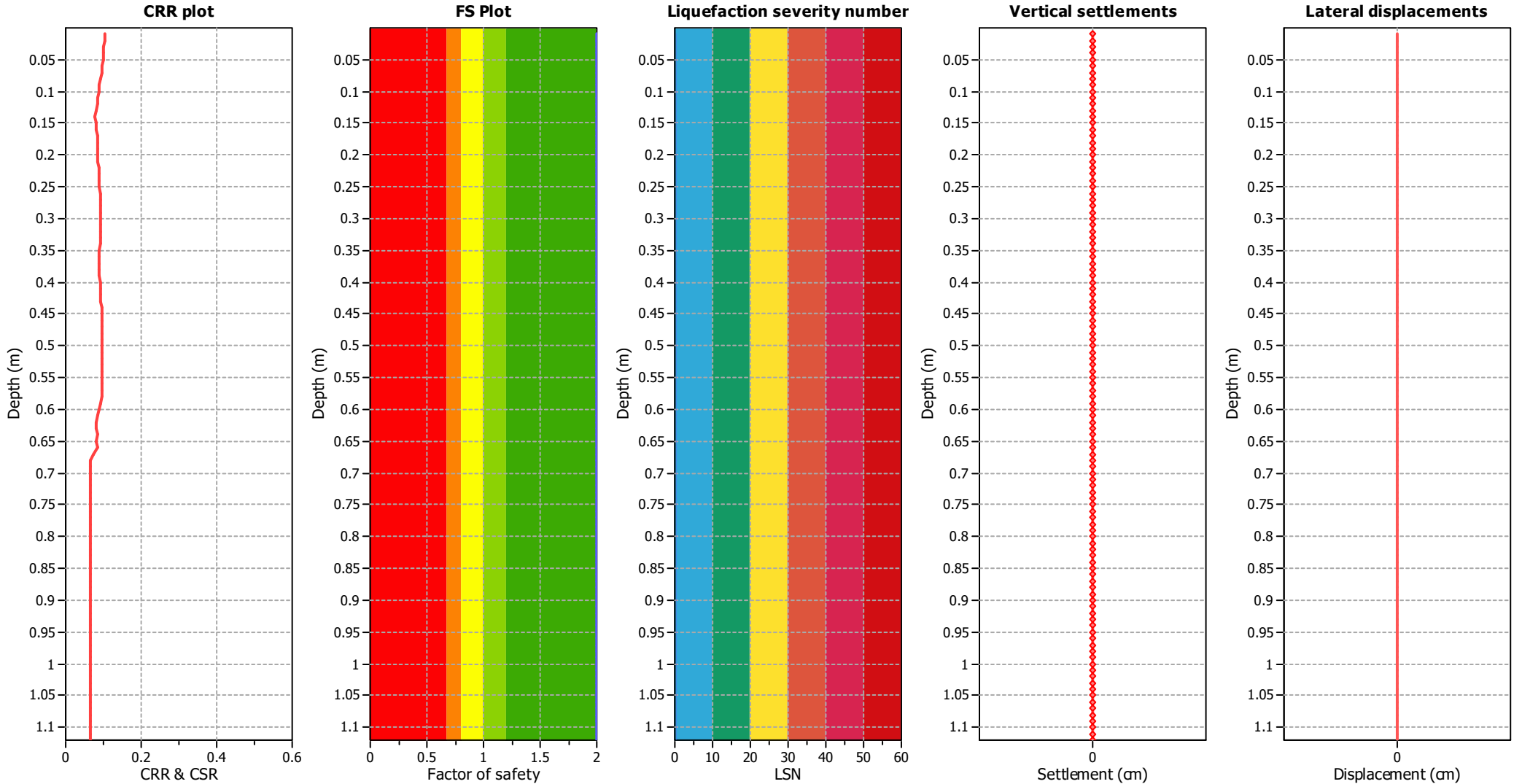
**F.S. color scheme**

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

**LSN color scheme**

- Severe damage
- Major expression of liquefaction
- Moderate to severe exp. of liquefaction
- Moderate expression of liquefaction
- Minor expression of liquefaction
- Little to no expression of liquefaction

### Liquefaction analysis overall plots



**Input parameters and analysis data**

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_{\sigma}$ applied:	Yes
Earthquake magnitude $M_w$ :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.00 m	Fill height:	N/A	Limit depth:	10.00 m

**F.S. color scheme**

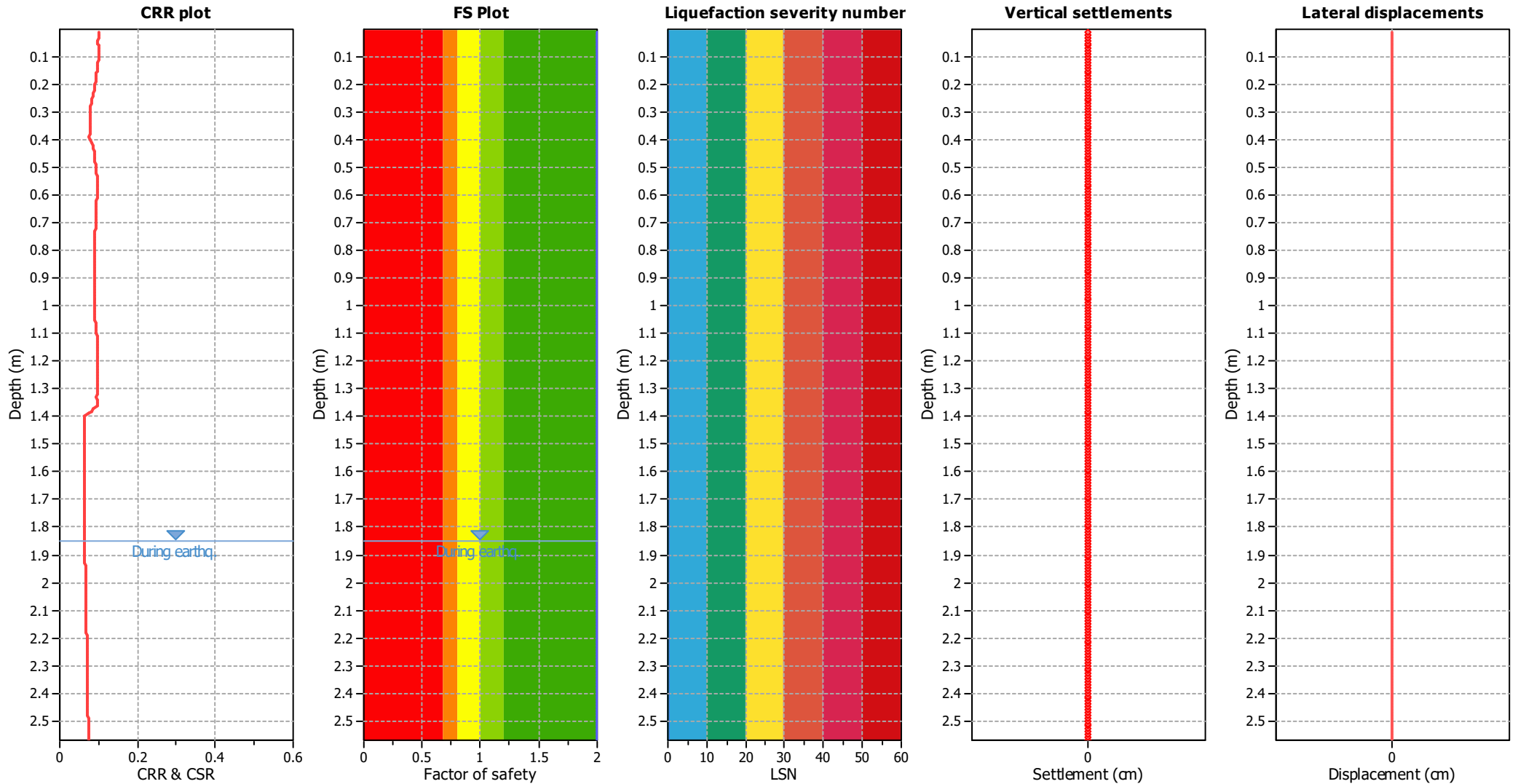
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

**LSN color scheme**

- Severe damage
- Major expression of liquefaction
- Moderate to severe exp. of liquefaction
- Moderate expression of liquefaction
- Minor expression of liquefaction
- Little to no expression of liquefaction



### Liquefaction analysis overall plots



#### Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (earthq.):	1.85 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_f$ applied:	Yes
Earthquake magnitude $M_w$ :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.85 m	Fill height:	N/A	Limit depth:	10.00 m

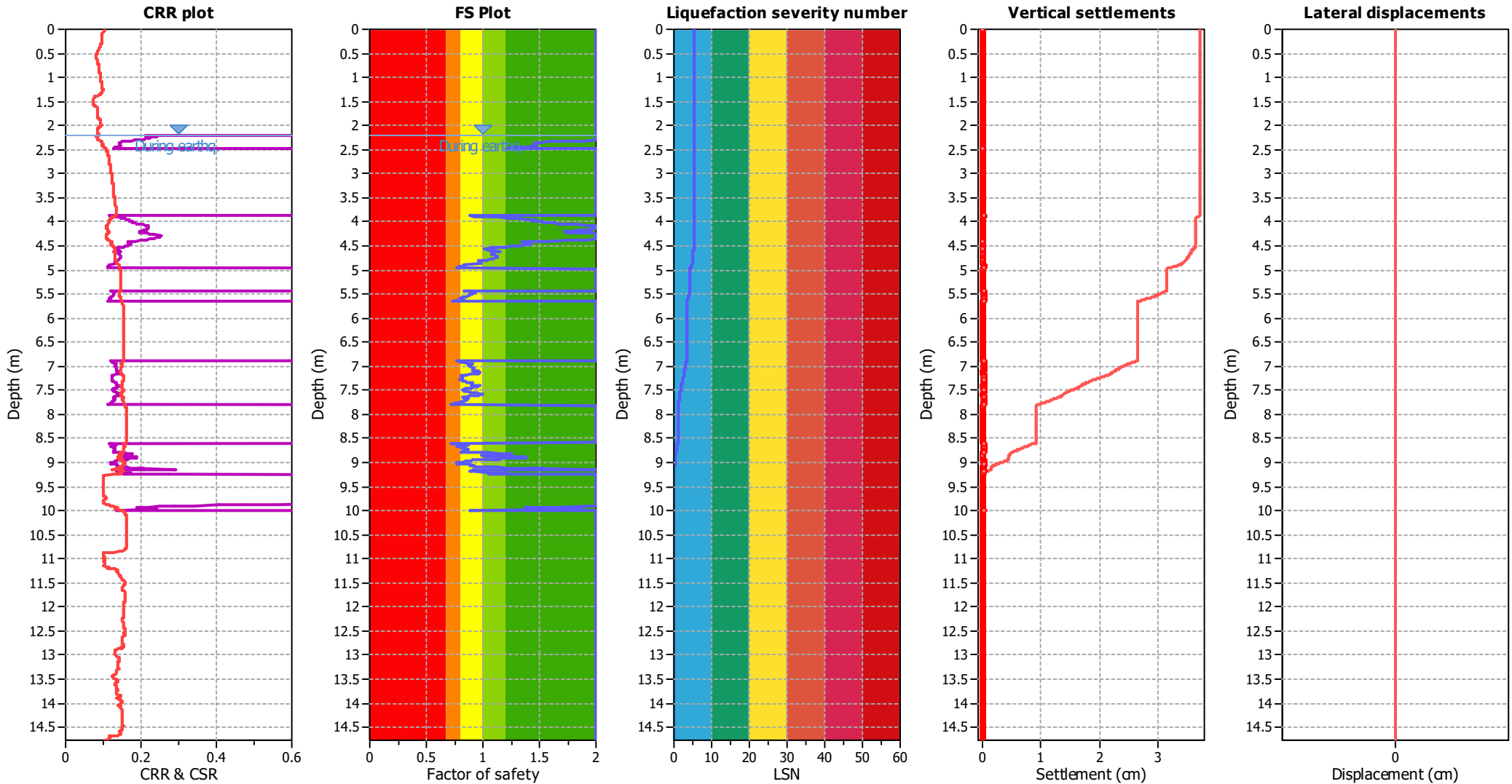
#### F.S. color scheme

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

#### LSN color scheme

- Severe damage
- Major expression of liquefaction
- Moderate to severe exp. of liquefaction
- Moderate expression of liquefaction
- Minor expression of liquefaction
- Little to no expression of liquefaction

### Liquefaction analysis overall plots



**Input parameters and analysis data**

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.20 m
Fines correction method:	B&I (2014)	Average results interval:	3
Points to test:	Based on Ic value	Ic cut-off value:	2.60
Earthquake magnitude $M_w$ :	6.00	Unit weight calculation:	Based on SBT
Peak ground acceleration:	0.19	Use fill:	No
Depth to water table (insitu):	2.20 m	Fill height:	N/A

Fill weight:	N/A
Transition detect. applied:	No
$K_v$ applied:	Yes
Clay like behavior applied:	Sands only
Limit depth applied:	Yes
Limit depth:	10.00 m

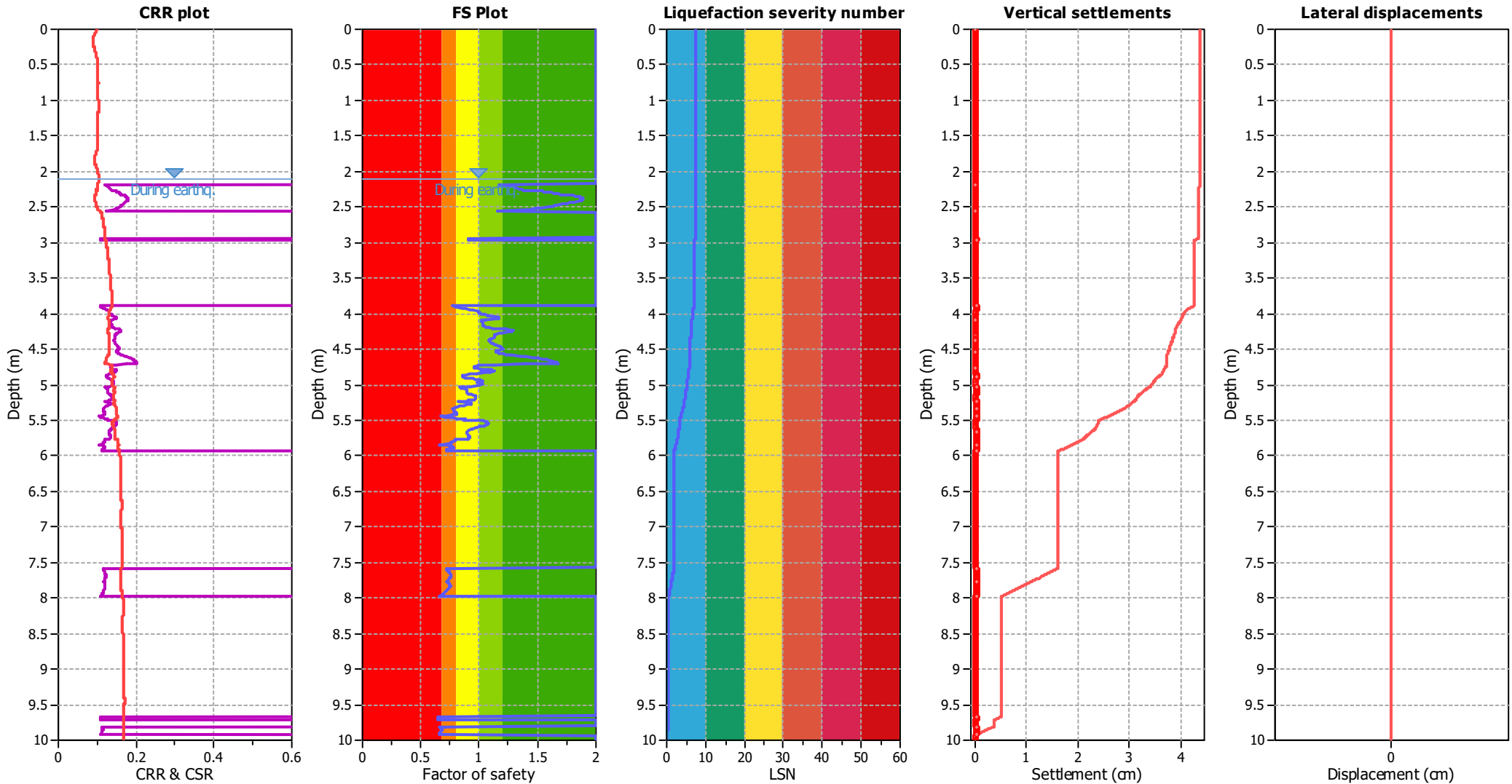
**F.S. color scheme**

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

**LSN color scheme**

- Severe damage
- Major expression of liquefaction
- Moderate to severe exp. of liquefaction
- Moderate expression of liquefaction
- Minor expression of liquefaction
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### Liquefaction analysis overall plots



**Input parameters and analysis data**

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.10 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_D$ applied:	Yes
Earthquake magnitude $M_w$ :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.10 m	Fill height:	N/A	Limit depth:	10.00 m

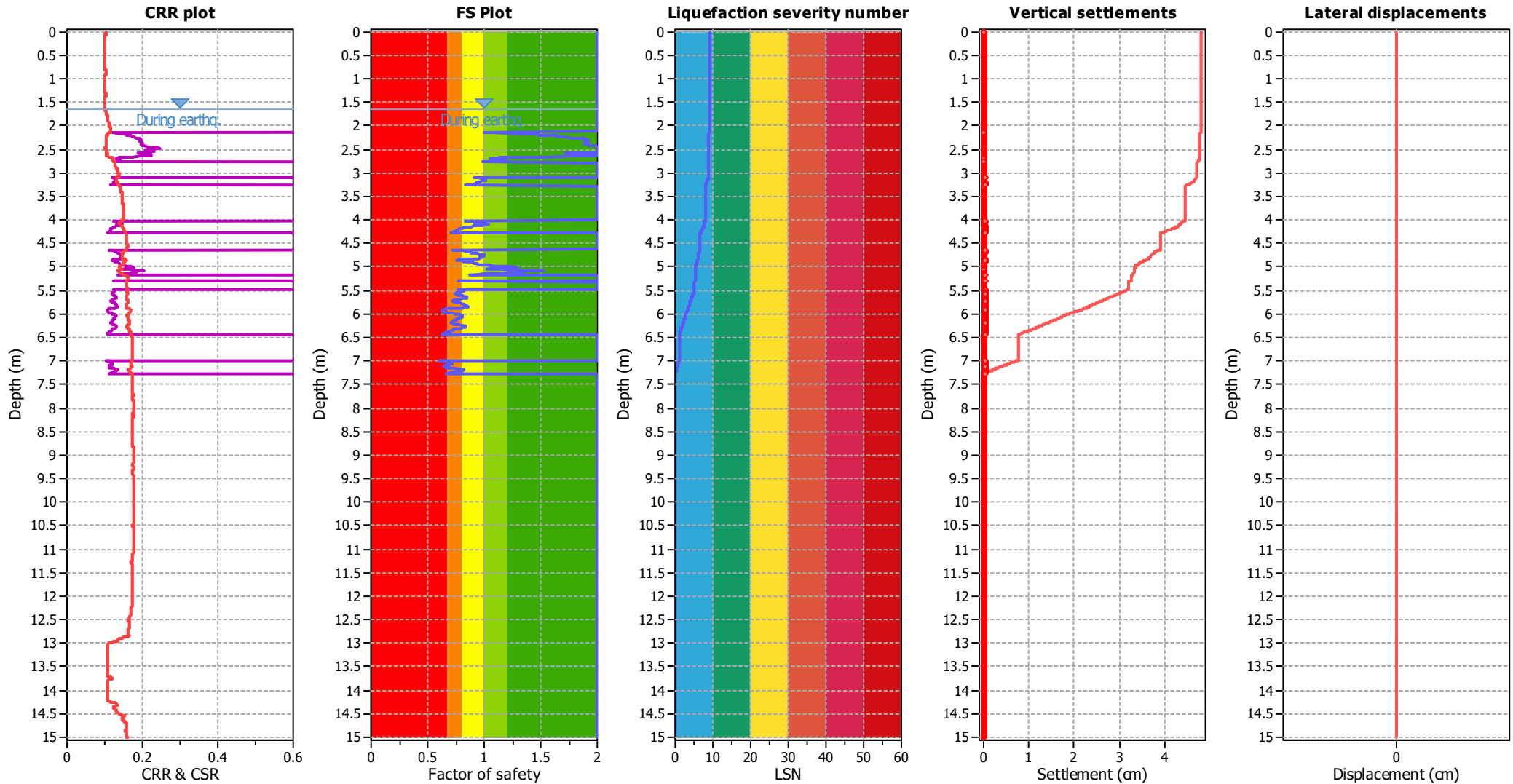
**F.S. color scheme**

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

**LSN color scheme**

- Severe damage
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### Liquefaction analysis overall plots



**Input parameters and analysis data**

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.65 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_D$ applied:	Yes
Earthquake magnitude $M_w$ :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.65 m	Fill height:	N/A	Limit depth:	10.00 m

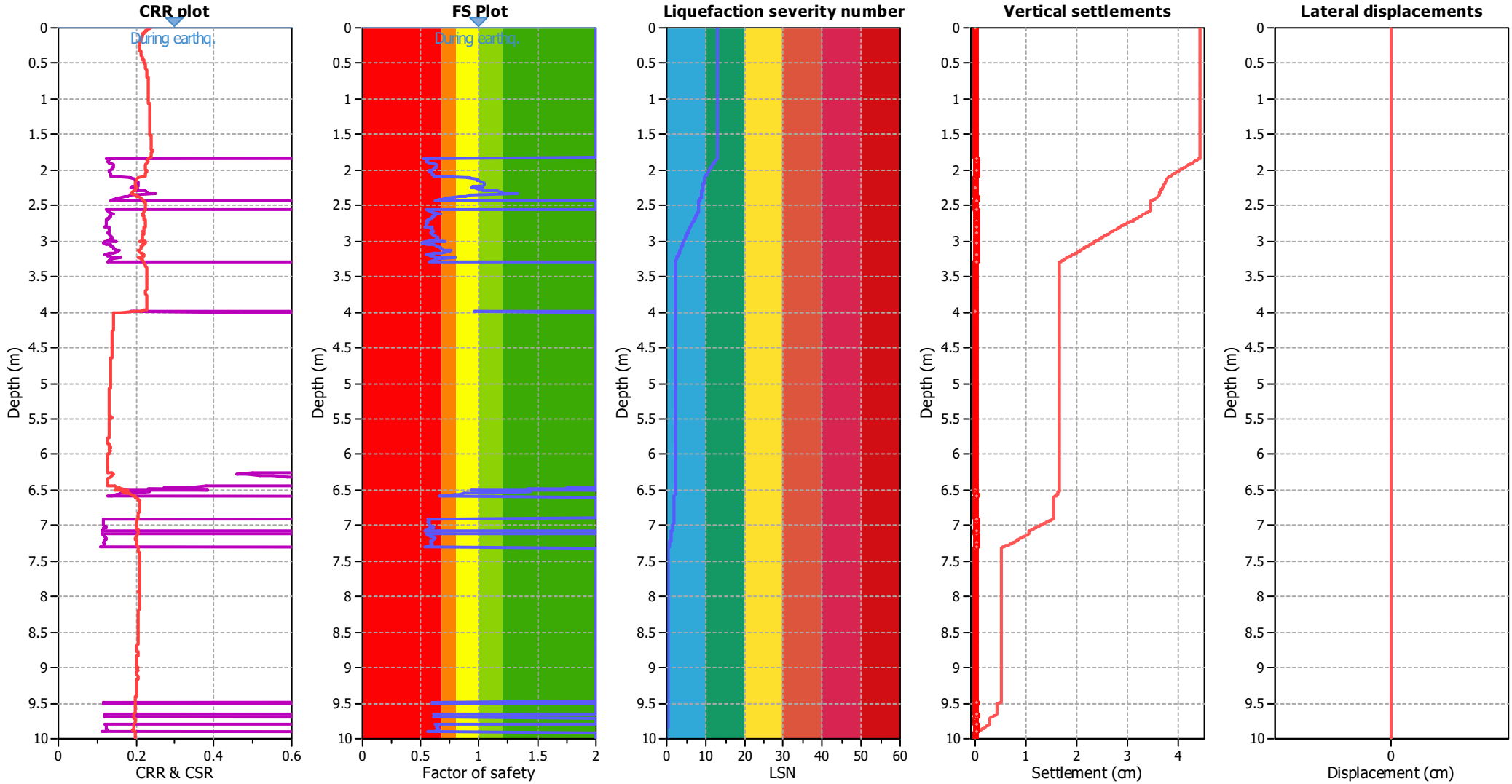
**F.S. color scheme**

- Almost certain it will liquefy
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- Liquefaction and no liq. are equally likely
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- Almost certain it will not liquefy

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- Minor expression of liquefaction
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### Liquefaction analysis overall plots



#### Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	0.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_d$ applied:	Yes
Earthquake magnitude $M_w$ :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	0.00 m	Fill height:	N/A	Limit depth:	10.00 m

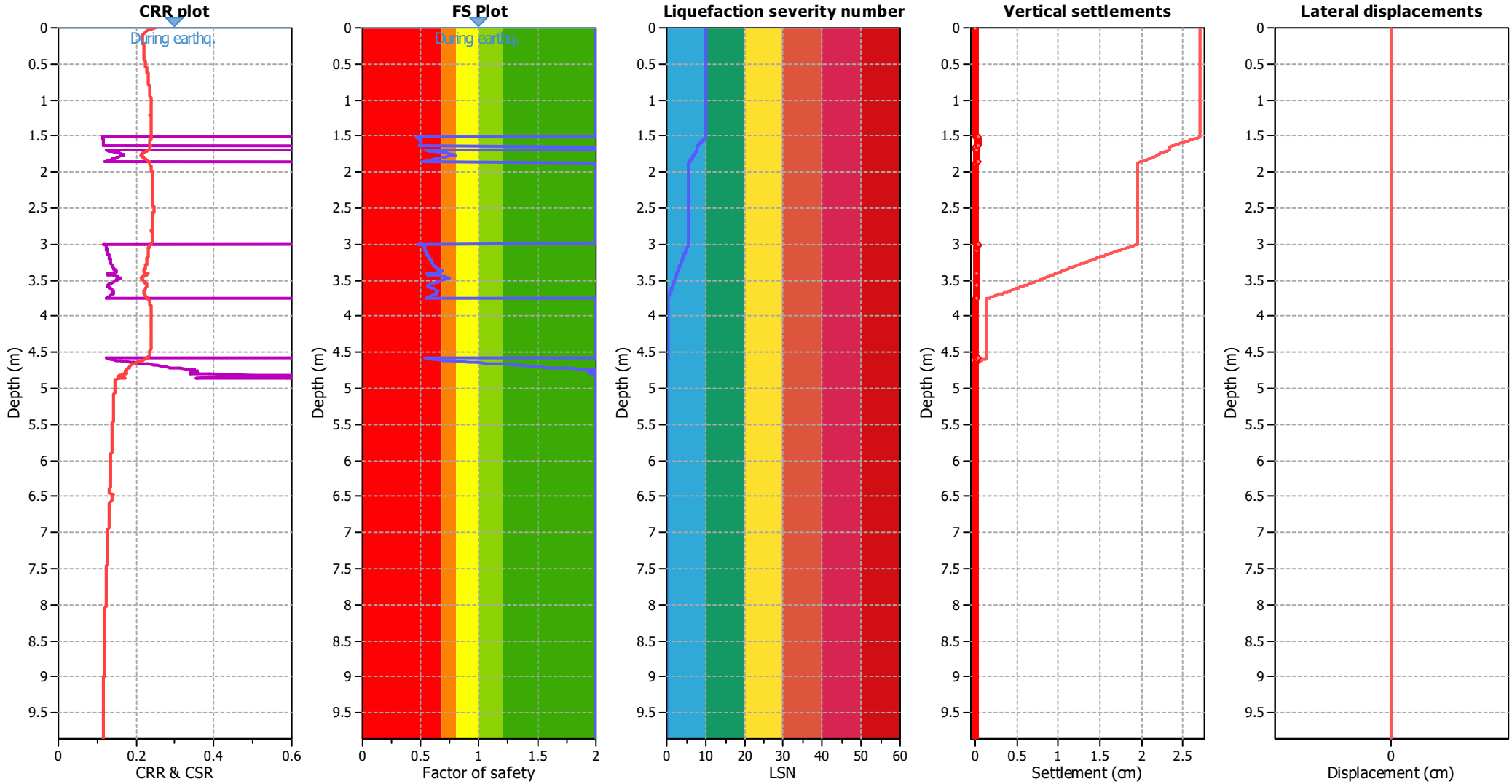
#### F.S. color scheme

- Almost certain it will liquefy
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- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

#### LSN color scheme

- Severe damage
- Major expression of liquefaction
- Moderate to severe exp. of liquefaction
- Moderate expression of liquefaction
- Minor expression of liquefaction
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### Liquefaction analysis overall plots



**Input parameters and analysis data**

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	0.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_0$ applied:	Yes
Earthquake magnitude $M_w$ :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	0.00 m	Fill height:	N/A	Limit depth:	10.00 m

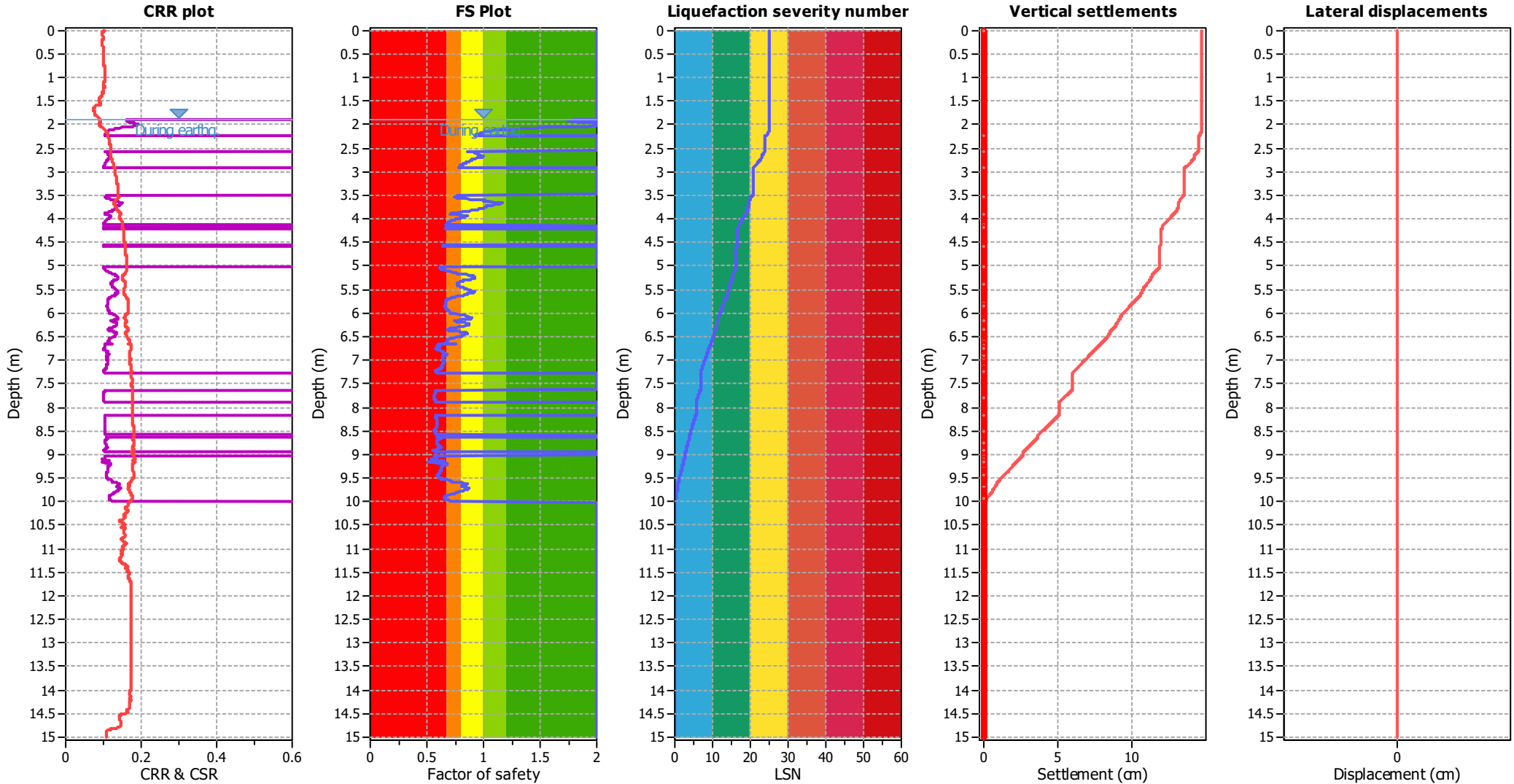
**F.S. color scheme**

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

**LSN color scheme**

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- Moderate to severe exp. of liquefaction
- Moderate expression of liquefaction
- Minor expression of liquefaction
- Little to no expression of liquefaction

### Liquefaction analysis overall plots



**Input parameters and analysis data**

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.90 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_v$ applied:	Yes
Earthquake magnitude $M_w$ :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.90 m	Fill height:	N/A	Limit depth:	10.00 m

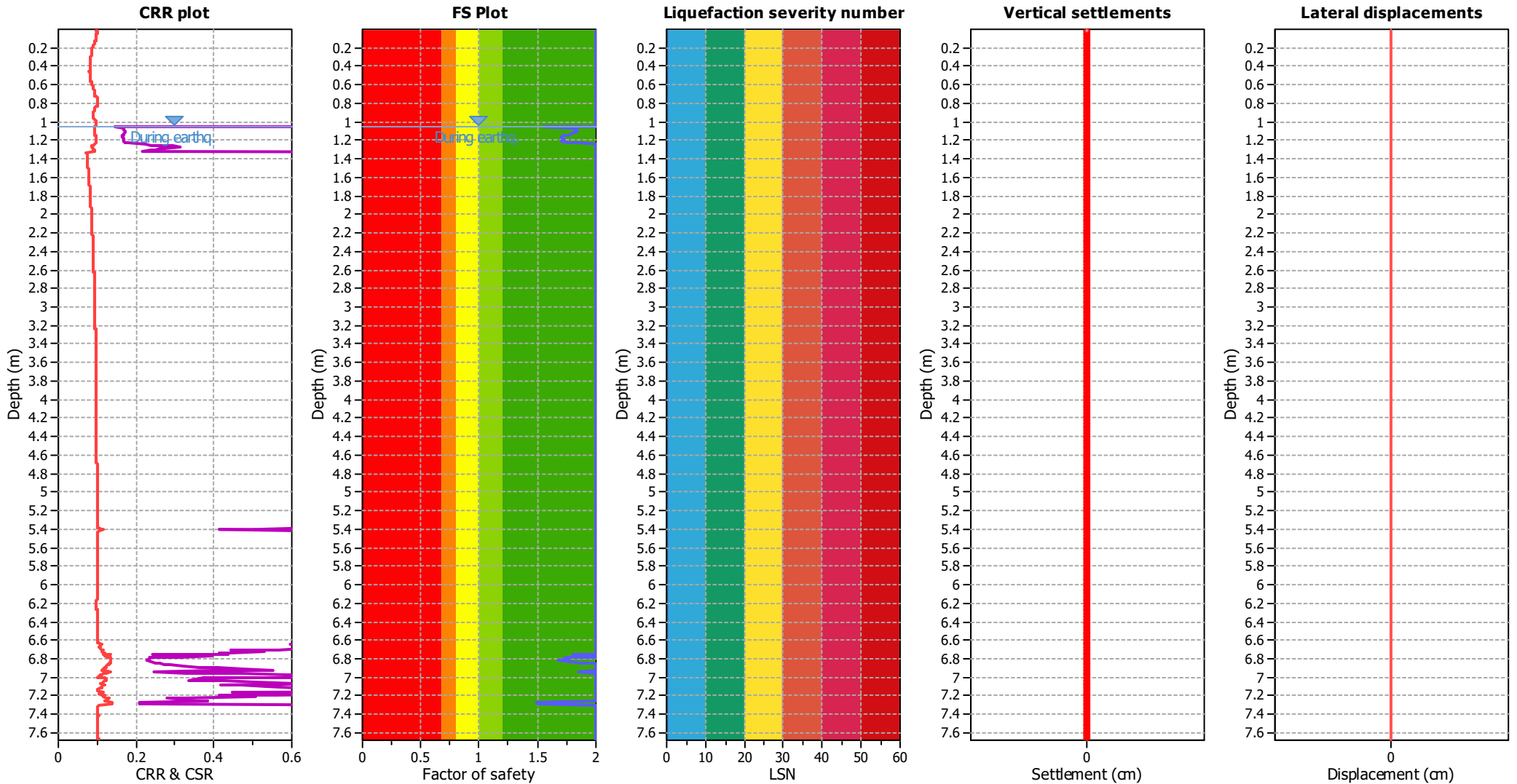
**F.S. color scheme**

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

**LSN color scheme**

- Severe damage
- Major expression of liquefaction
- Moderate to severe exp. of liquefaction
- Moderate expression of liquefaction
- Minor expression of liquefaction
- Little to no expression of liquefaction

### Liquefaction analysis overall plots



#### Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.05 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_v$ applied:	Yes
Earthquake magnitude $M_w$ :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.05 m	Fill height:	N/A	Limit depth:	10.00 m

#### F.S. color scheme

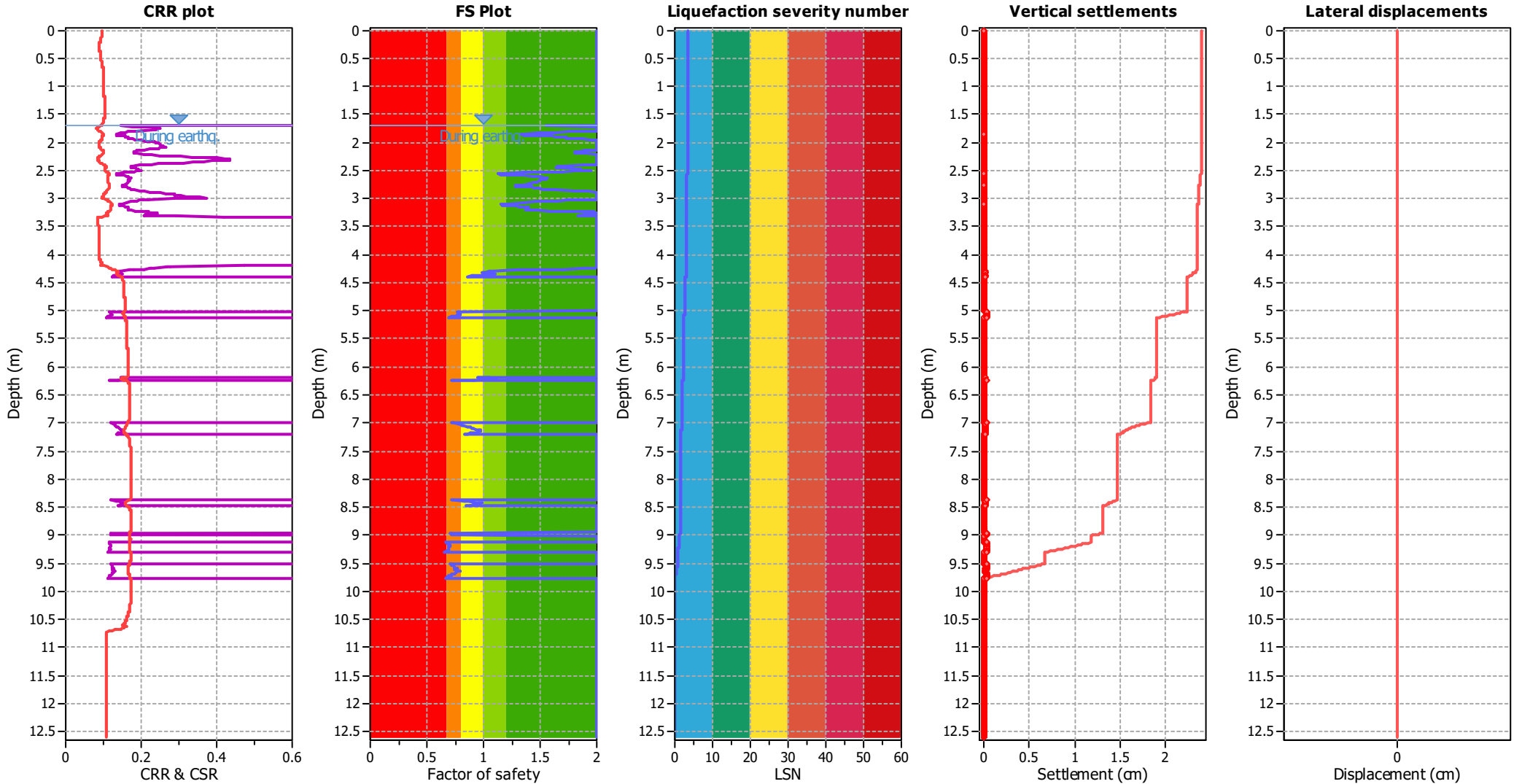
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

#### LSN color scheme

- Severe damage
- Major expression of liquefaction
- Moderate to severe exp. of liquefaction
- Moderate expression of liquefaction
- Minor expression of liquefaction
- Little to no expression of liquefaction



### Liquefaction analysis overall plots



**Input parameters and analysis data**

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_v$ applied:	Yes
Earthquake magnitude $M_w$ :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	10.00 m

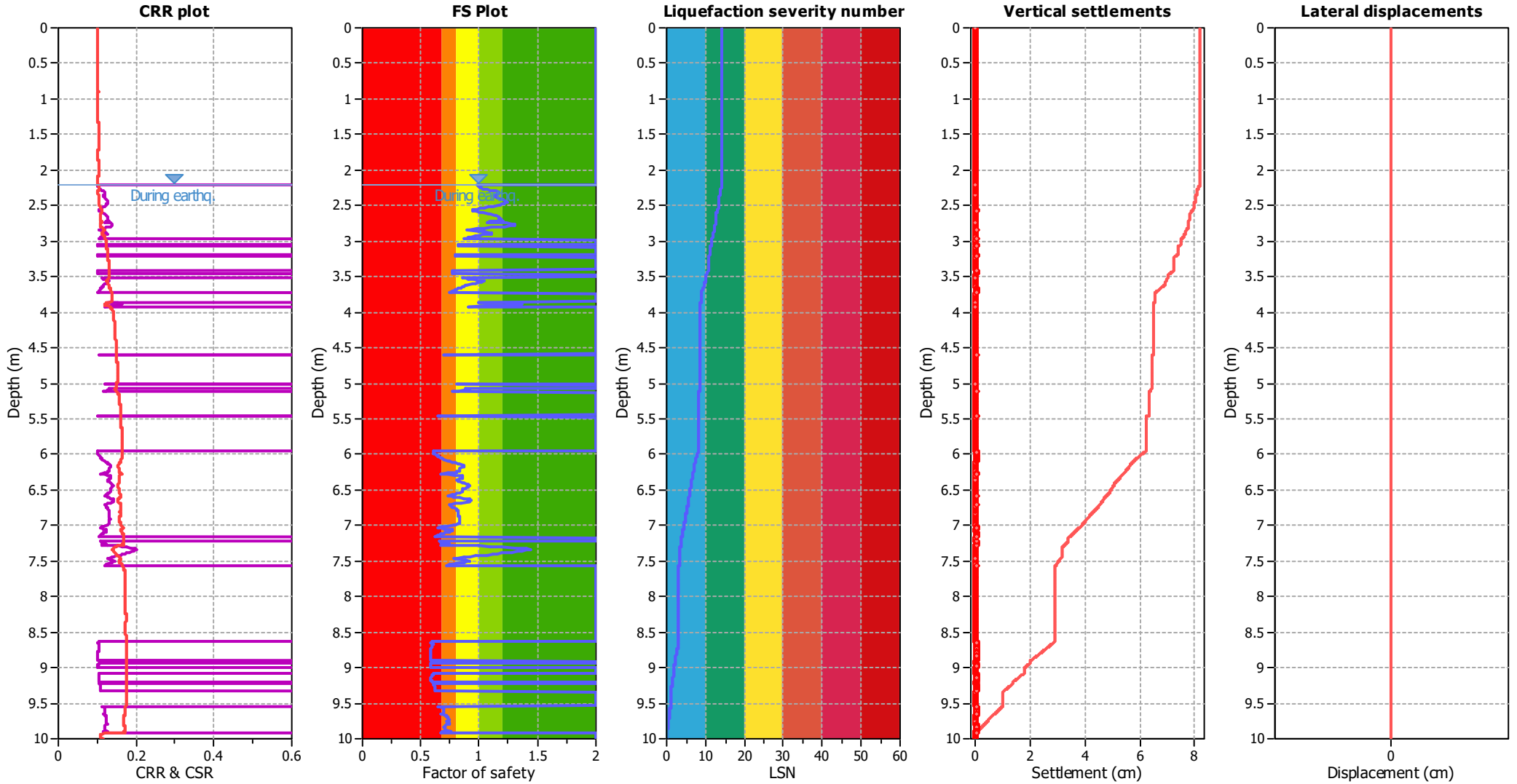
**F.S. color scheme**

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

**LSN color scheme**

- Severe damage
- Major expression of liquefaction
- Moderate to severe exp. of liquefaction
- Moderate expression of liquefaction
- Minor expression of liquefaction
- Little to no expression of liquefaction

### Liquefaction analysis overall plots



**Input parameters and analysis data**

Analysis method:	B&I (2014)	Depth to GWT (earthq.):	2.20 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_d$ applied:	Yes
Earthquake magnitude $M_w$ :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.20 m	Fill height:	N/A	Limit depth:	10.00 m

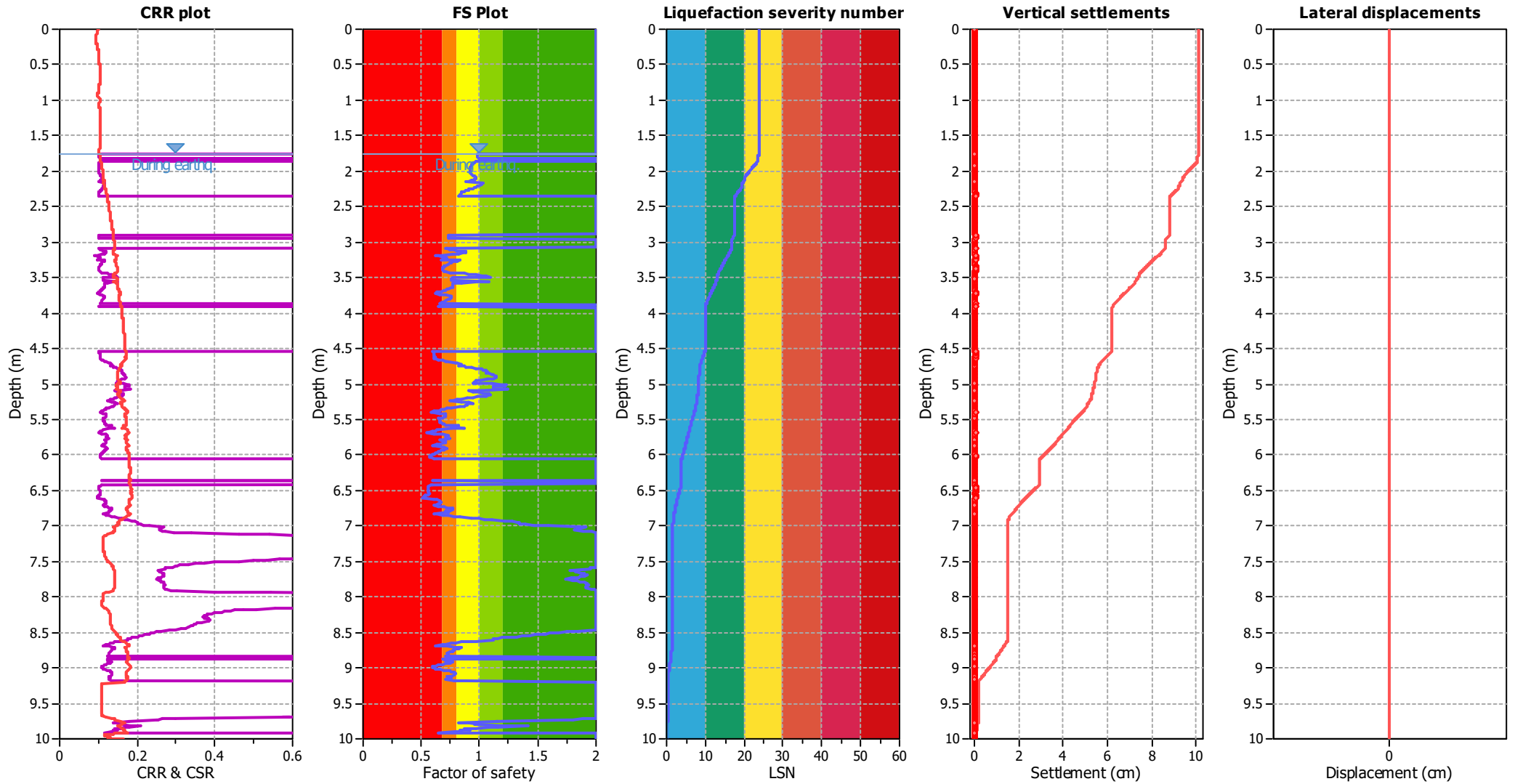
**F.S. color scheme**

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

**LSN color scheme**

- Severe damage
- Major expression of liquefaction
- Moderate to severe exp. of liquefaction
- Moderate expression of liquefaction
- Minor expression of liquefaction
- Little to no expression of liquefaction

### Liquefaction analysis overall plots



**Input parameters and analysis data**

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.75 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_d$ applied:	Yes
Earthquake magnitude $M_w$ :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.75 m	Fill height:	N/A	Limit depth:	10.00 m

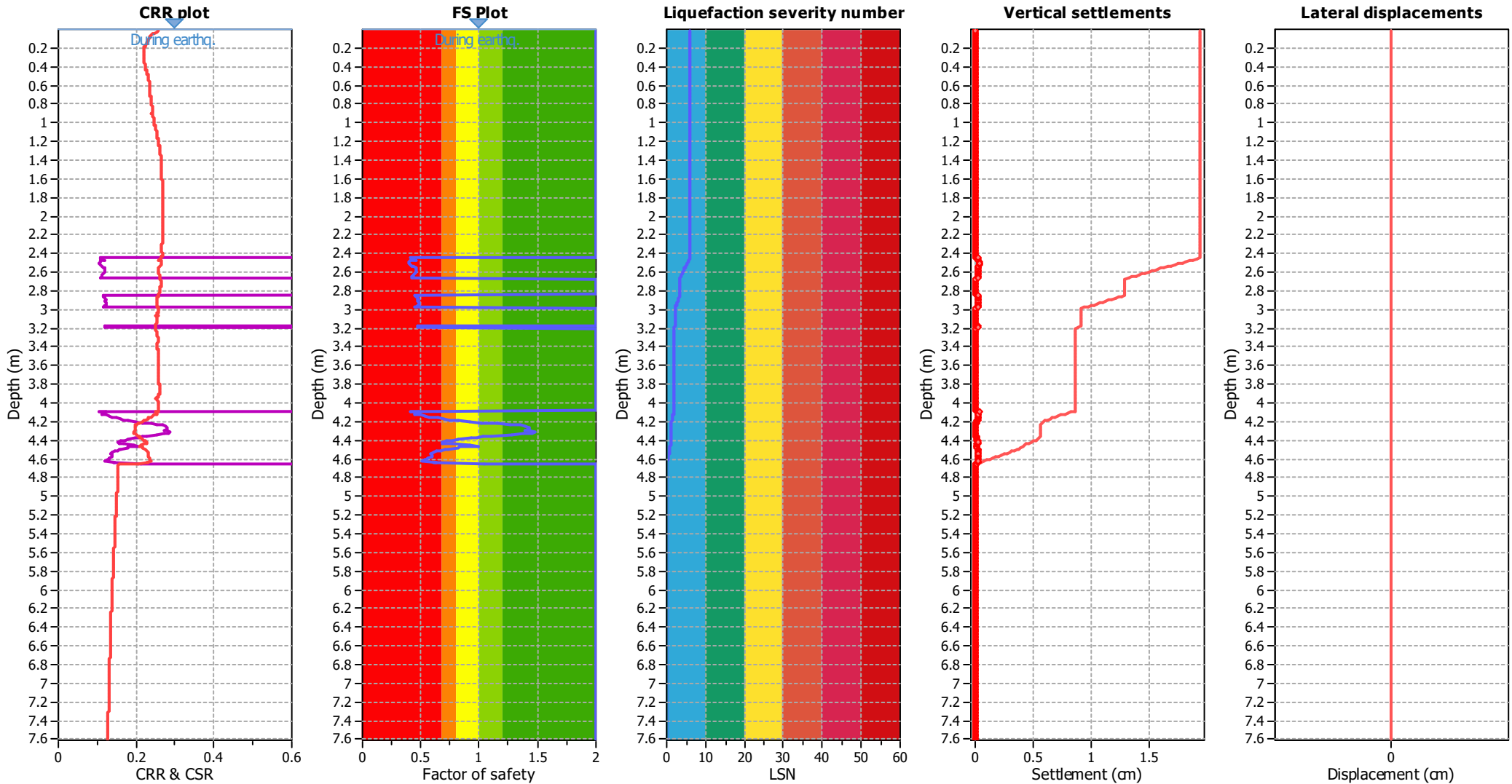
**F.S. color scheme**

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

**LSN color scheme**

- Severe damage
- Major expression of liquefaction
- Moderate to severe exp. of liquefaction
- Moderate expression of liquefaction
- Minor expression of liquefaction
- Little to no expression of liquefaction

### Liquefaction analysis overall plots



**Input parameters and analysis data**

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	0.00 m
Fines correction method:	B&I (2014)	Average results interval:	3
Points to test:	Based on Ic value	Ic cut-off value:	2.60
Earthquake magnitude $M_w$ :	6.00	Unit weight calculation:	Based on SBT
Peak ground acceleration:	0.19	Use fill:	No
Depth to water table (insitu):	0.00 m	Fill height:	N/A

Fill weight:	N/A
Transition detect. applied:	No
$K_v$ applied:	Yes
Clay like behavior applied:	Sands only
Limit depth applied:	Yes
Limit depth:	10.00 m

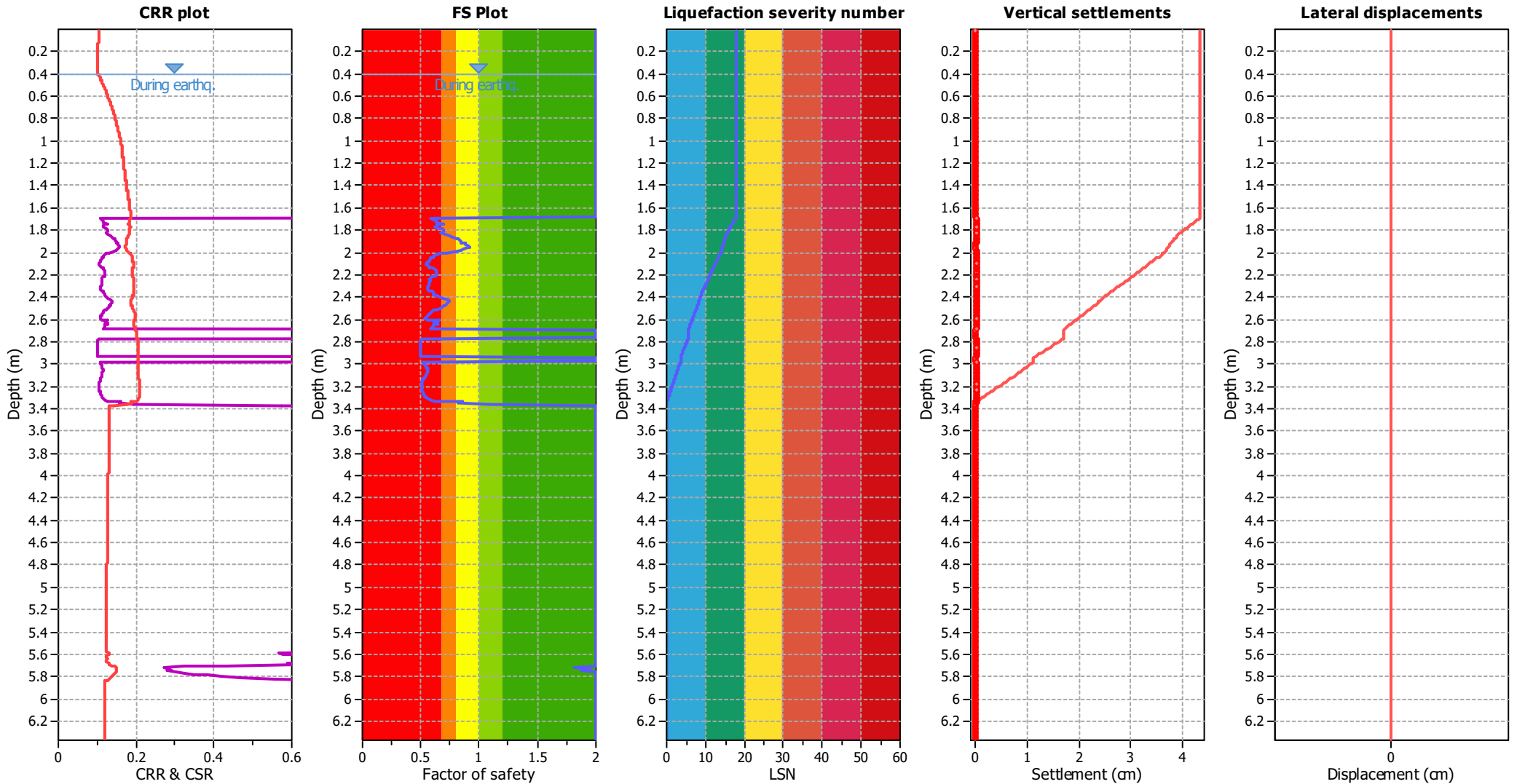
**F.S. color scheme**

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

**LSN color scheme**

- Severe damage
- Major expression of liquefaction
- Moderate to severe exp. of liquefaction
- Moderate expression of liquefaction
- Minor expression of liquefaction
- Little to no expression of liquefaction

### Liquefaction analysis overall plots



#### Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	0.40 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_f$ applied:	Yes
Earthquake magnitude $M_w$ :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	0.40 m	Fill height:	N/A	Limit depth:	10.00 m

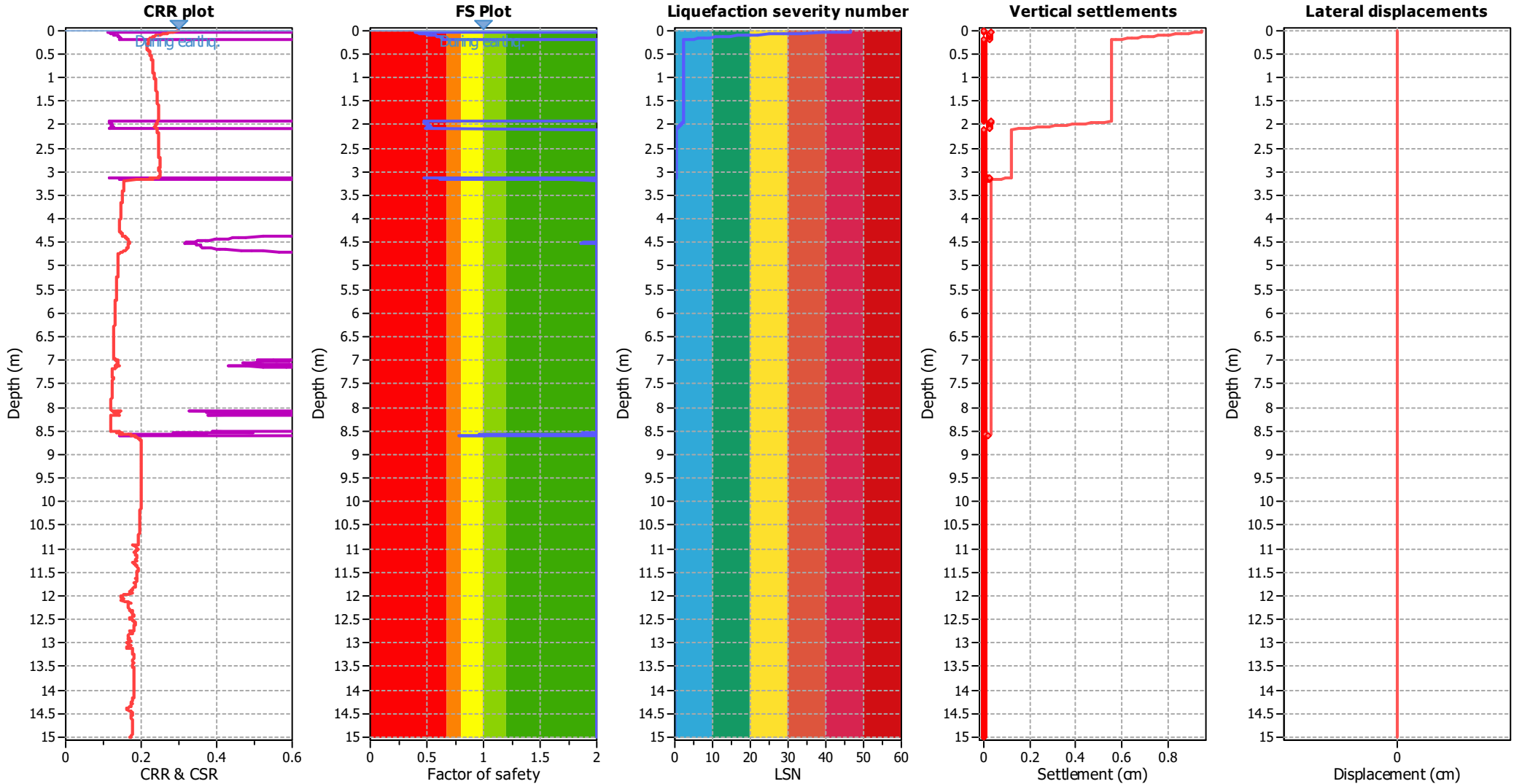
#### F.S. color scheme

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

#### LSN color scheme

- Severe damage
- Major expression of liquefaction
- Moderate to severe exp. of liquefaction
- Moderate expression of liquefaction
- Minor expression of liquefaction
- Little to no expression of liquefaction

### Liquefaction analysis overall plots



**Input parameters and analysis data**

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	0.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K <sub>σ</sub> applied:	Yes
Earthquake magnitude M <sub>w</sub> :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	0.00 m	Fill height:	N/A	Limit depth:	10.00 m

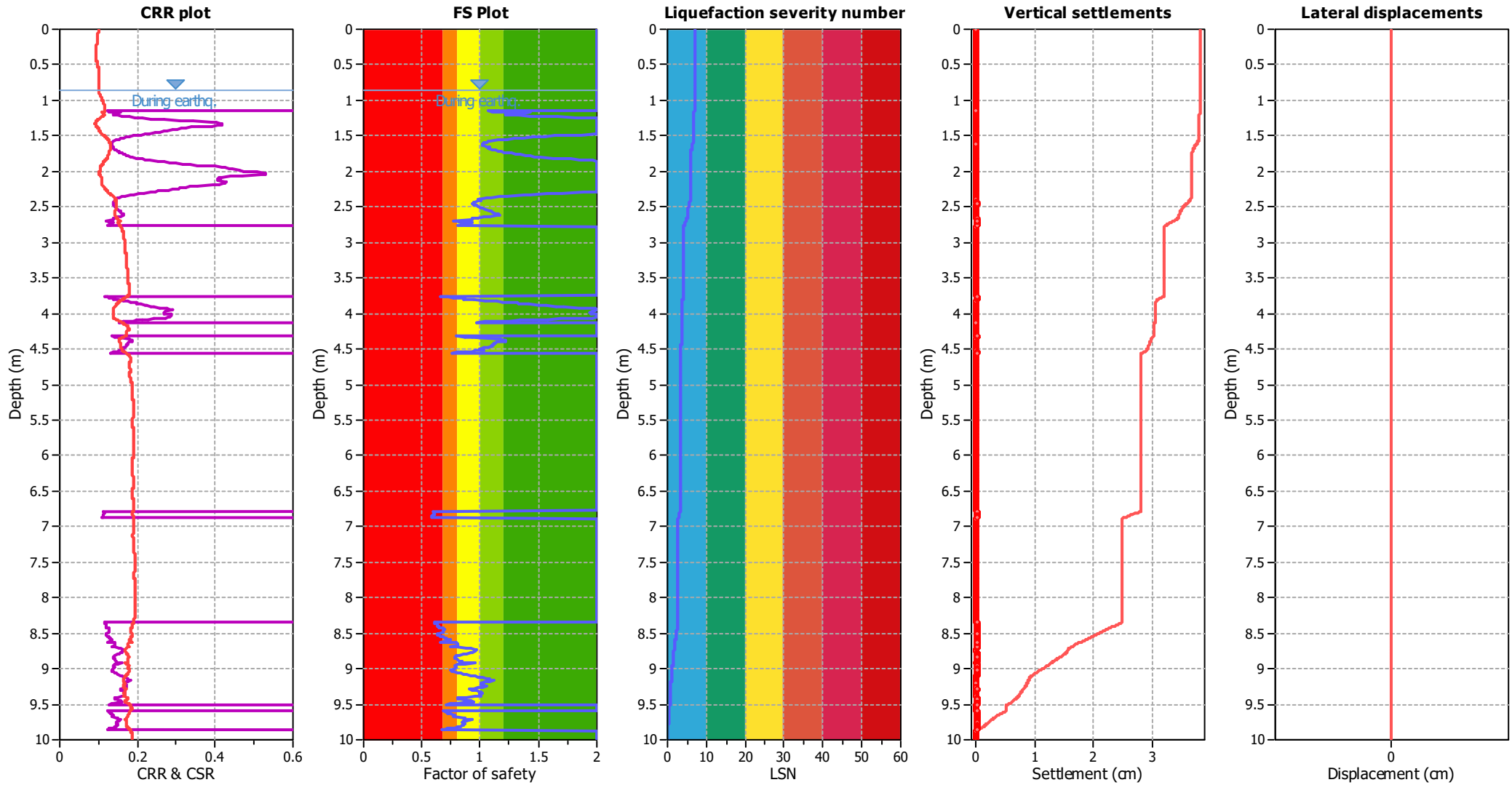
**F.S. color scheme**

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

**LSN color scheme**

- Severe damage
- Major expression of liquefaction
- Moderate to severe exp. of liquefaction
- Moderate expression of liquefaction
- Minor expression of liquefaction
- Little to no expression of liquefaction

### Liquefaction analysis overall plots



#### Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (earthq.):	0.85 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_d$ applied:	Yes
Earthquake magnitude $M_w$ :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	0.85 m	Fill height:	N/A	Limit depth:	10.00 m

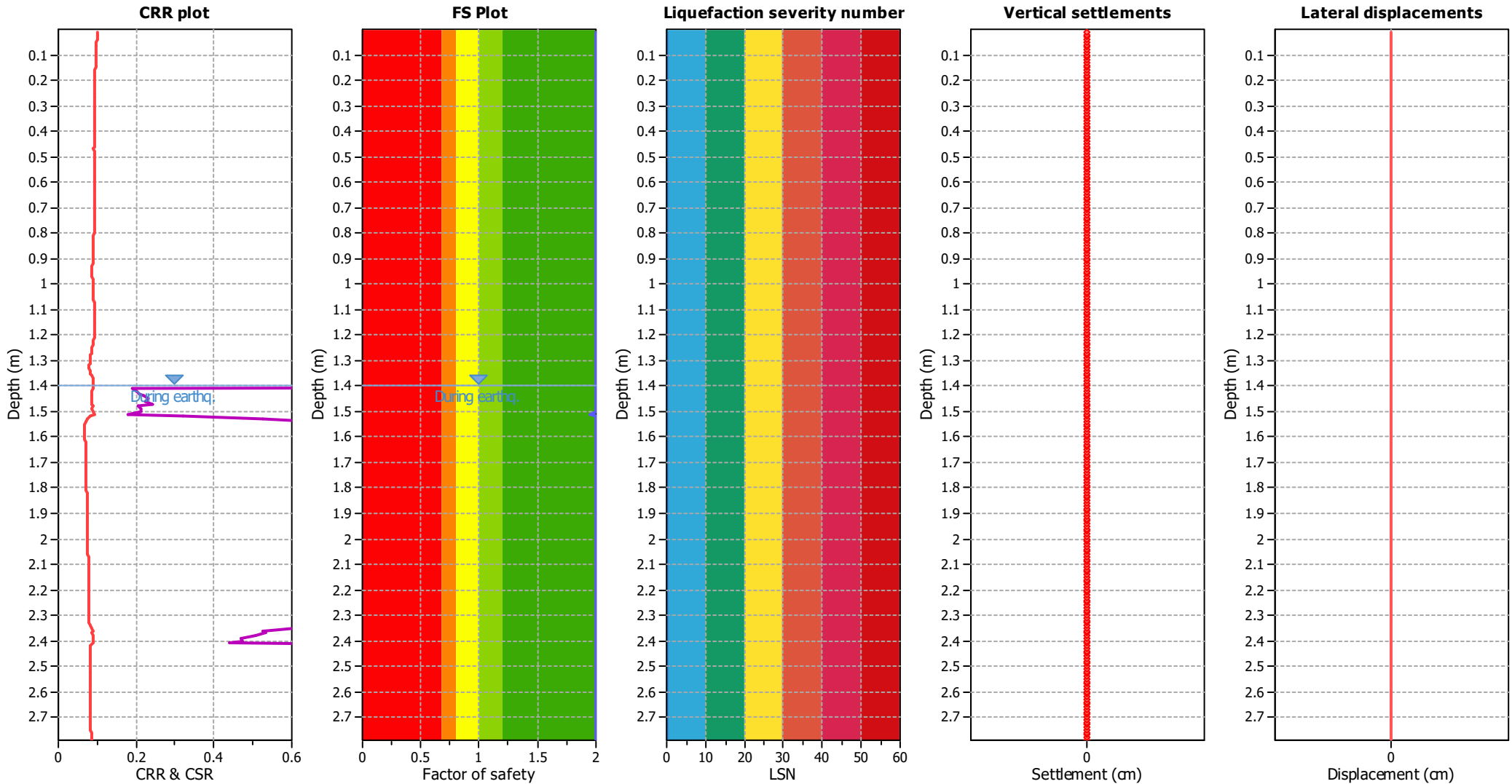
#### F.S. color scheme

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

#### LSN color scheme

- Severe damage
- Major expression of liquefaction
- Moderate to severe exp. of liquefaction
- Moderate expression of liquefaction
- Minor expression of liquefaction
- Little to no expression of liquefaction

### Liquefaction analysis overall plots



**Input parameters and analysis data**

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.40 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_f$ applied:	Yes
Earthquake magnitude $M_w$ :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.40 m	Fill height:	N/A	Limit depth:	10.00 m

**F.S. color scheme**

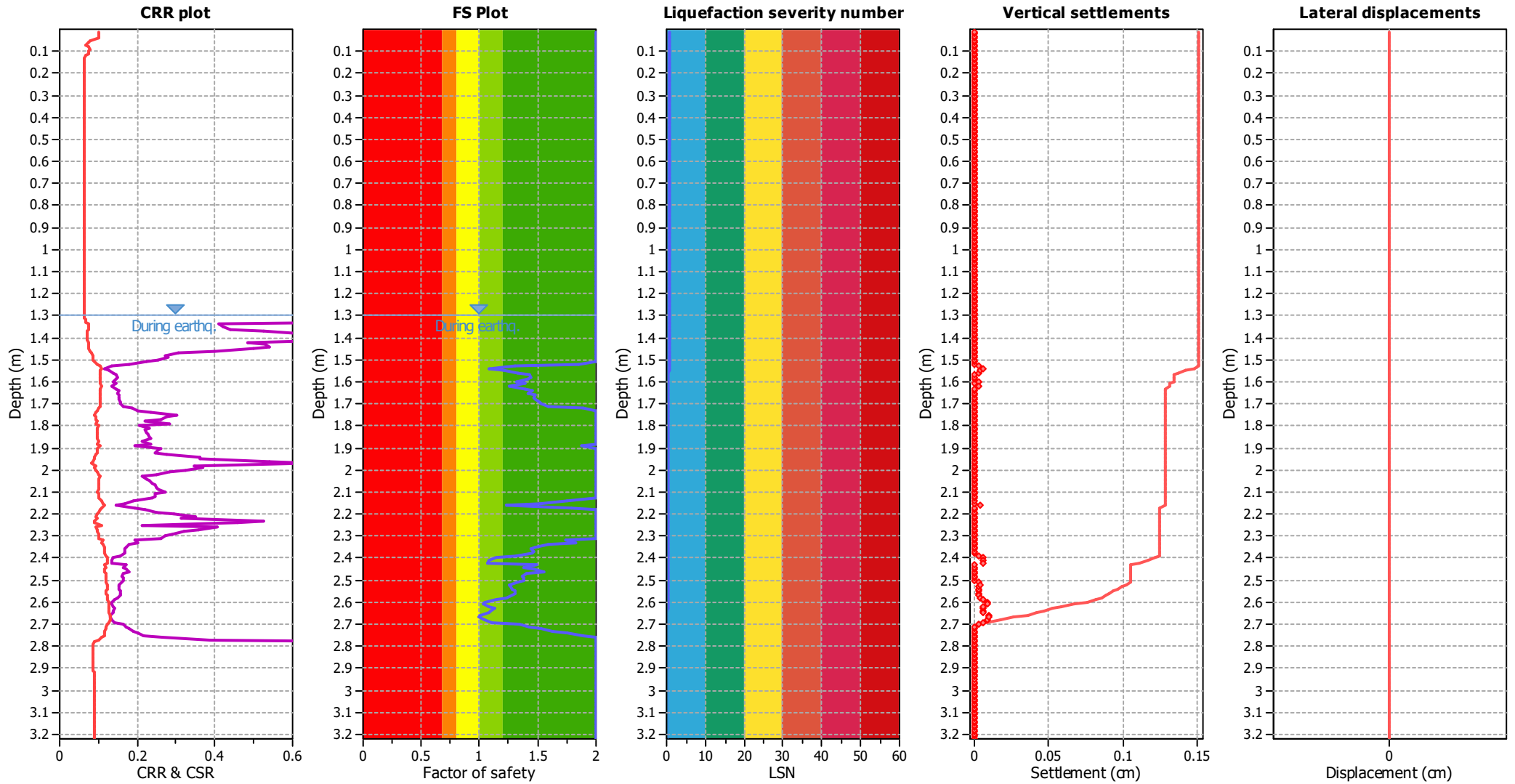
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
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- Almost certain it will not liquefy

**LSN color scheme**

- Severe damage
- Major expression of liquefaction
- Moderate to severe exp. of liquefaction
- Moderate expression of liquefaction
- Minor expression of liquefaction
- Little to no expression of liquefaction



### Liquefaction analysis overall plots



**Input parameters and analysis data**

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.30 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_f$ applied:	Yes
Earthquake magnitude $M_w$ :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.30 m	Fill height:	N/A	Limit depth:	10.00 m

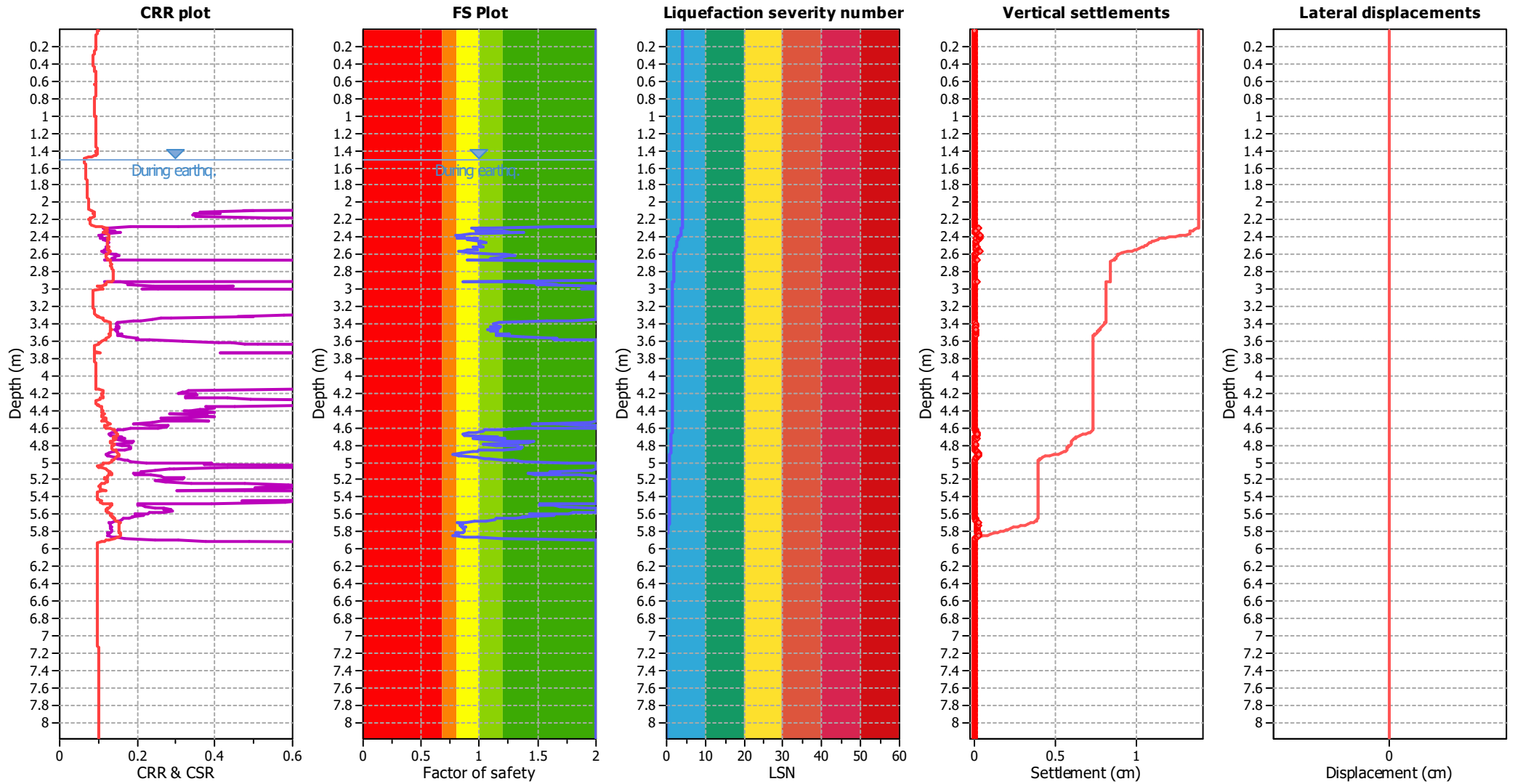
**F.S. color scheme**

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- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

**LSN color scheme**

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- Major expression of liquefaction
- Moderate to severe exp. of liquefaction
- Moderate expression of liquefaction
- Minor expression of liquefaction
- Little to no expression of liquefaction

### Liquefaction analysis overall plots



**Input parameters and analysis data**

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.50 m
Fines correction method:	B&I (2014)	Average results interval:	3
Points to test:	Based on Ic value	Ic cut-off value:	2.60
Earthquake magnitude $M_w$ :	6.00	Unit weight calculation:	Based on SBT
Peak ground acceleration:	0.19	Use fill:	No
Depth to water table (insitu):	1.50 m	Fill height:	N/A

Fill weight:	N/A
Transition detect. applied:	No
$K_\sigma$ applied:	Yes
Clay like behavior applied:	Sands only
Limit depth applied:	Yes
Limit depth:	10.00 m

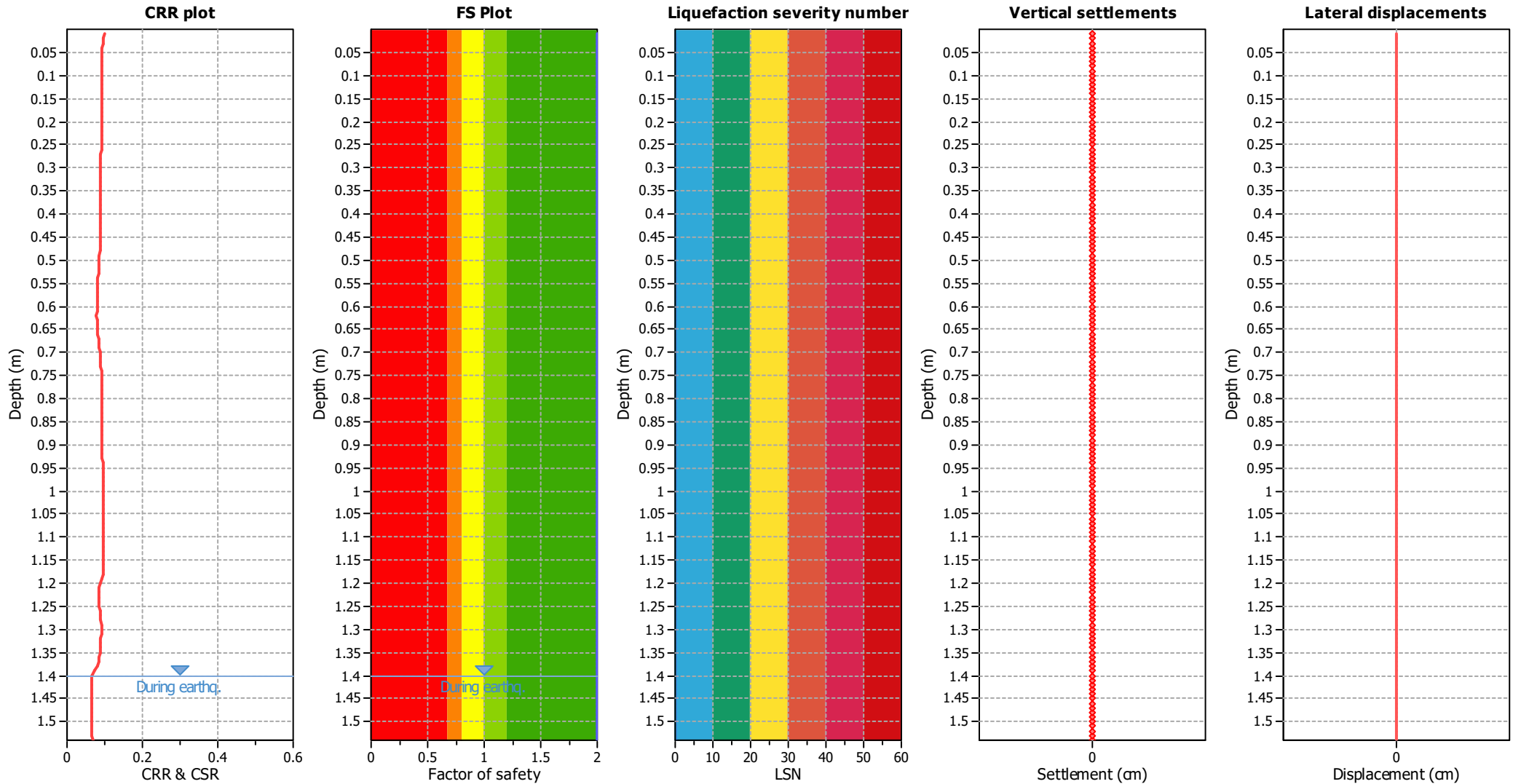
**F.S. color scheme**

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

**LSN color scheme**

- Severe damage
- Major expression of liquefaction
- Moderate to severe exp. of liquefaction
- Moderate expression of liquefaction
- Minor expression of liquefaction
- Little to no expression of liquefaction

### Liquefaction analysis overall plots



#### Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.40 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_{\sigma}$ applied:	Yes
Earthquake magnitude $M_w$ :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.40 m	Fill height:	N/A	Limit depth:	10.00 m

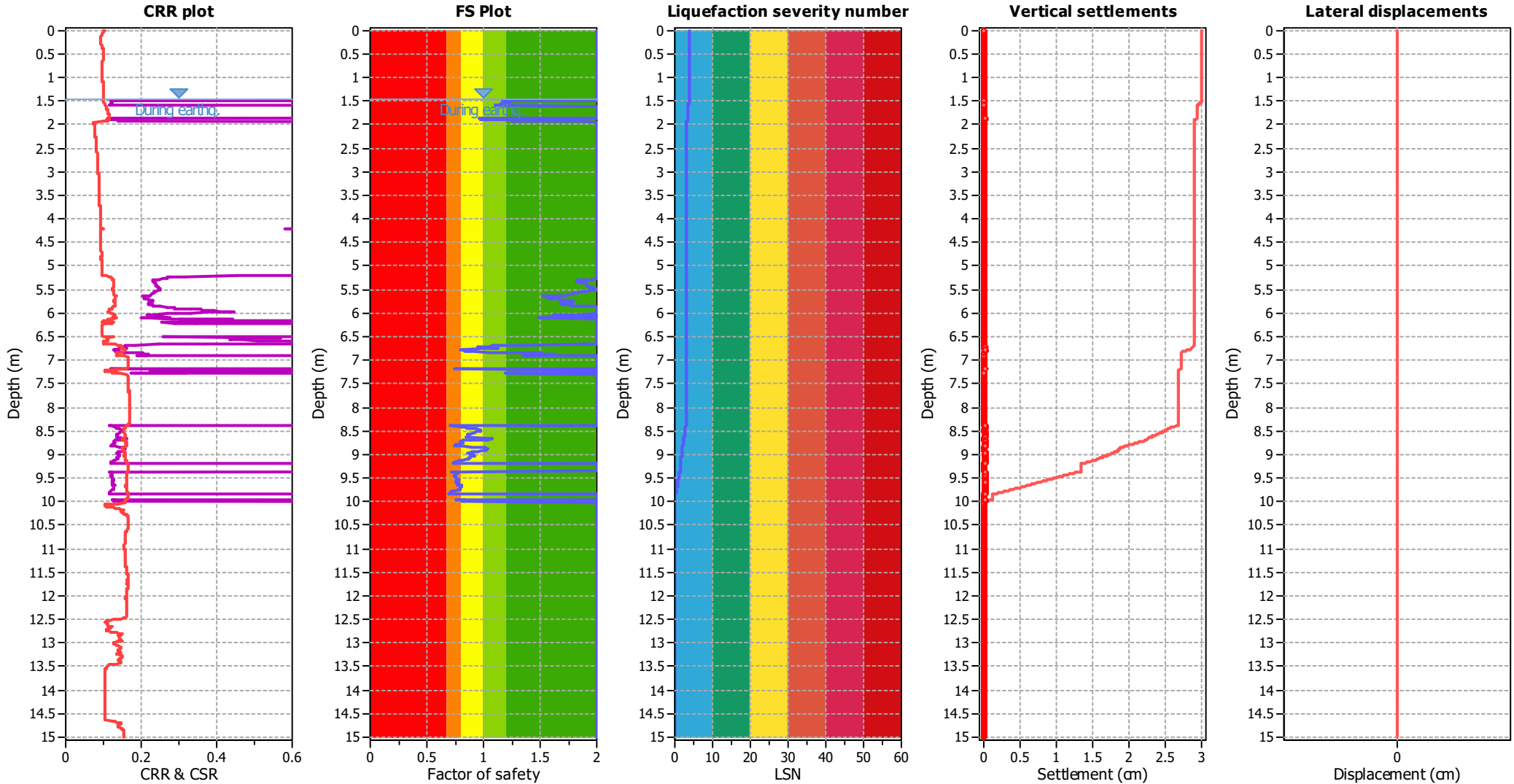
#### F.S. color scheme

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

#### LSN color scheme

- Severe damage
- Major expression of liquefaction
- Moderate to severe exp. of liquefaction
- Moderate expression of liquefaction
- Minor expression of liquefaction
- Little to no expression of liquefaction

### Liquefaction analysis overall plots



**Input parameters and analysis data**

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.45 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_v$ applied:	Yes
Earthquake magnitude $M_w$ :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.45 m	Fill height:	N/A	Limit depth:	10.00 m

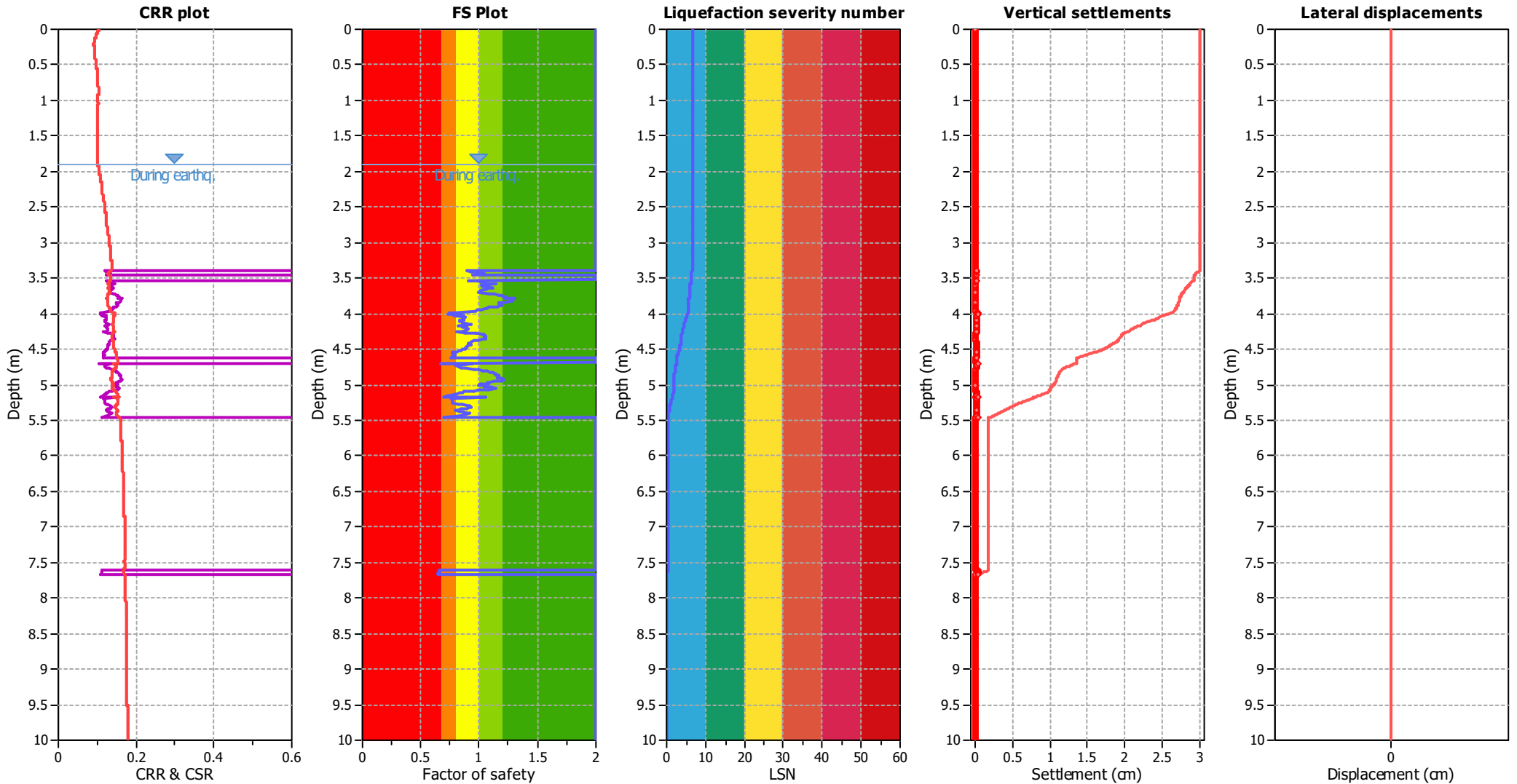
**F.S. color scheme**

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

**LSN color scheme**

- Severe damage
- Major expression of liquefaction
- Moderate to severe exp. of liquefaction
- Moderate expression of liquefaction
- Minor expression of liquefaction
- Little to no expression of liquefaction

### Liquefaction analysis overall plots



#### Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.90 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_f$ applied:	Yes
Earthquake magnitude $M_w$ :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.90 m	Fill height:	N/A	Limit depth:	10.00 m

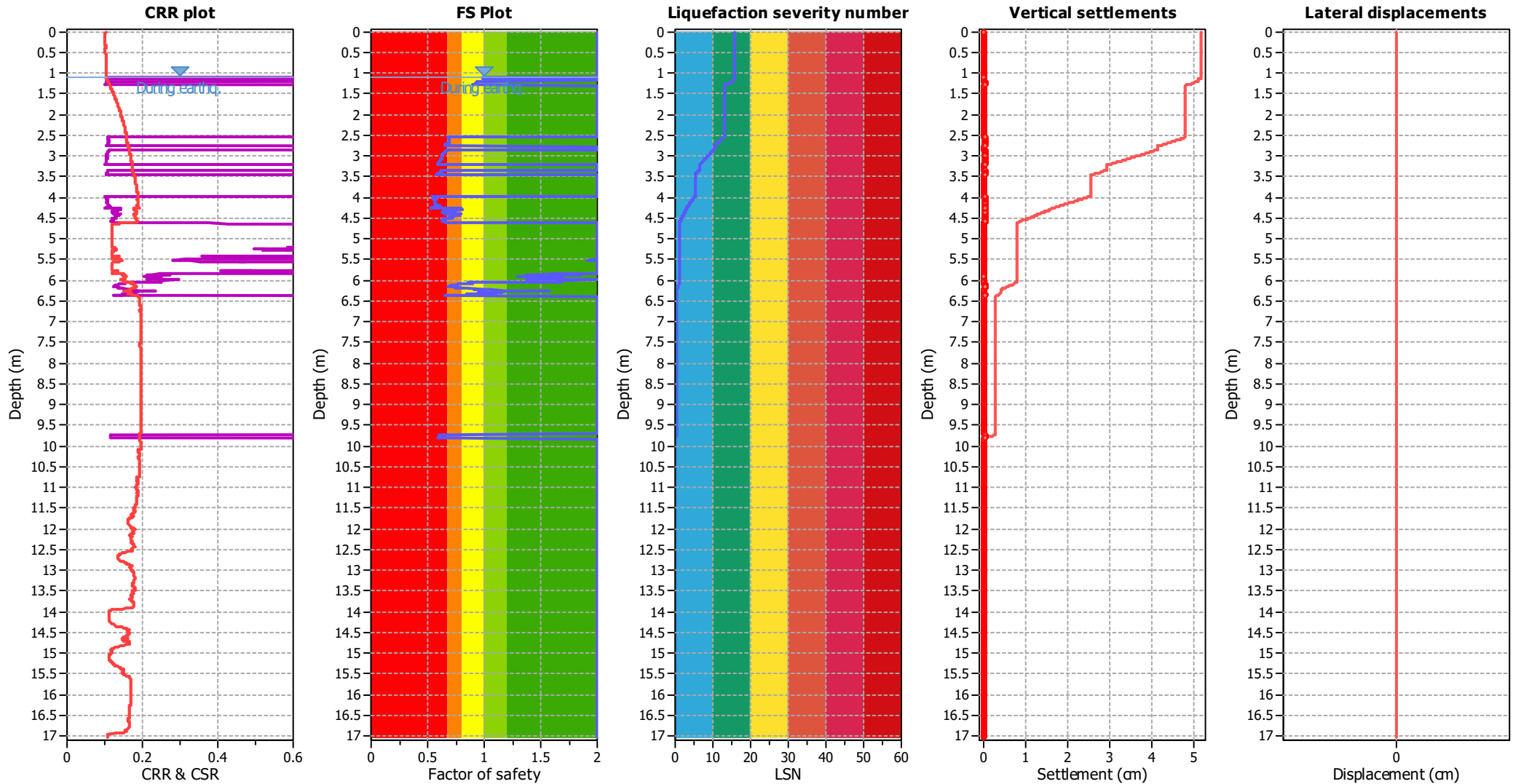
#### F.S. color scheme

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

#### LSN color scheme

- Severe damage
- Major expression of liquefaction
- Moderate to severe exp. of liquefaction
- Moderate expression of liquefaction
- Minor expression of liquefaction
- Little to no expression of liquefaction

### Liquefaction analysis overall plots



#### Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.10 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_D$ applied:	Yes
Earthquake magnitude $M_w$ :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.10 m	Fill height:	N/A	Limit depth:	10.00 m

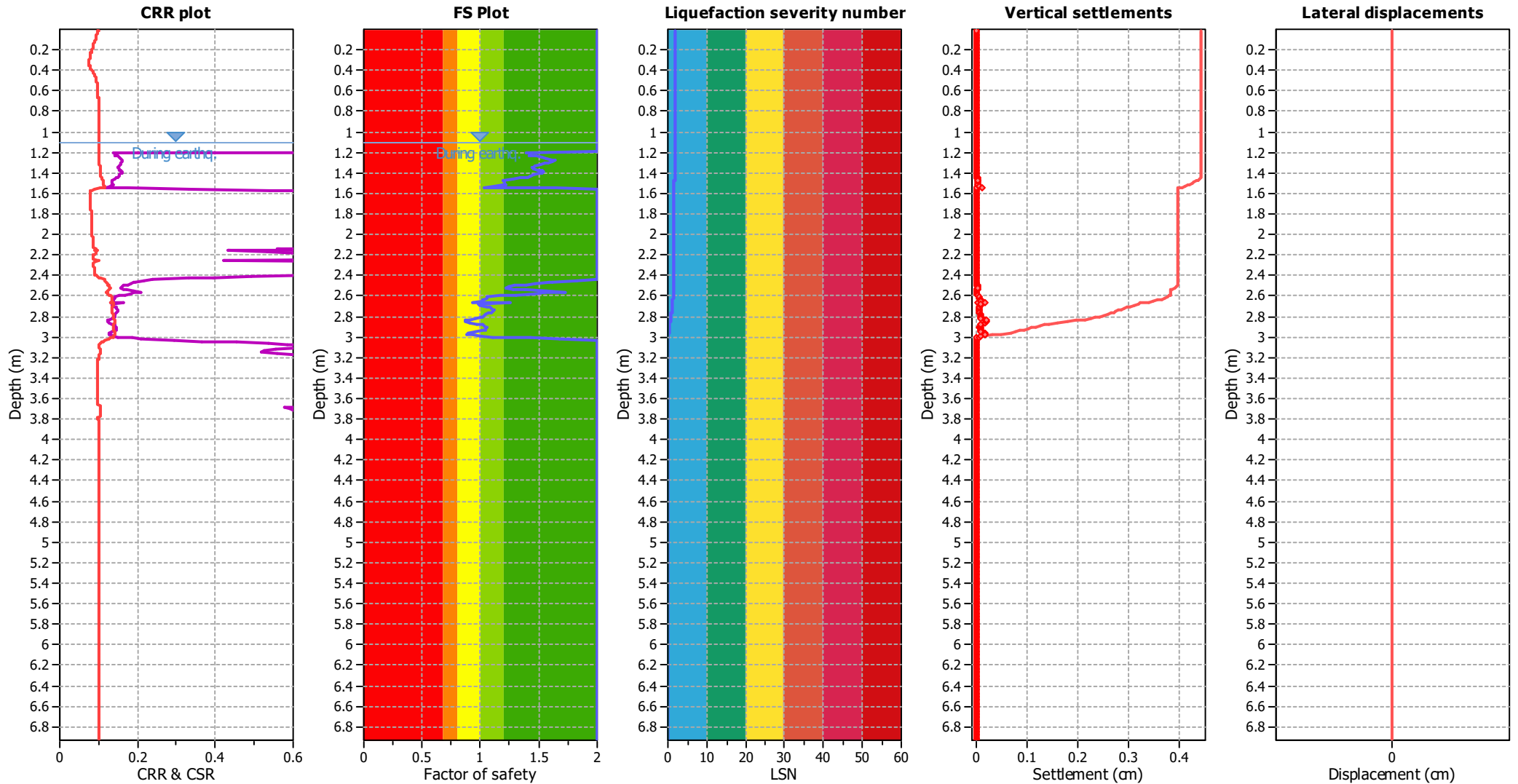
#### F.S. color scheme

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

#### LSN color scheme

- Severe damage
- Major expression of liquefaction
- Moderate to severe exp. of liquefaction
- Moderate expression of liquefaction
- Minor expression of liquefaction
- Little to no expression of liquefaction

### Liquefaction analysis overall plots



**Input parameters and analysis data**

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.10 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_v$ applied:	Yes
Earthquake magnitude $M_w$ :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.10 m	Fill height:	N/A	Limit depth:	10.00 m

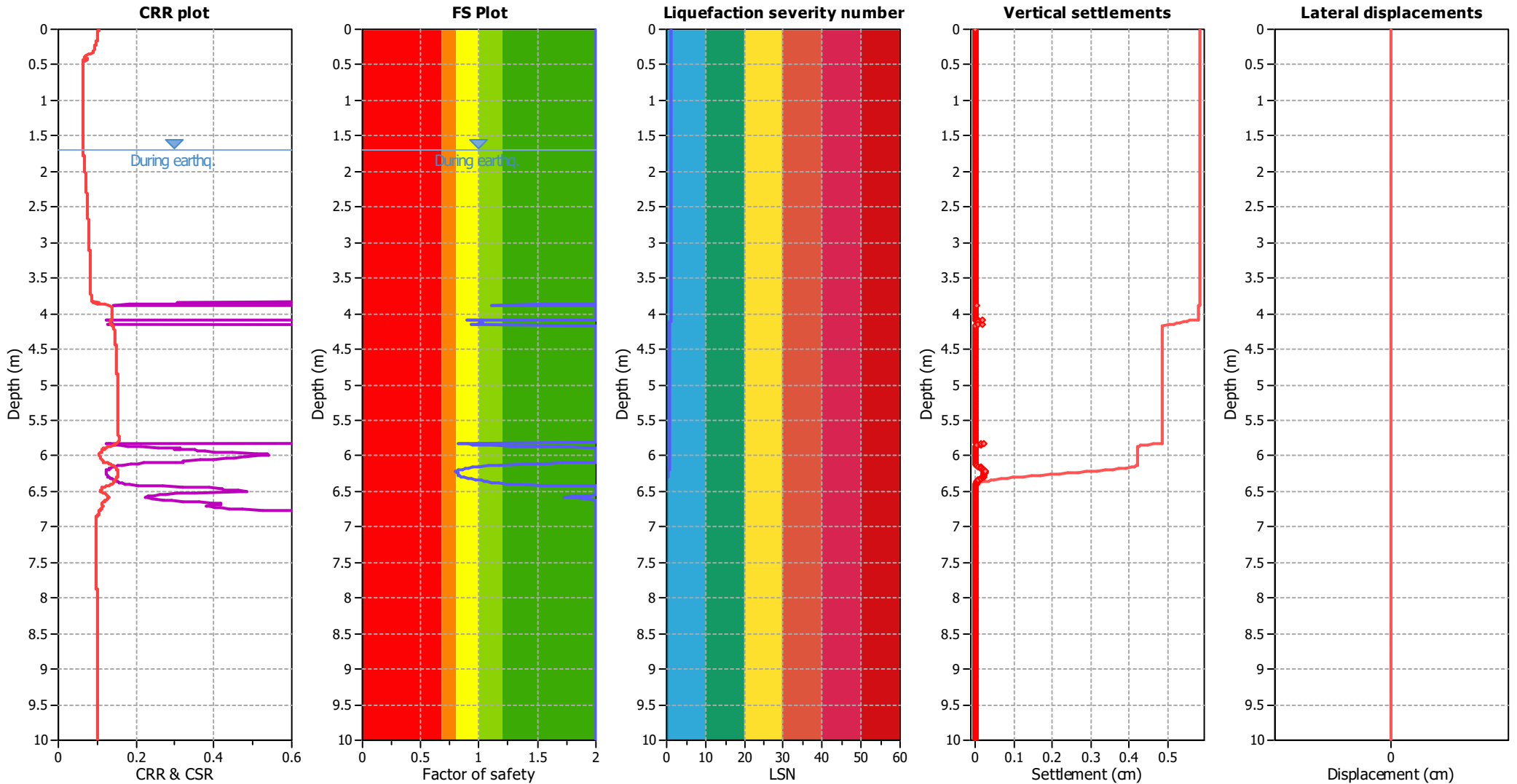
**F.S. color scheme**

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

**LSN color scheme**

- Severe damage
- Major expression of liquefaction
- Moderate to severe exp. of liquefaction
- Moderate expression of liquefaction
- Minor expression of liquefaction
- Little to no expression of liquefaction

### Liquefaction analysis overall plots



#### Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_d$ applied:	Yes
Earthquake magnitude $M_w$ :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	10.00 m

#### F.S. color scheme

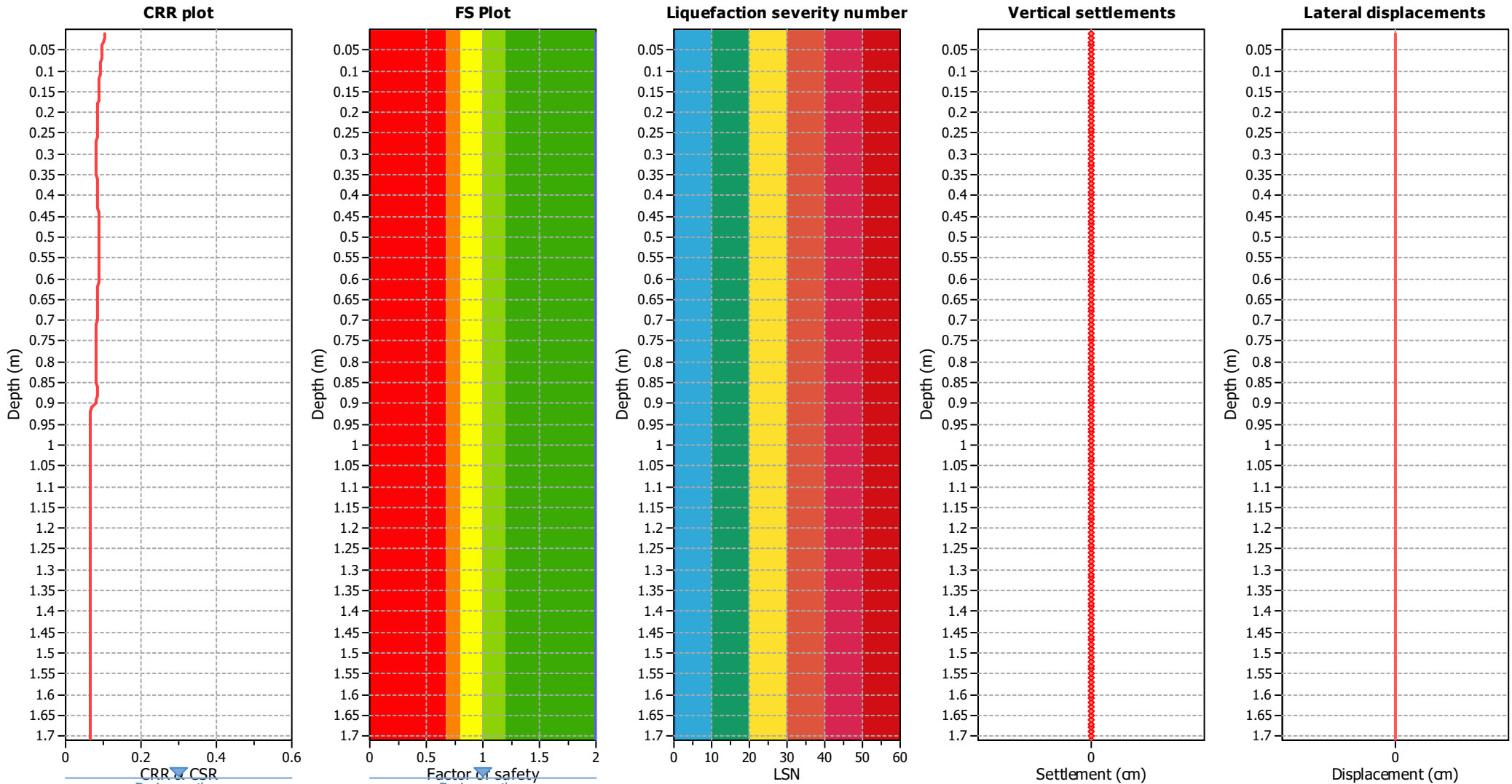
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

#### LSN color scheme

- Severe damage
- Major expression of liquefaction
- Moderate to severe exp. of liquefaction
- Moderate expression of liquefaction
- Minor expression of liquefaction
- Little to no expression of liquefaction



### Liquefaction analysis overall plots



**Input parameters and analysis data**

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.80 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K <sub>σ</sub> applied:	Yes
Earthquake magnitude M <sub>w</sub> :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.80 m	Fill height:	N/A	Limit depth:	10.00 m

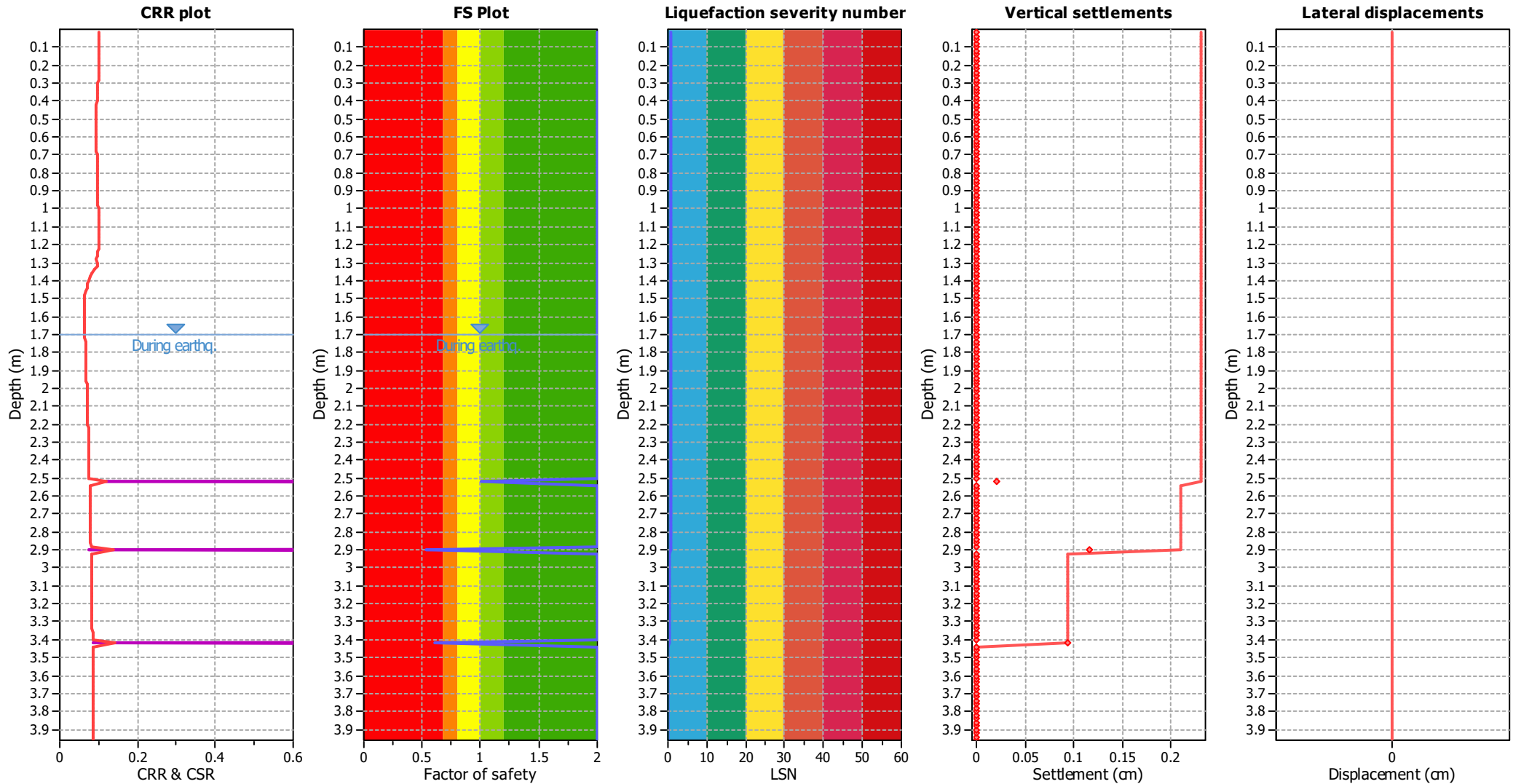
**F.S. color scheme**

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

**LSN color scheme**

- Severe damage
- Major expression of liquefaction
- Moderate to severe exp. of liquefaction
- Moderate expression of liquefaction
- Minor expression of liquefaction
- Little to no expression of liquefaction

### Liquefaction analysis overall plots



**Input parameters and analysis data**

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_f$ applied:	Yes
Earthquake magnitude $M_w$ :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	10.00 m

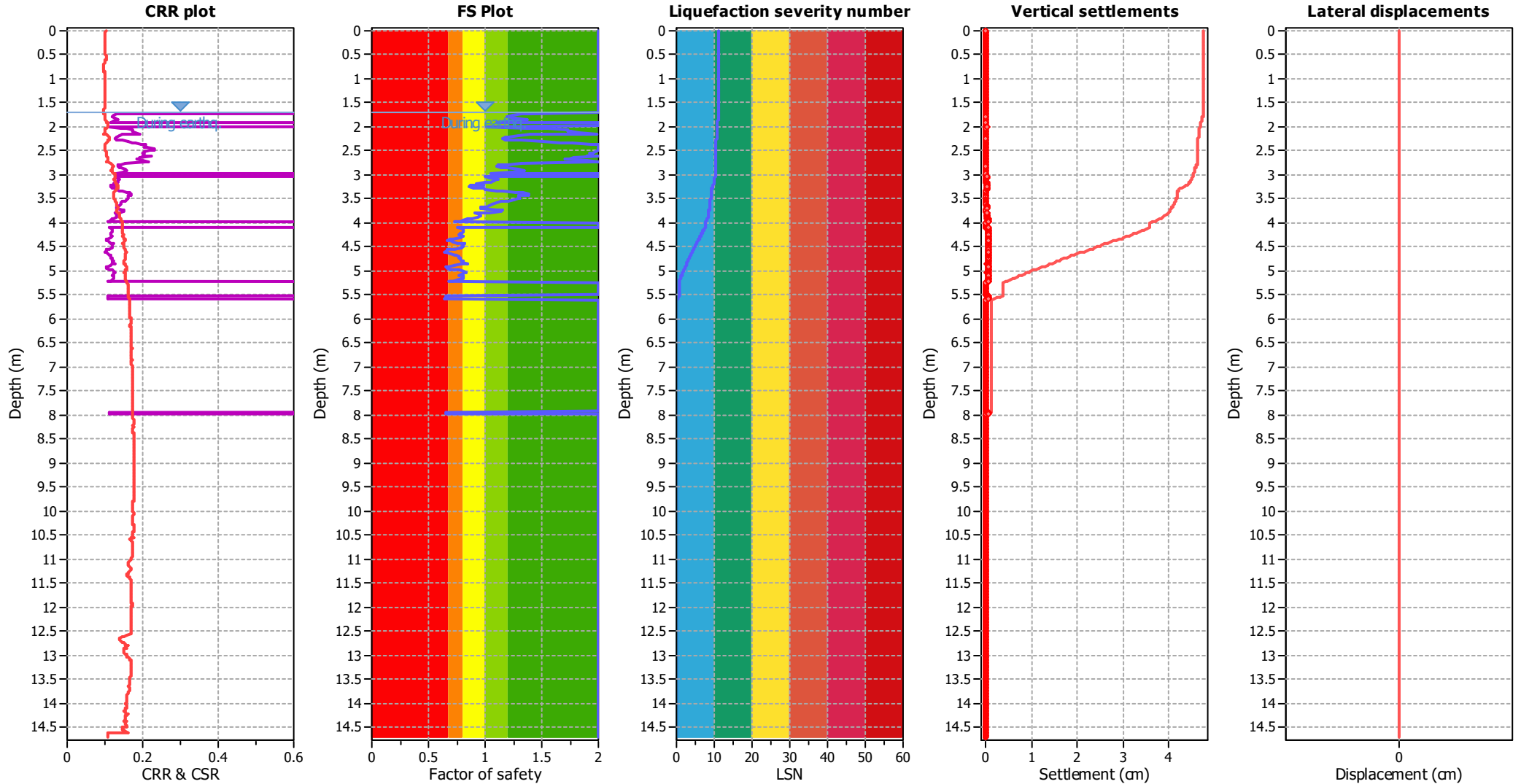
**F.S. color scheme**

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

**LSN color scheme**

- Severe damage
- Major expression of liquefaction
- Moderate to severe exp. of liquefaction
- Moderate expression of liquefaction
- Minor expression of liquefaction
- Little to no expression of liquefaction

### Liquefaction analysis overall plots



**Input parameters and analysis data**

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_v$ applied:	Yes
Earthquake magnitude $M_w$ :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	10.00 m

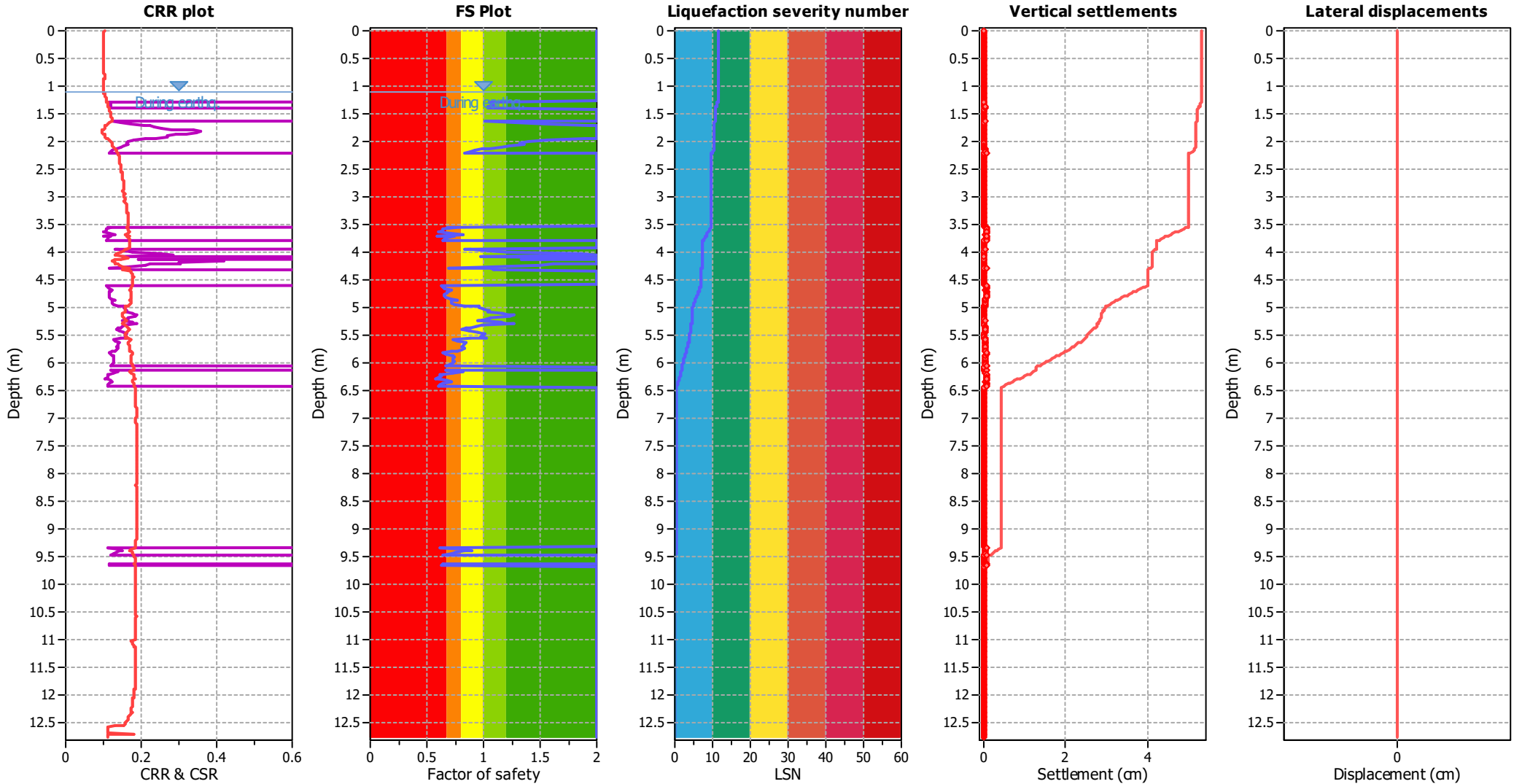
**F.S. color scheme**

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

**LSN color scheme**

- Severe damage
- Major expression of liquefaction
- Moderate to severe exp. of liquefaction
- Moderate expression of liquefaction
- Minor expression of liquefaction
- Little to no expression of liquefaction

### Liquefaction analysis overall plots



**Input parameters and analysis data**

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.10 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_v$ applied:	Yes
Earthquake magnitude $M_w$ :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.10 m	Fill height:	N/A	Limit depth:	10.00 m

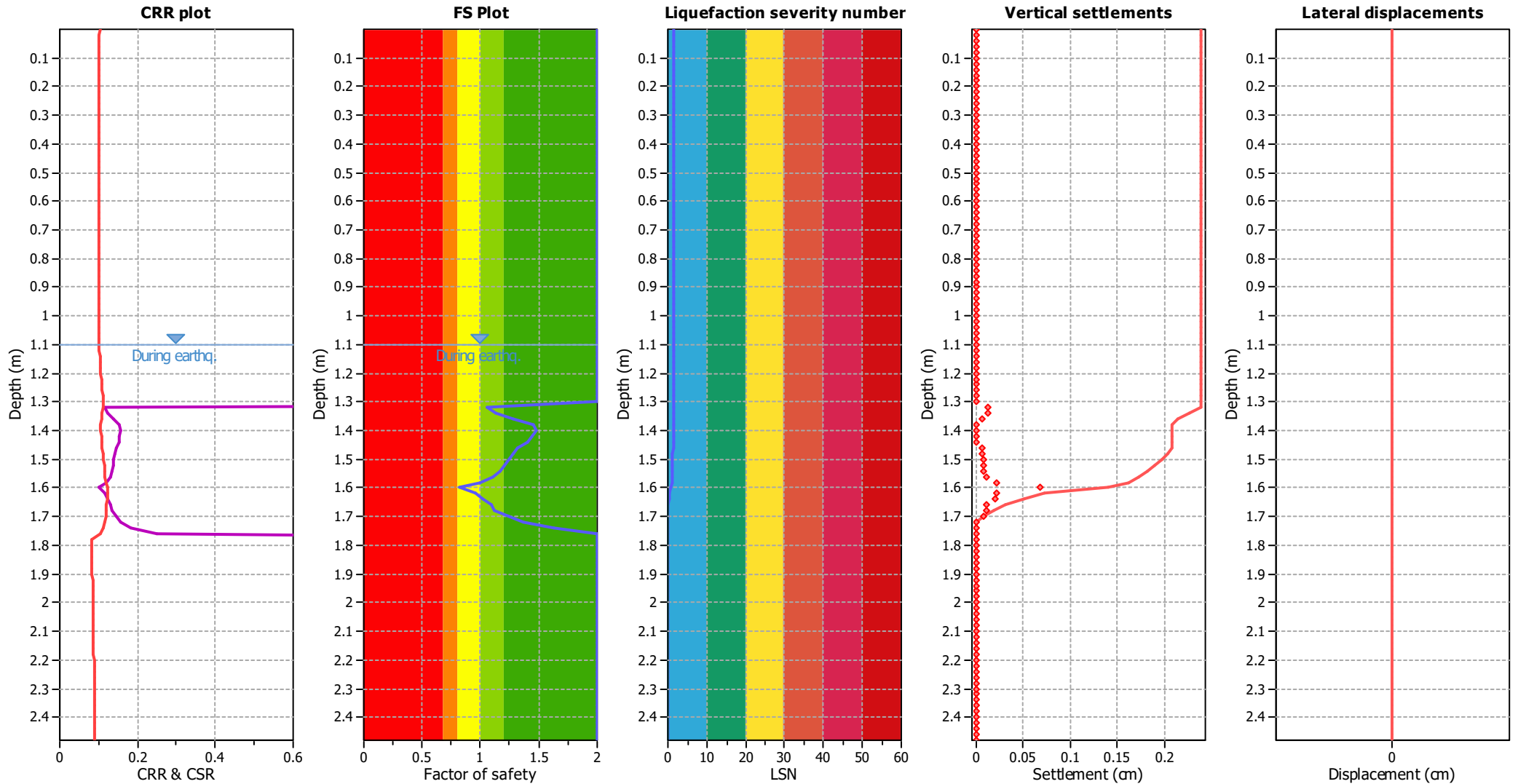
**F.S. color scheme**

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- Moderate to severe exp. of liquefaction
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- Minor expression of liquefaction
- Little to no expression of liquefaction

### Liquefaction analysis overall plots



**Input parameters and analysis data**

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.10 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_f$ applied:	Yes
Earthquake magnitude $M_w$ :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.10 m	Fill height:	N/A	Limit depth:	10.00 m

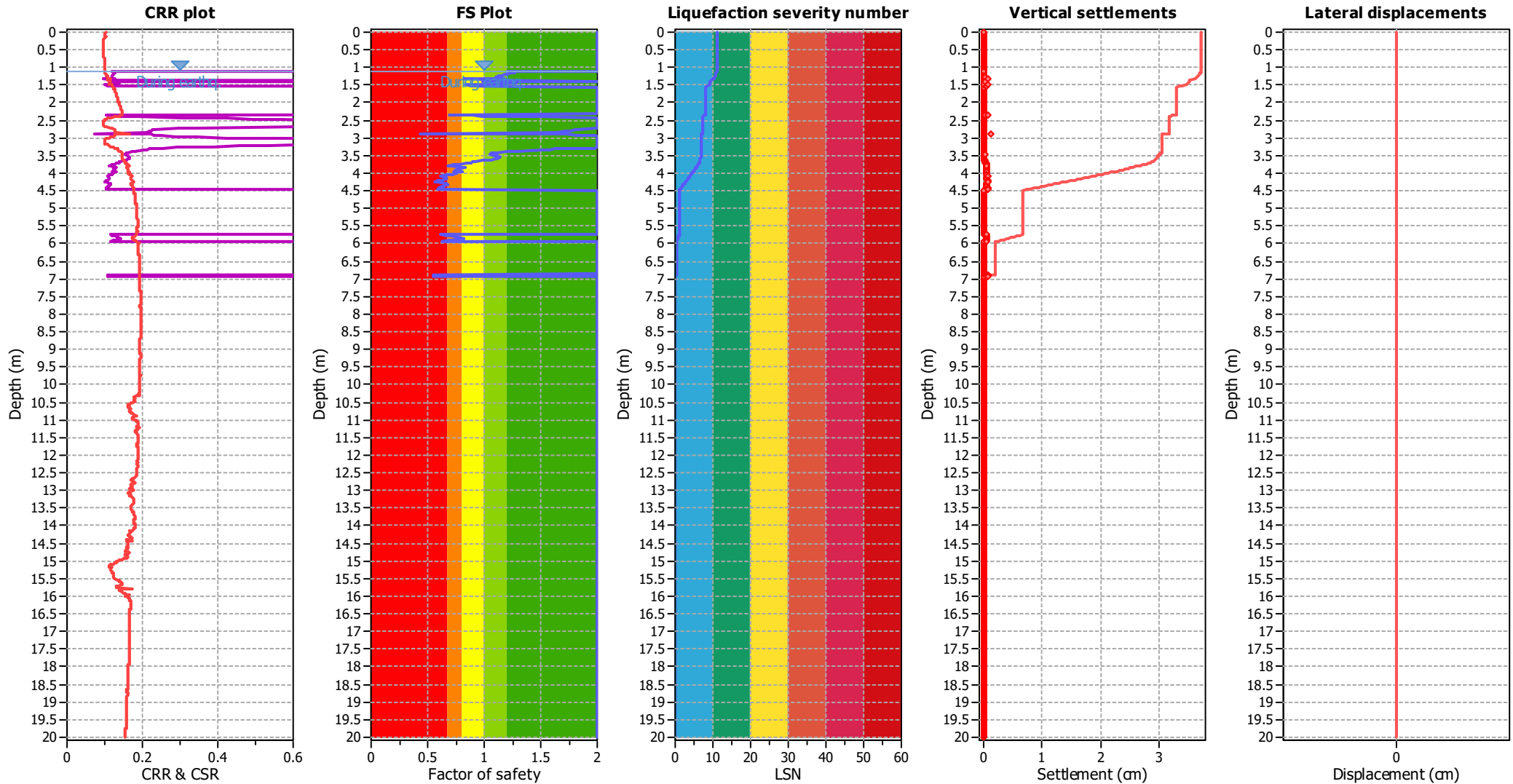
**F.S. color scheme**

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- Severe damage
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- Moderate expression of liquefaction
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### Liquefaction analysis overall plots



**Input parameters and analysis data**

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.10 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_v$ applied:	Yes
Earthquake magnitude $M_w$ :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.10 m	Fill height:	N/A	Limit depth:	10.00 m

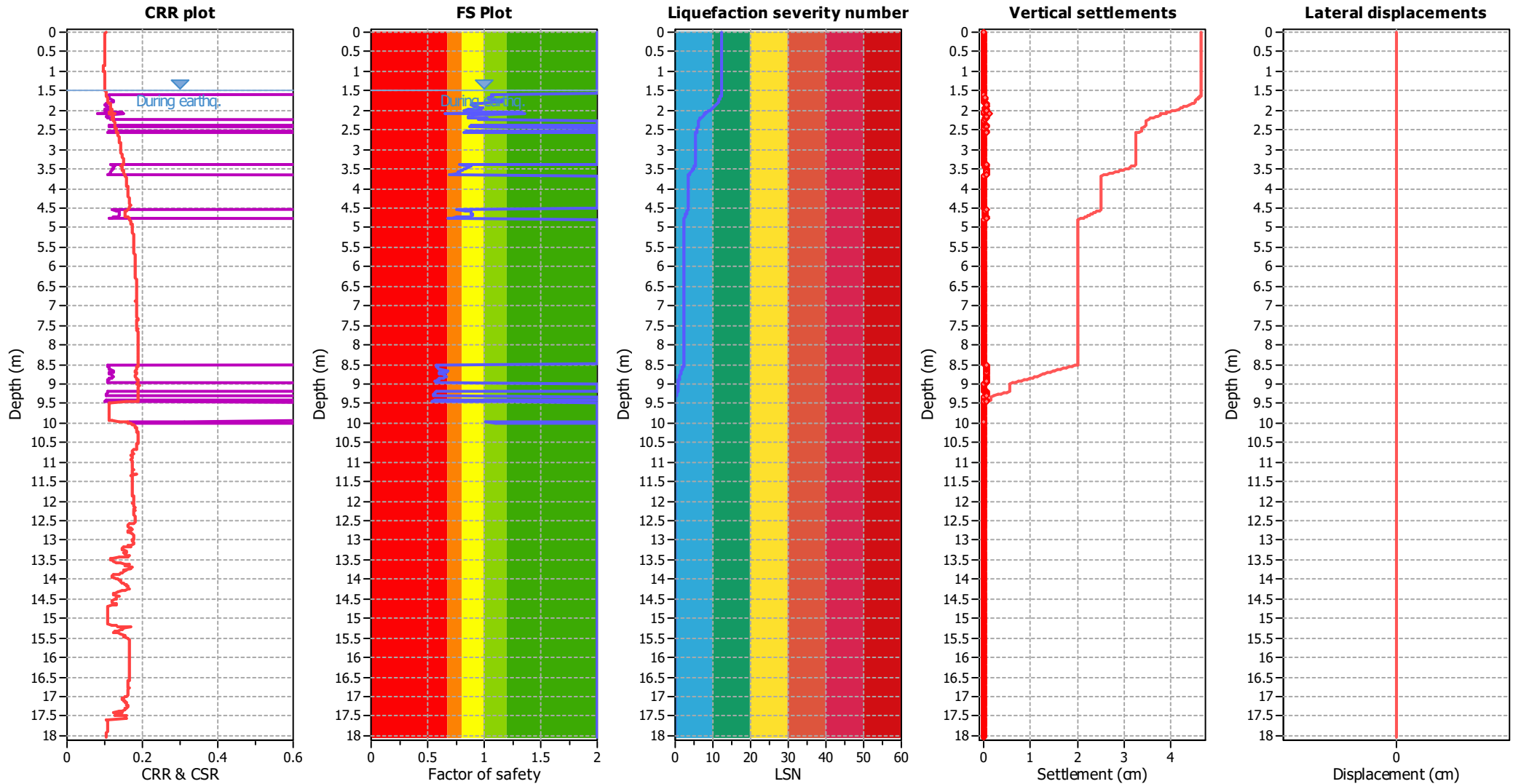
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- Moderate expression of liquefaction
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### Liquefaction analysis overall plots



**Input parameters and analysis data**

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.50 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_v$ applied:	Yes
Earthquake magnitude $M_w$ :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	10.00 m

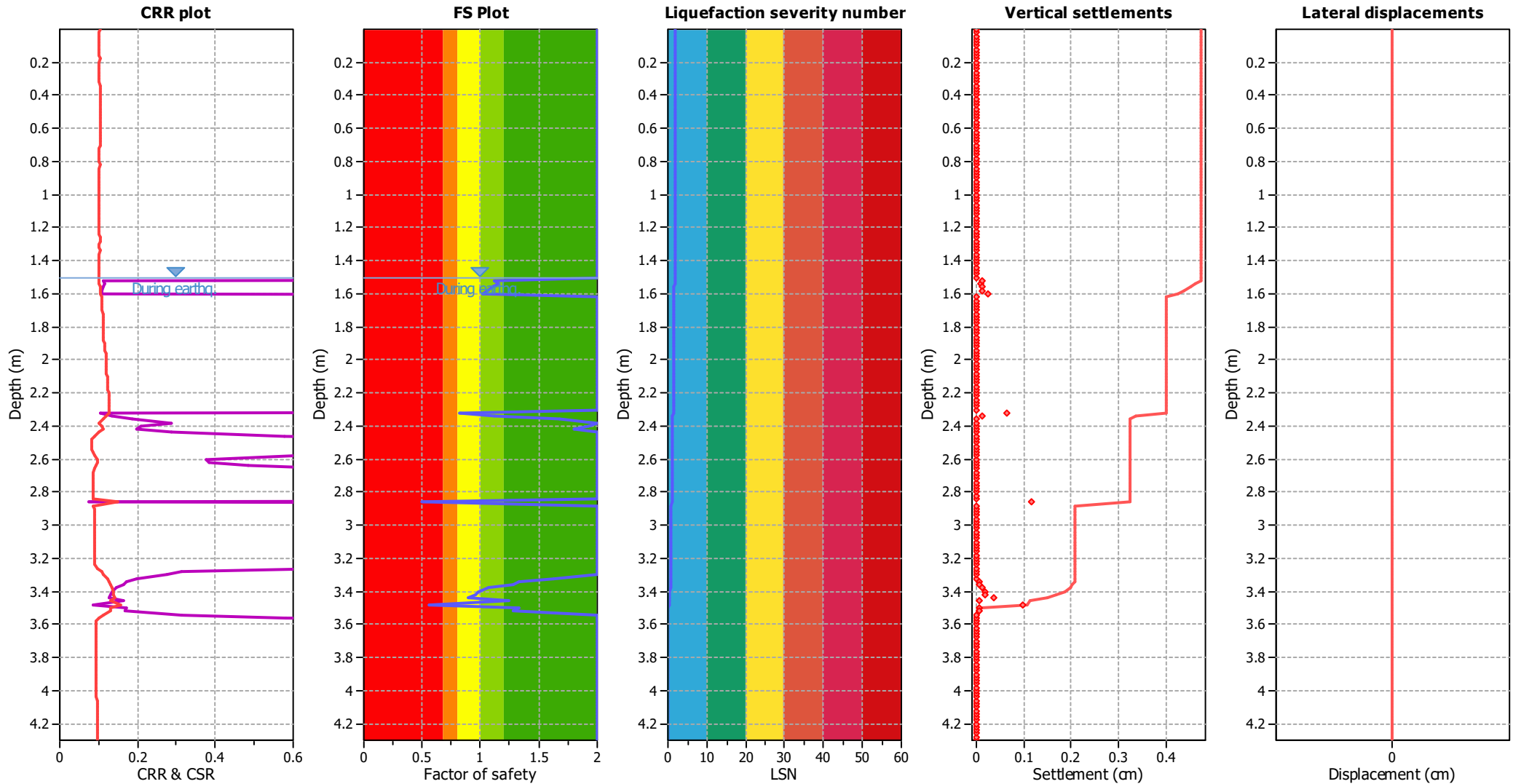
**F.S. color scheme**

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- Moderate expression of liquefaction
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### Liquefaction analysis overall plots



**Input parameters and analysis data**

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.50 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_v$ applied:	Yes
Earthquake magnitude $M_w$ :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	10.00 m

**F.S. color scheme**

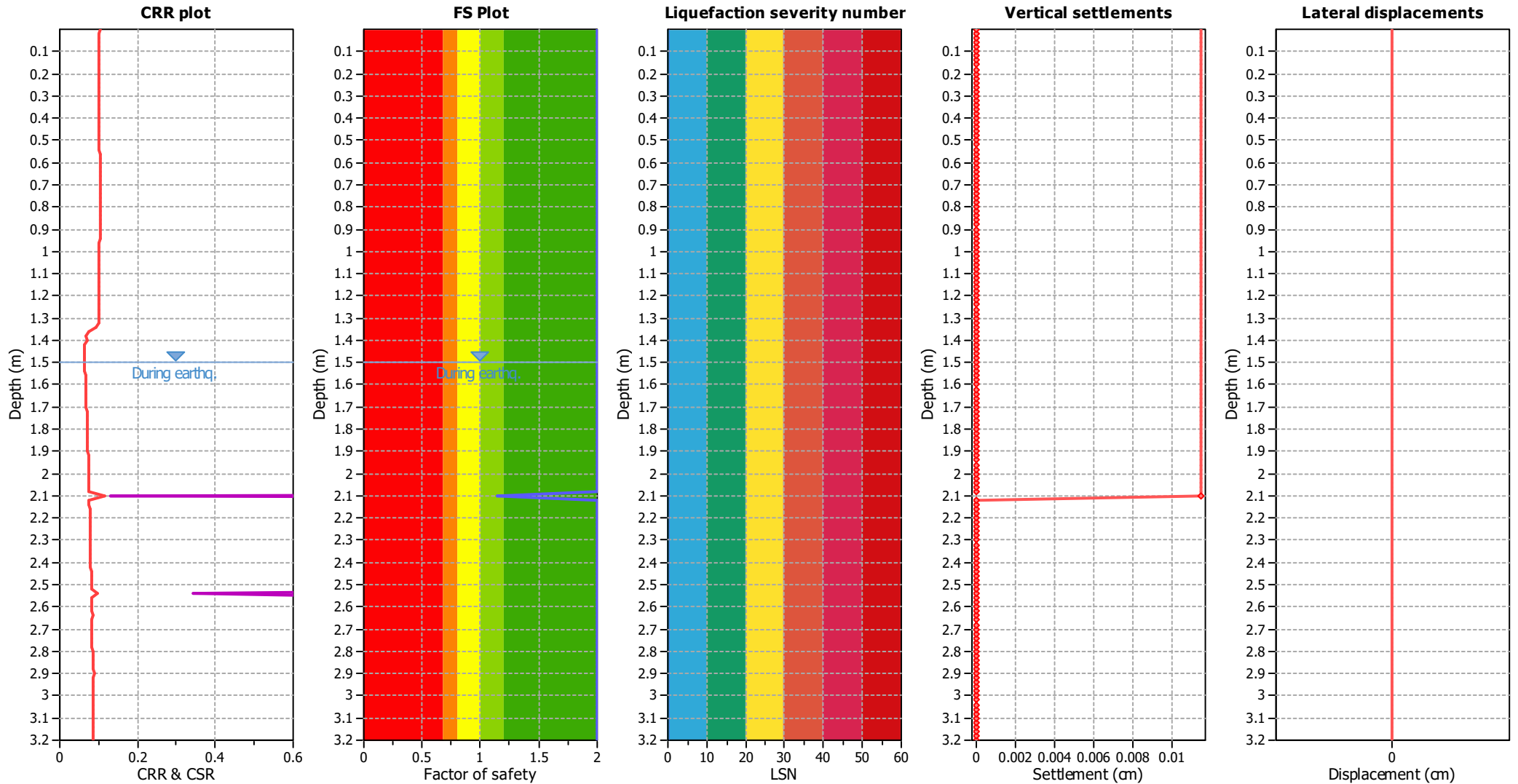
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### Liquefaction analysis overall plots



**Input parameters and analysis data**

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.50 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K <sub>0</sub> applied:	Yes
Earthquake magnitude M <sub>w</sub> :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	10.00 m

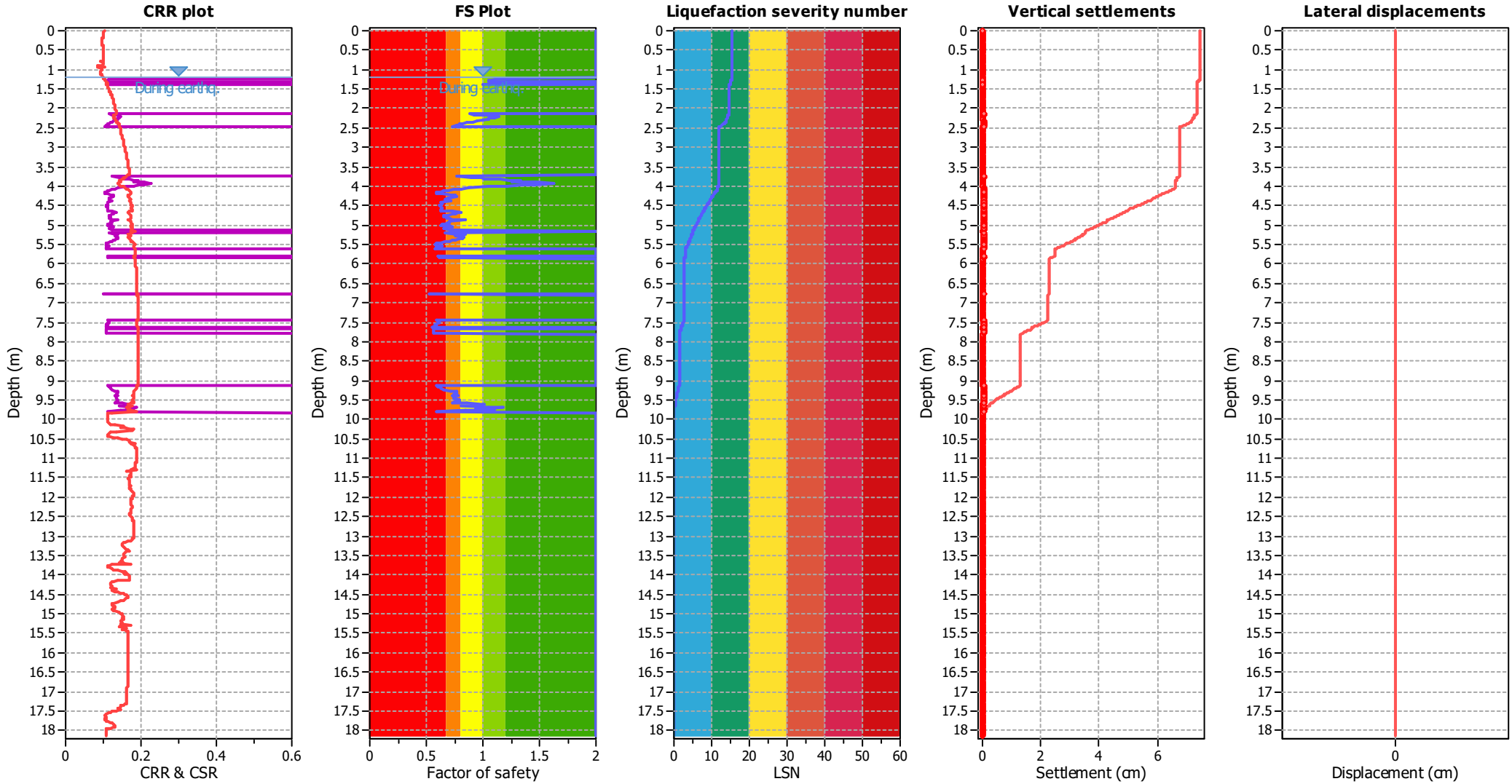
**F.S. color scheme**

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### Liquefaction analysis overall plots



#### Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.20 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_{\sigma}$ applied:	Yes
Earthquake magnitude $M_w$ :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.20 m	Fill height:	N/A	Limit depth:	10.00 m

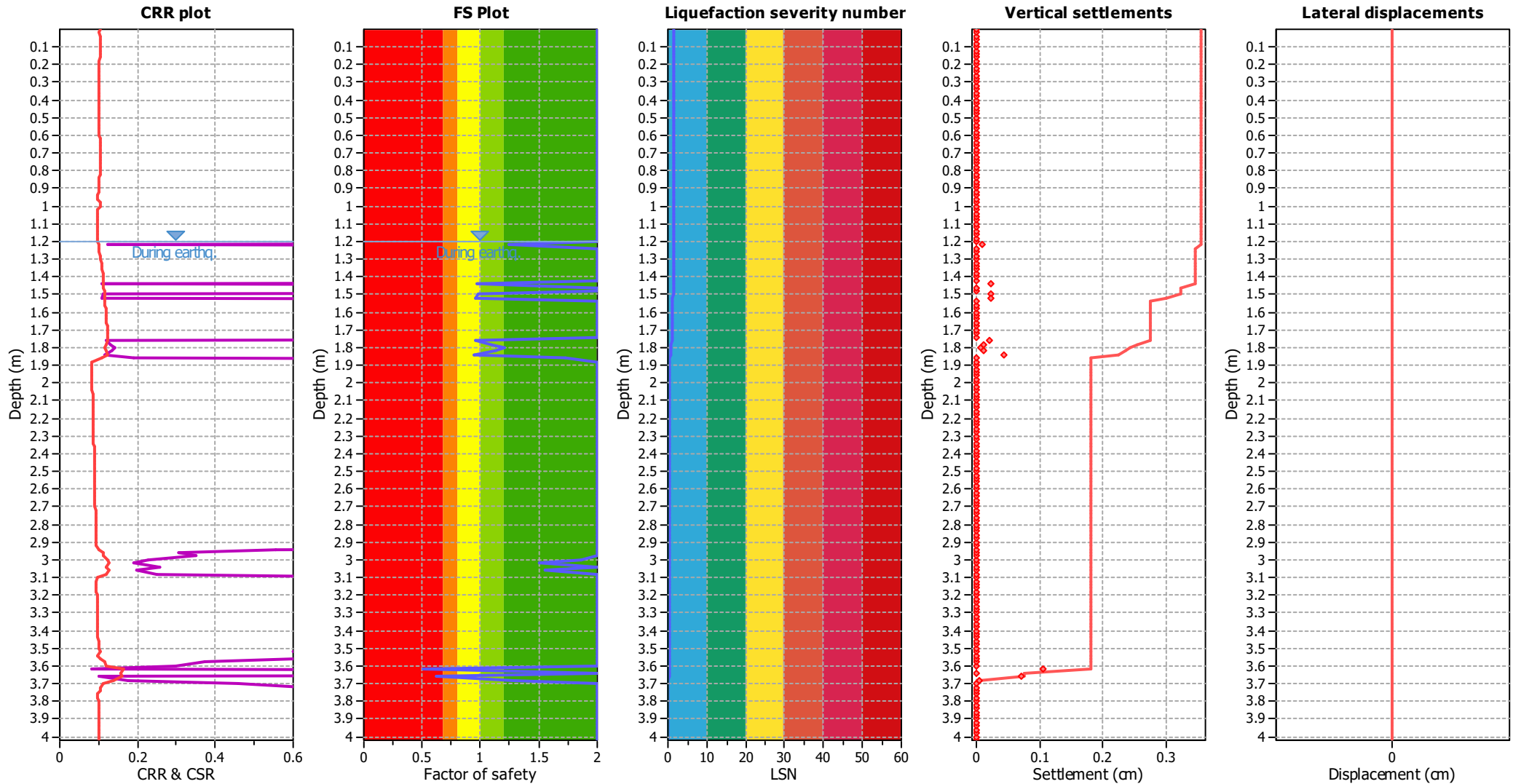
#### F.S. color scheme

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### Liquefaction analysis overall plots



**Input parameters and analysis data**

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.20 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_f$ applied:	Yes
Earthquake magnitude $M_w$ :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.20 m	Fill height:	N/A	Limit depth:	10.00 m

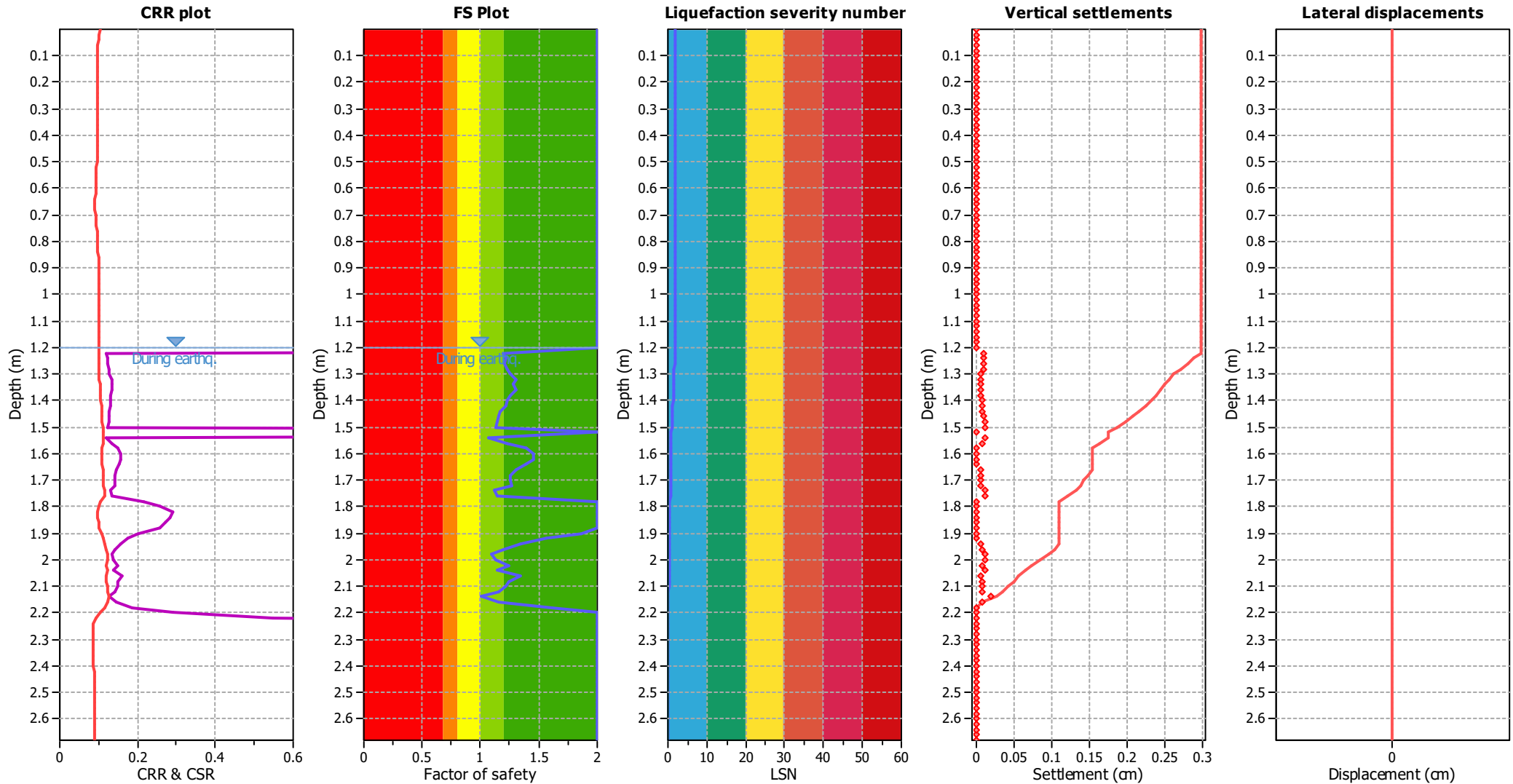
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### Liquefaction analysis overall plots



#### Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.20 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_f$ applied:	Yes
Earthquake magnitude $M_w$ :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.20 m	Fill height:	N/A	Limit depth:	10.00 m

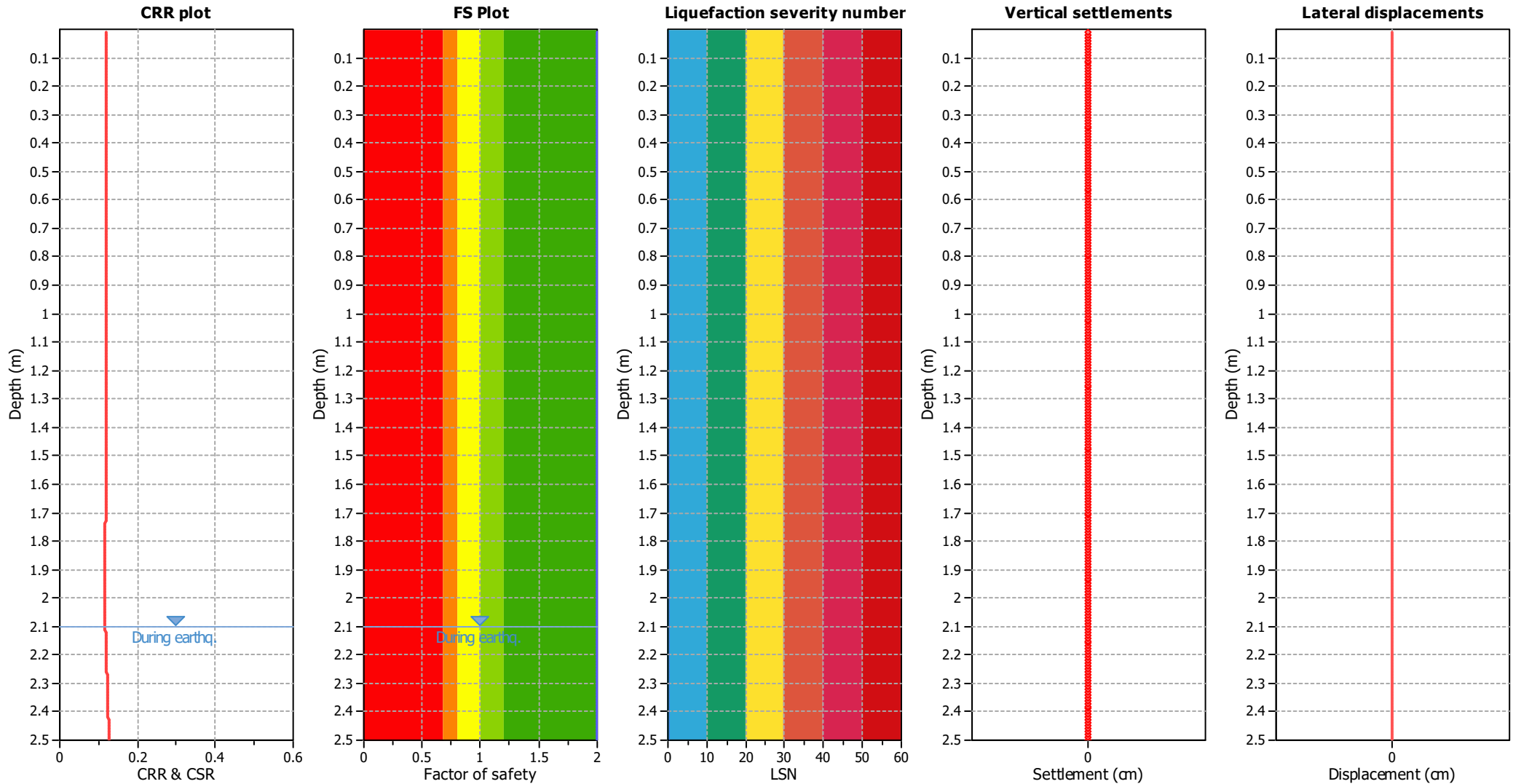
#### F.S. color scheme

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### Liquefaction analysis overall plots



**Input parameters and analysis data**

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.10 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_d$ applied:	Yes
Earthquake magnitude $M_w$ :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.20	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.10 m	Fill height:	N/A	Limit depth:	10.00 m

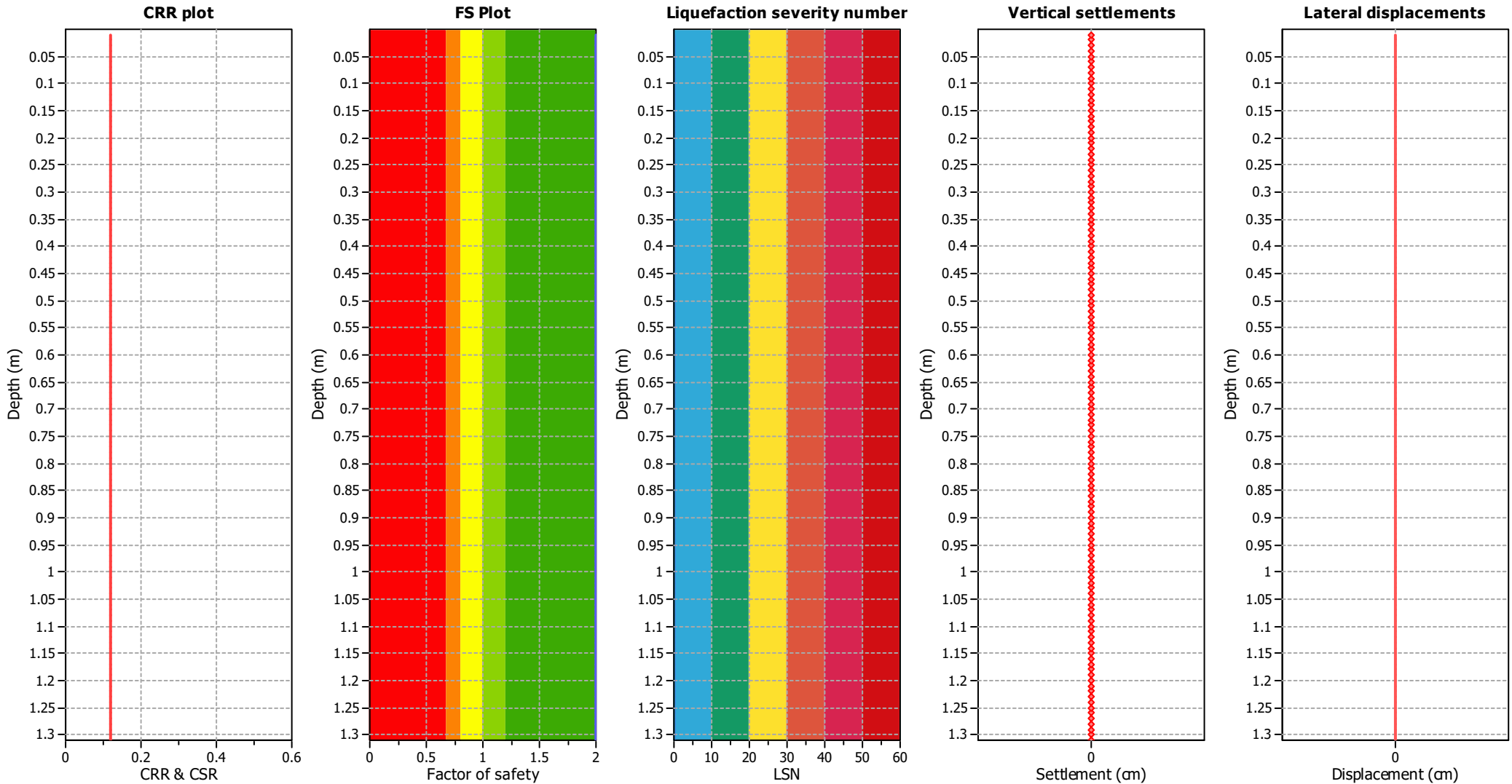
**F.S. color scheme**

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- Almost certain it will not liquefy

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- Moderate expression of liquefaction
- Minor expression of liquefaction
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### Liquefaction analysis overall plots



#### Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.10 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_{\sigma}$ applied:	Yes
Earthquake magnitude $M_w$ :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.20	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.10 m	Fill height:	N/A	Limit depth:	10.00 m

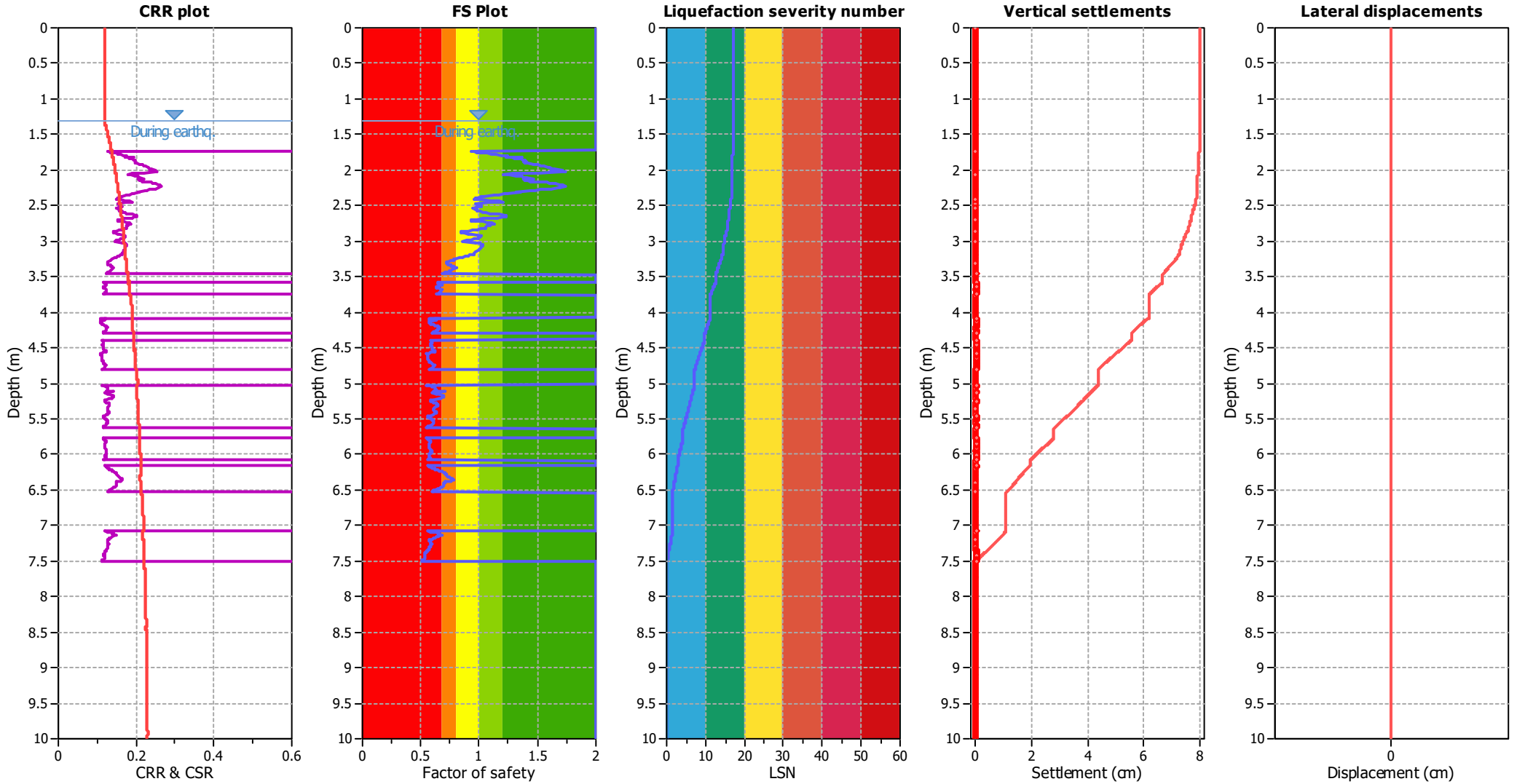
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### Liquefaction analysis overall plots



**Input parameters and analysis data**

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.30 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_d$ applied:	Yes
Earthquake magnitude $M_w$ :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.20	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.30 m	Fill height:	N/A	Limit depth:	10.00 m

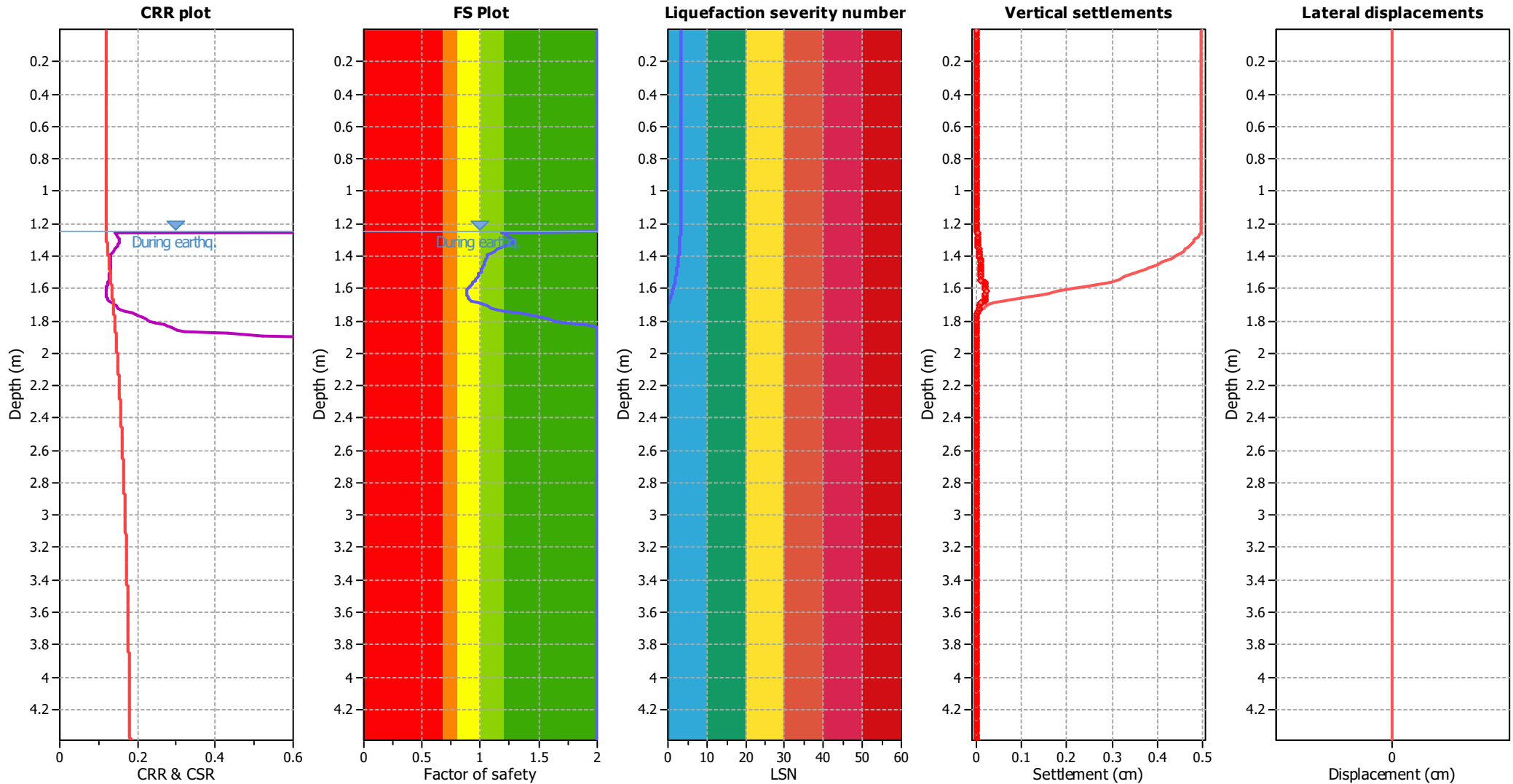
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- Moderate expression of liquefaction
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### Liquefaction analysis overall plots



#### Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.25 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_f$ applied:	Yes
Earthquake magnitude $M_w$ :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.20	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.25 m	Fill height:	N/A	Limit depth:	10.00 m

#### F.S. color scheme

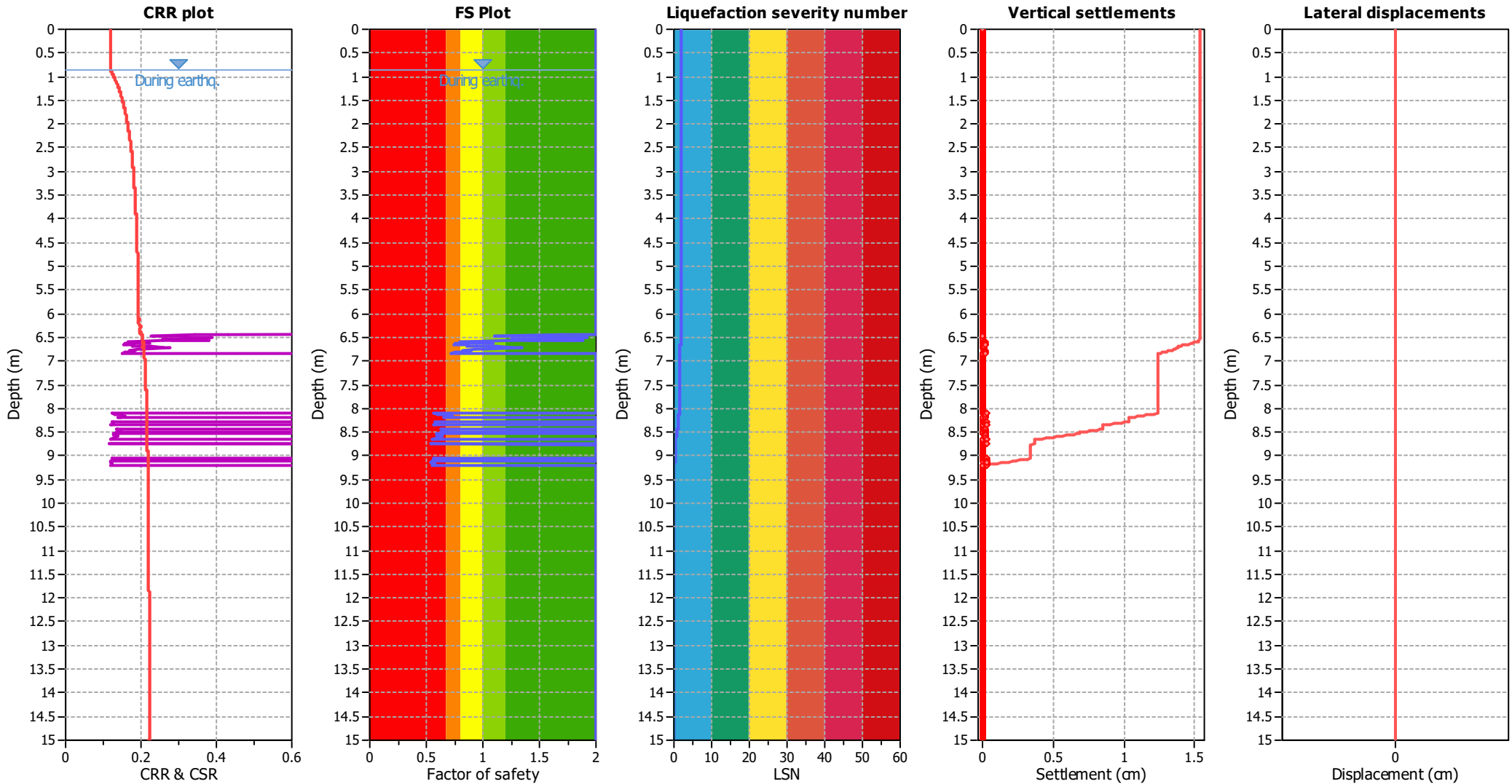
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
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- Almost certain it will not liquefy

#### LSN color scheme

- Severe damage
- Major expression of liquefaction
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- Minor expression of liquefaction
- Little to no expression of liquefaction



### Liquefaction analysis overall plots



#### Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	0.85 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_f$ applied:	Yes
Earthquake magnitude $M_w$ :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.20	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	0.85 m	Fill height:	N/A	Limit depth:	10.00 m

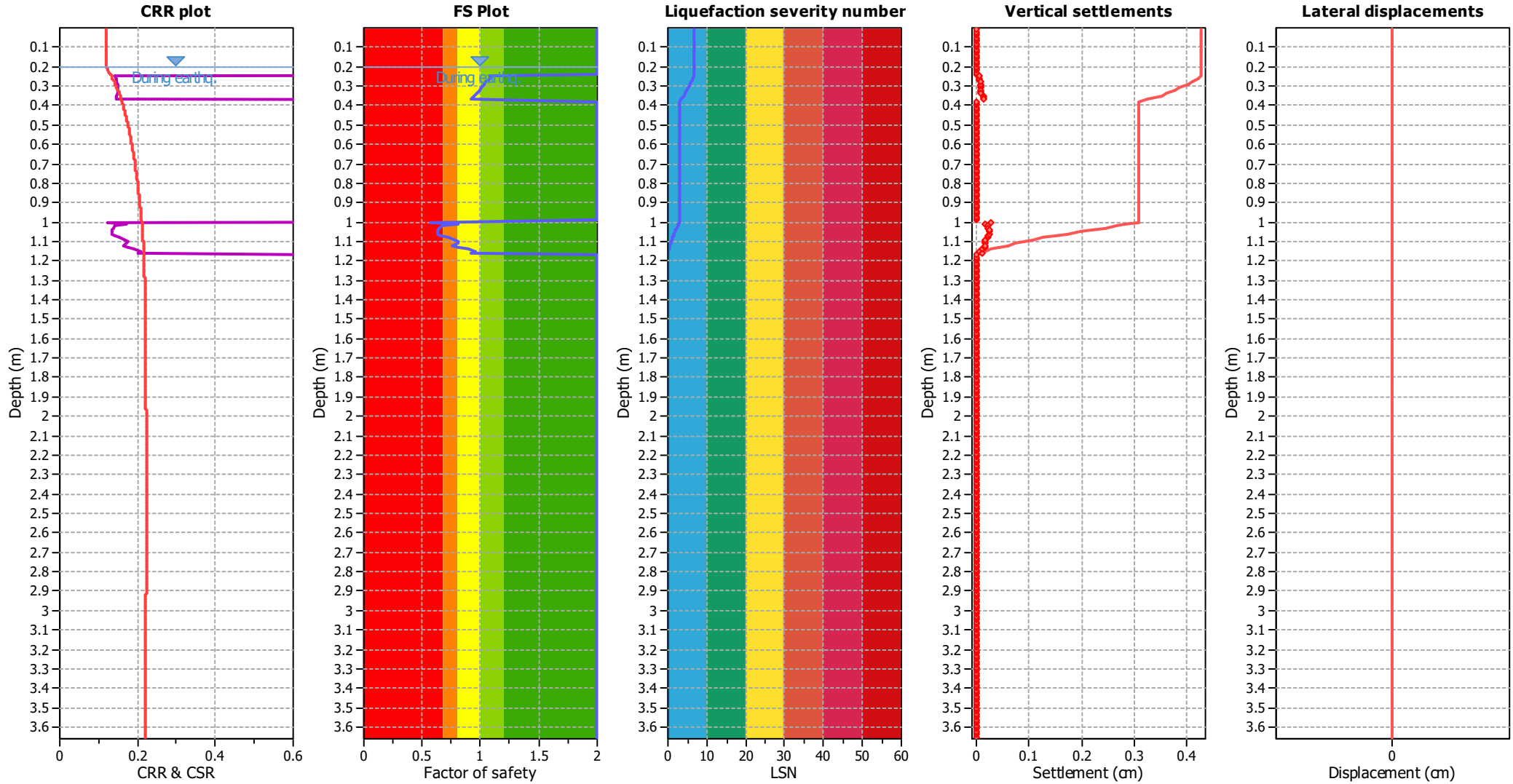
#### F.S. color scheme

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### Liquefaction analysis overall plots



**Input parameters and analysis data**

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	0.20 m
Fines correction method:	B&I (2014)	Average results interval:	3
Points to test:	Based on Ic value	Ic cut-off value:	2.60
Earthquake magnitude $M_w$ :	7.50	Unit weight calculation:	Based on SBT
Peak ground acceleration:	0.20	Use fill:	No
Depth to water table (insitu):	0.20 m	Fill height:	N/A

Fill weight:	N/A
Transition detect. applied:	No
$K_v$ applied:	Yes
Clay like behavior applied:	Sands only
Limit depth applied:	Yes
Limit depth:	10.00 m

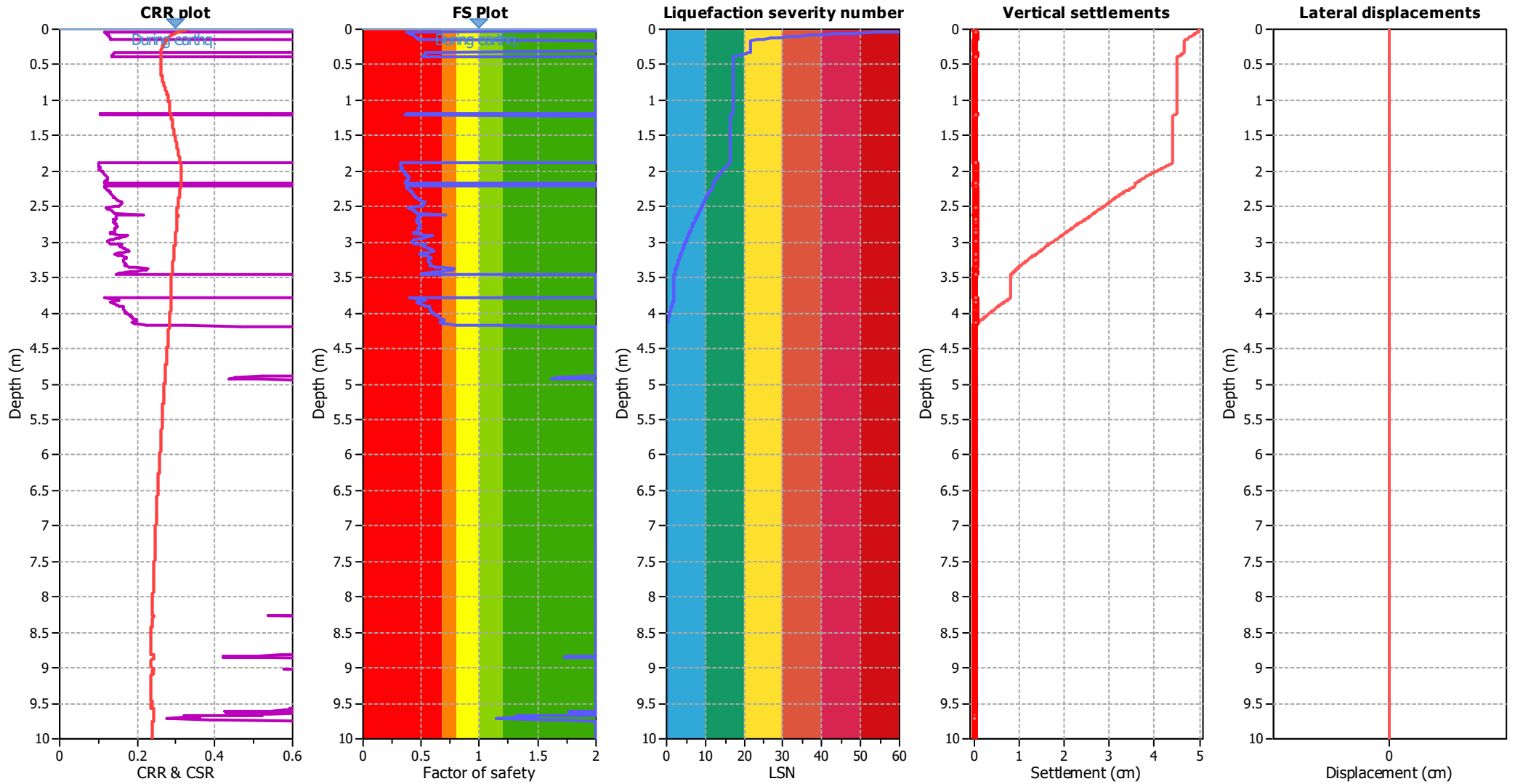
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### Liquefaction analysis overall plots



#### Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	0.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_f$ applied:	Yes
Earthquake magnitude $M_w$ :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.20	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	0.00 m	Fill height:	N/A	Limit depth:	10.00 m

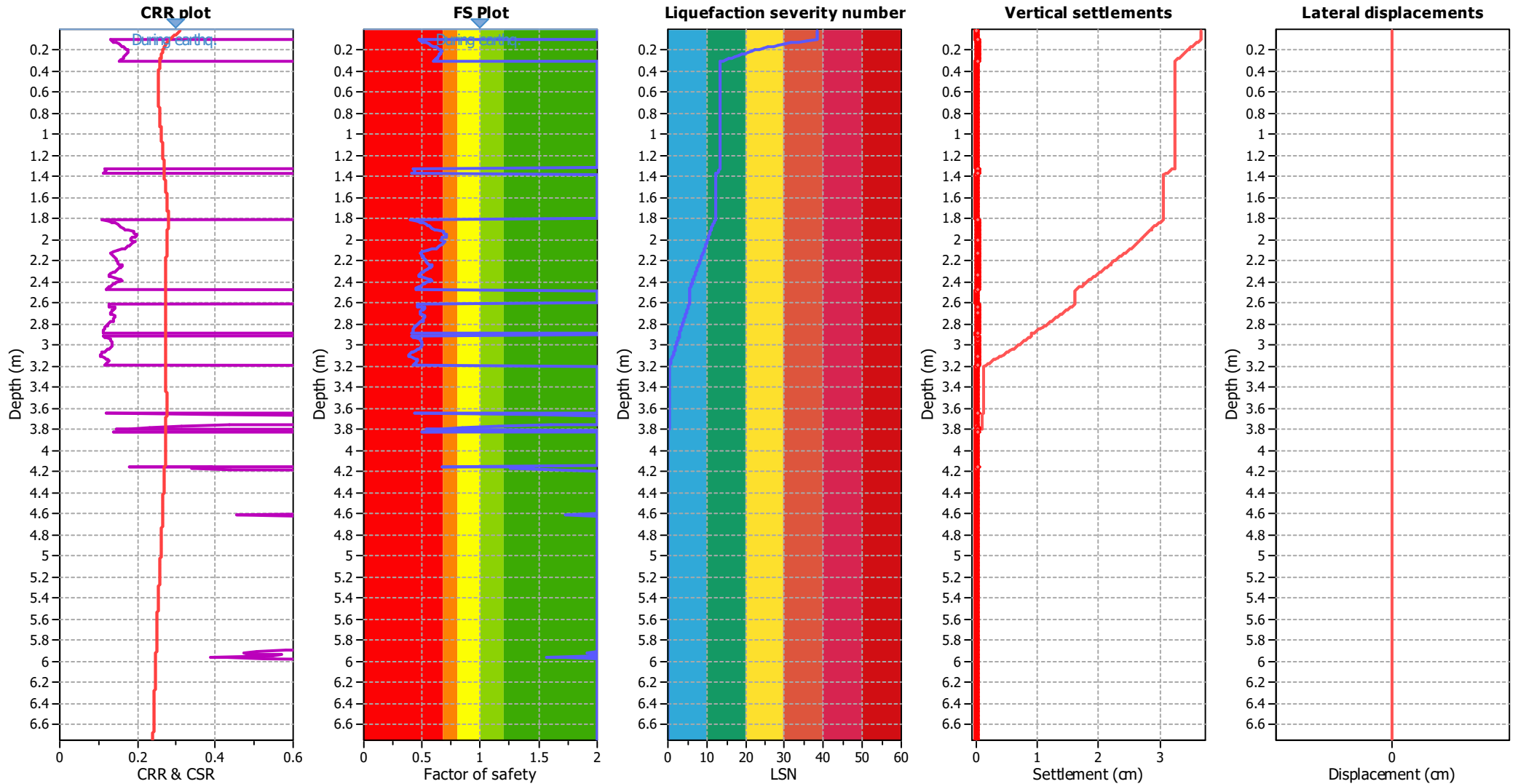
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### Liquefaction analysis overall plots



#### Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	0.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_d$ applied:	Yes
Earthquake magnitude $M_w$ :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.20	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	0.00 m	Fill height:	N/A	Limit depth:	10.00 m

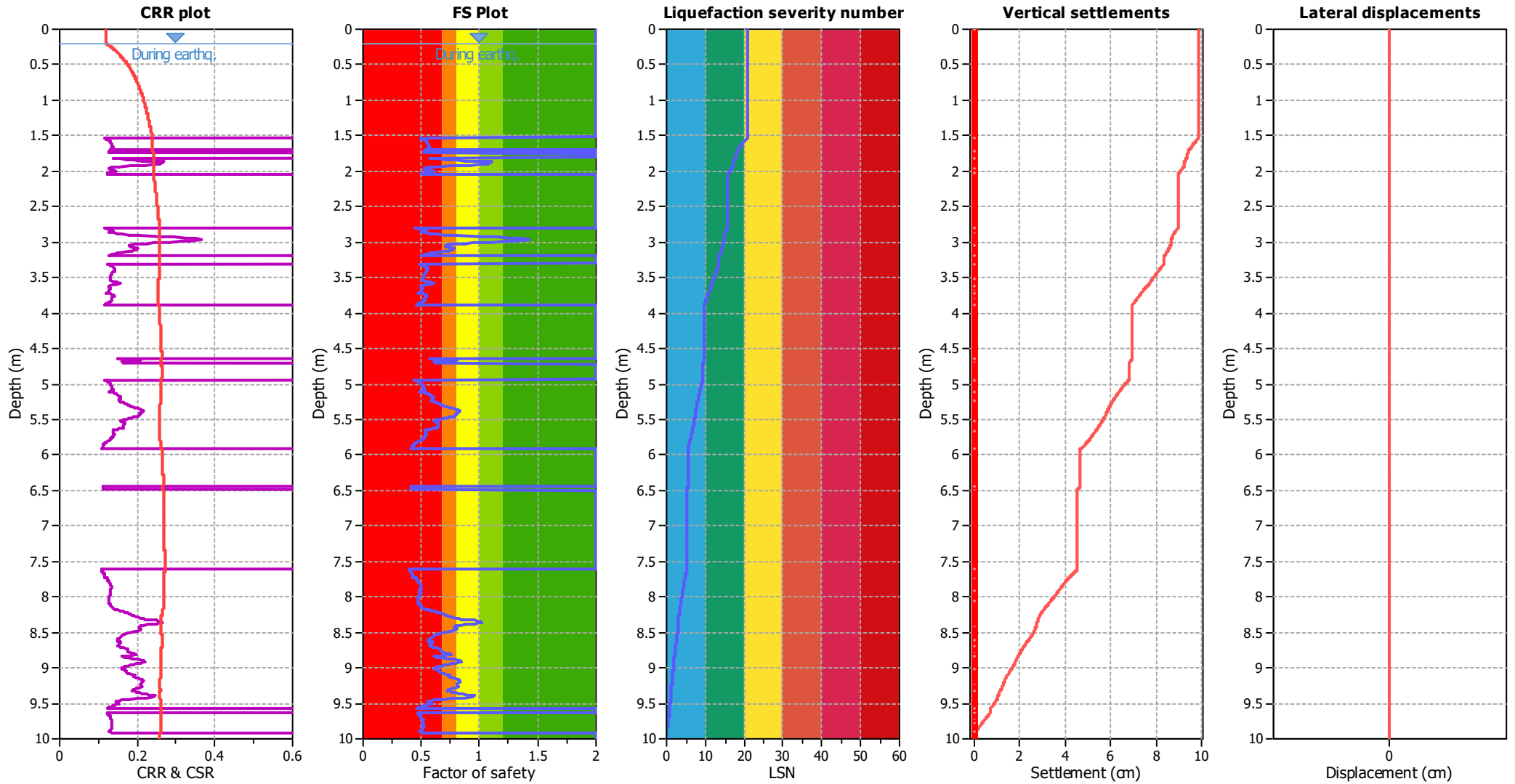
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### Liquefaction analysis overall plots



**Input parameters and analysis data**

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	0.20 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_d$ applied:	Yes
Earthquake magnitude $M_w$ :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.20	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	0.20 m	Fill height:	N/A	Limit depth:	10.00 m

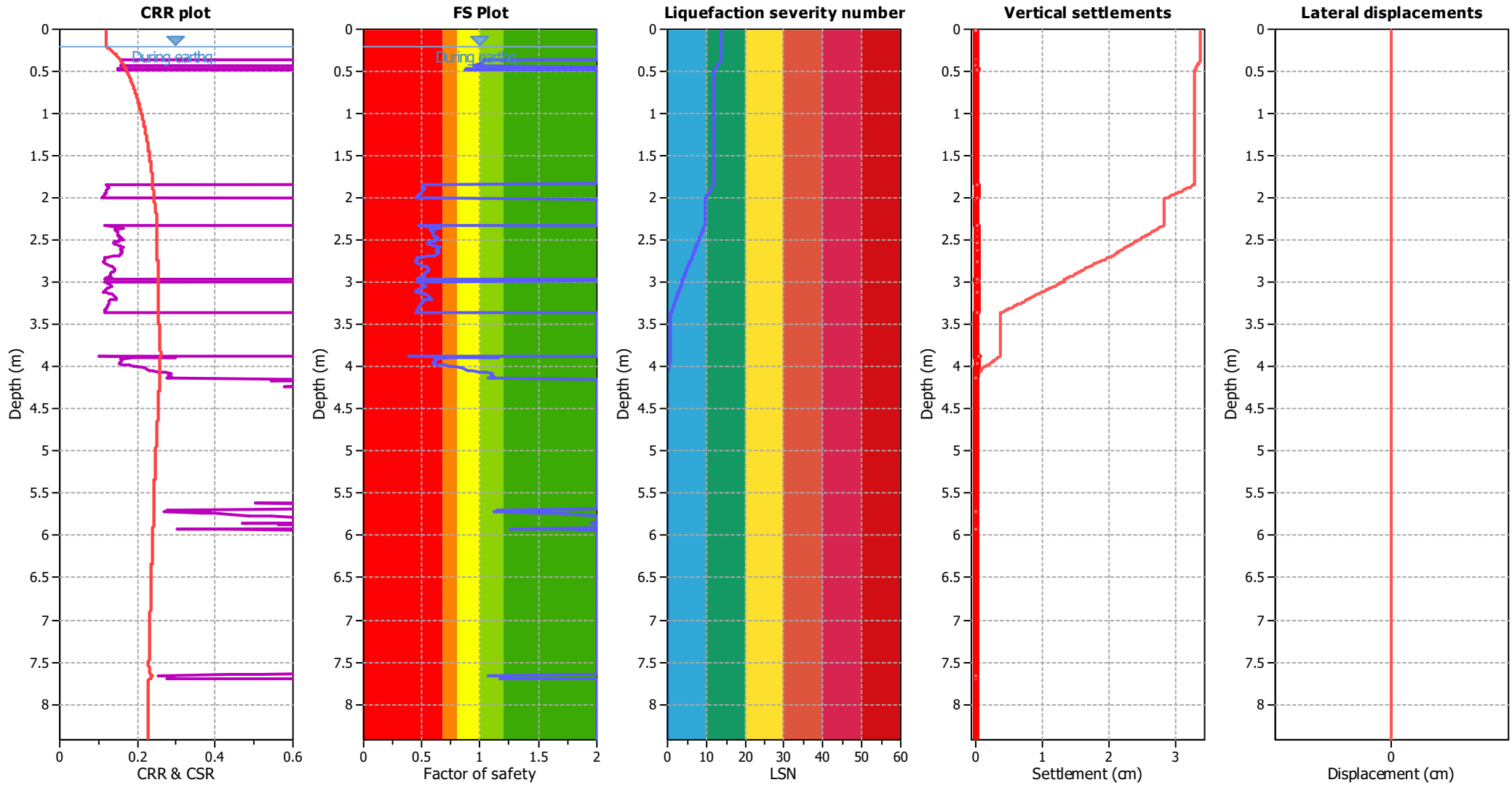
**F.S. color scheme**

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

**LSN color scheme**

- Severe damage
- Major expression of liquefaction
- Moderate to severe exp. of liquefaction
- Moderate expression of liquefaction
- Minor expression of liquefaction
- Little to no expression of liquefaction

### Liquefaction analysis overall plots



#### Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	0.20 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_v$ applied:	Yes
Earthquake magnitude $M_w$ :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.20	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	0.20 m	Fill height:	N/A	Limit depth:	10.00 m

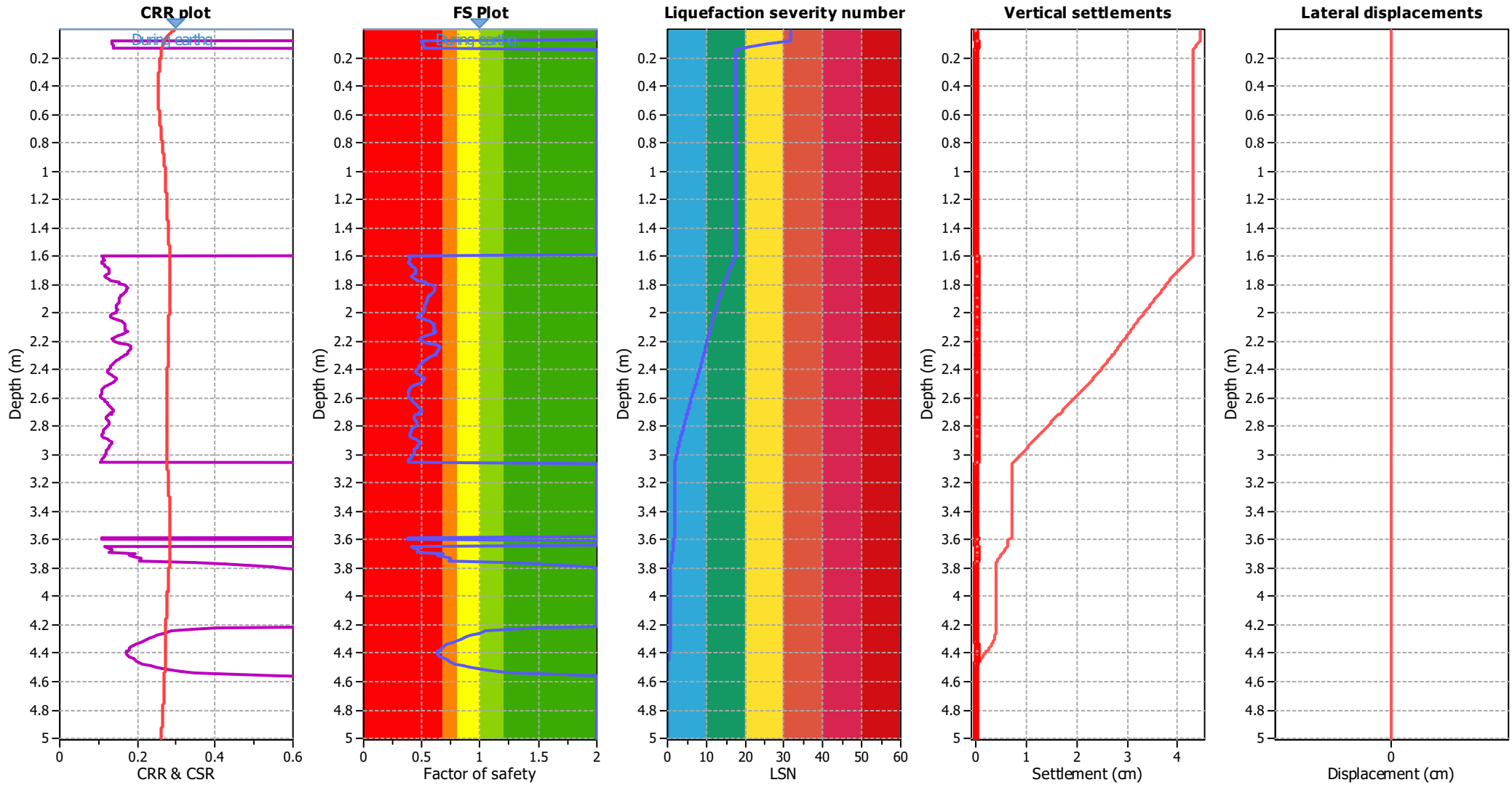
#### F.S. color scheme

<span style="color: red;">■</span>	Almost certain it will liquefy
<span style="color: orange;">■</span>	Very likely to liquefy
<span style="color: yellow;">■</span>	Liquefaction and no liq. are equally likely
<span style="color: lightgreen;">■</span>	Unlike to liquefy
<span style="color: green;">■</span>	Almost certain it will not liquefy

#### LSN color scheme

<span style="color: red;">■</span>	Severe damage
<span style="color: pink;">■</span>	Major expression of liquefaction
<span style="color: orange;">■</span>	Moderate to severe exp. of liquefaction
<span style="color: yellow;">■</span>	Moderate expression of liquefaction
<span style="color: lightgreen;">■</span>	Minor expression of liquefaction
<span style="color: blue;">■</span>	Little to no expression of liquefaction

### Liquefaction analysis overall plots



**Input parameters and analysis data**

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	0.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_f$ applied:	Yes
Earthquake magnitude $M_w$ :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.20	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	0.00 m	Fill height:	N/A	Limit depth:	10.00 m

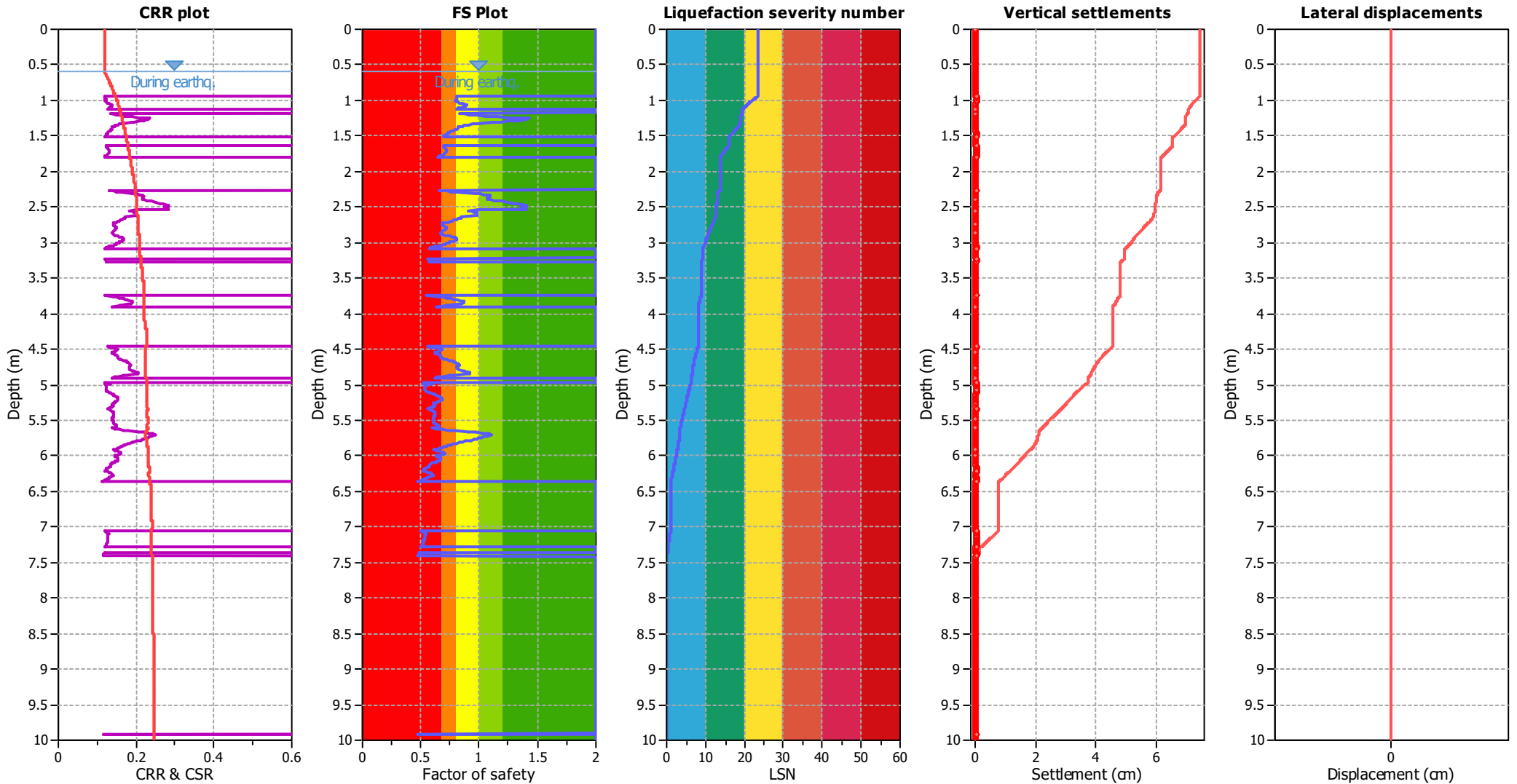
**F.S. color scheme**

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

**LSN color scheme**

- Severe damage
- Major expression of liquefaction
- Moderate to severe exp. of liquefaction
- Moderate expression of liquefaction
- Minor expression of liquefaction
- Little to no expression of liquefaction

### Liquefaction analysis overall plots



#### Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (earthq.):	0.60 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_d$ applied:	Yes
Earthquake magnitude $M_w$ :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.20	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	0.60 m	Fill height:	N/A	Limit depth:	10.00 m

#### F.S. color scheme

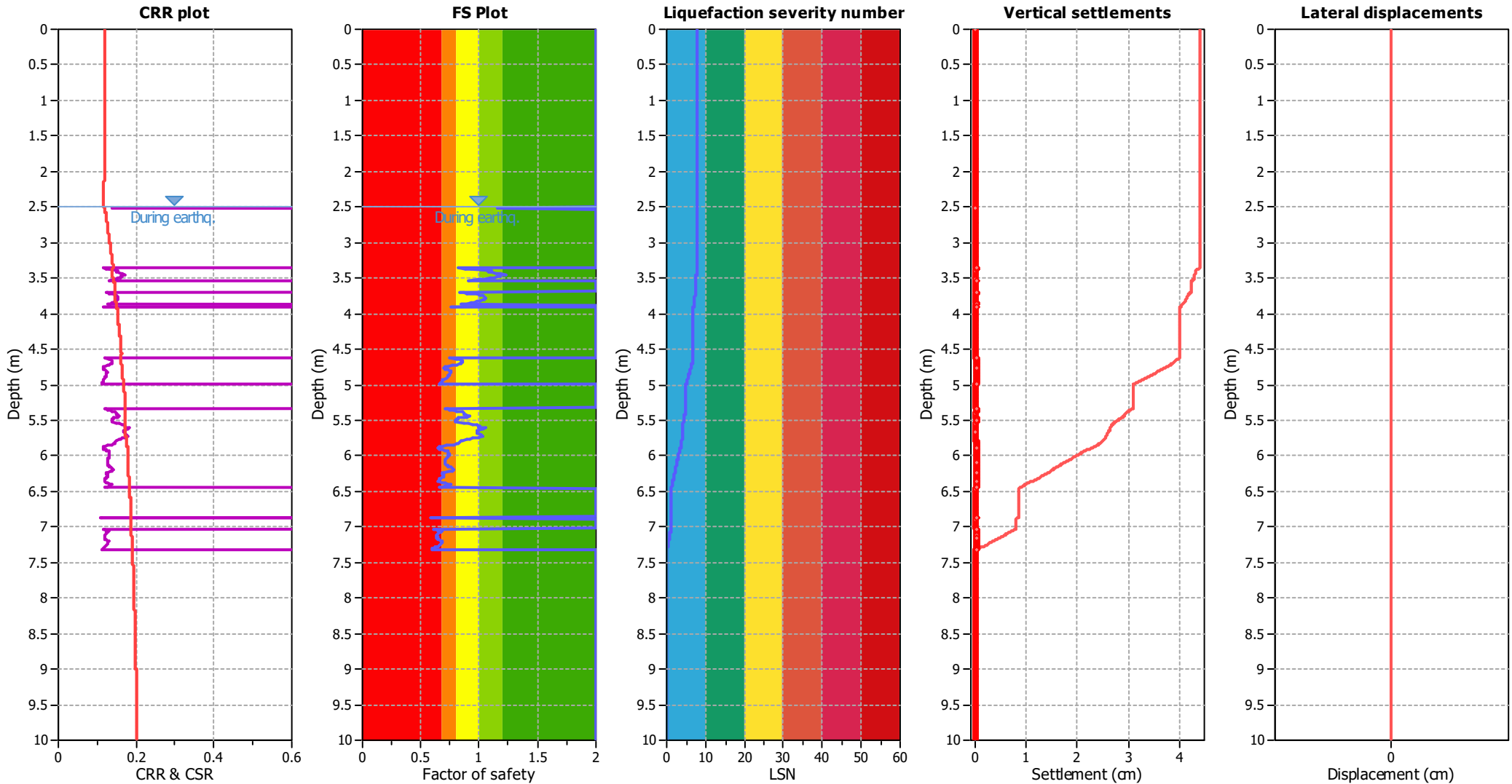
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

#### LSN color scheme

- Severe damage
- Major expression of liquefaction
- Moderate to severe exp. of liquefaction
- Moderate expression of liquefaction
- Minor expression of liquefaction
- Little to no expression of liquefaction



### Liquefaction analysis overall plots



**Input parameters and analysis data**

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.50 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_{\sigma}$ applied:	Yes
Earthquake magnitude $M_w$ :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.20	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.50 m	Fill height:	N/A	Limit depth:	10.00 m

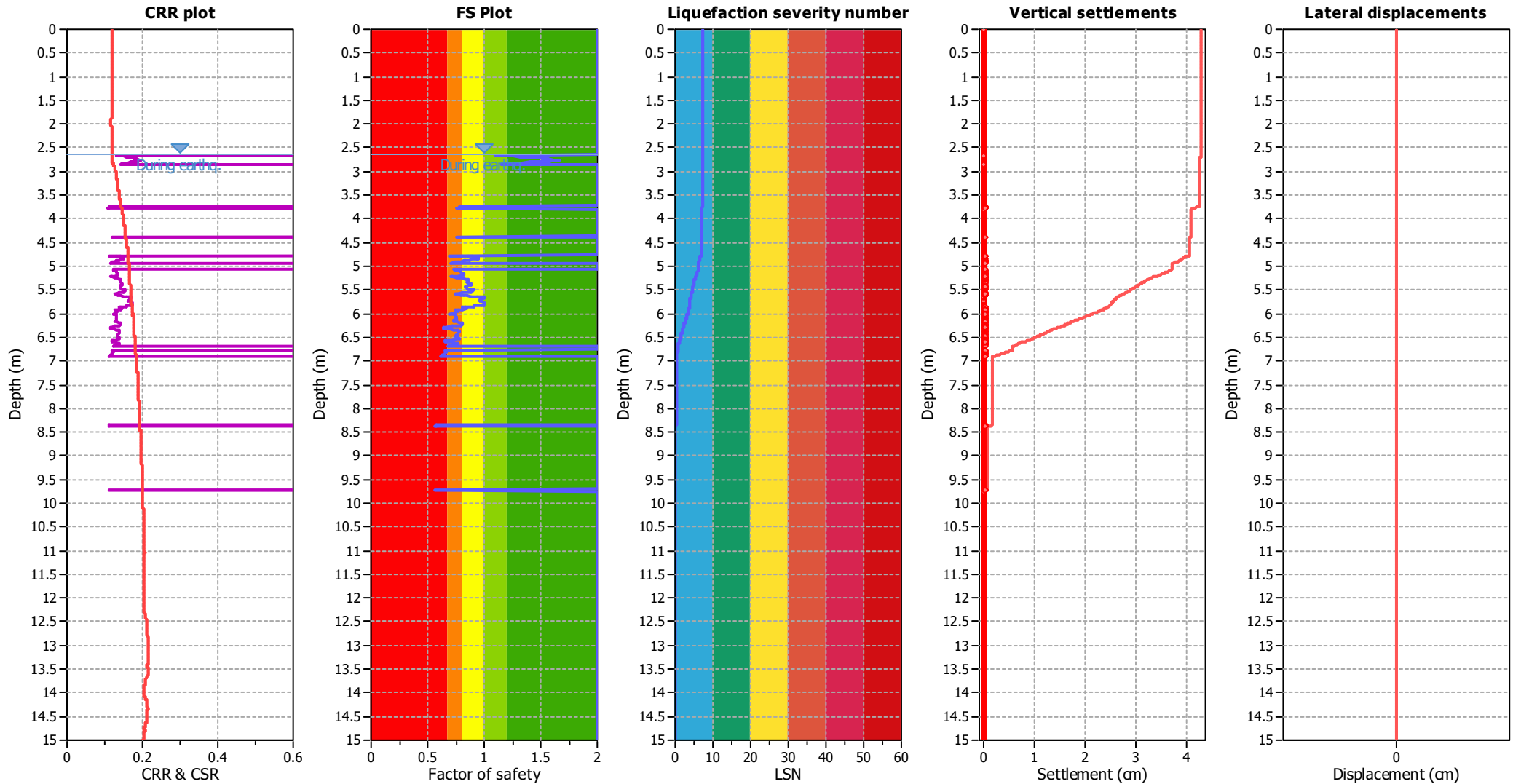
**F.S. color scheme**

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

**LSN color scheme**

- Severe damage
- Major expression of liquefaction
- Moderate to severe exp. of liquefaction
- Moderate expression of liquefaction
- Minor expression of liquefaction
- Little to no expression of liquefaction

### Liquefaction analysis overall plots



#### Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.65 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_f$ applied:	Yes
Earthquake magnitude $M_w$ :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.20	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.65 m	Fill height:	N/A	Limit depth:	10.00 m

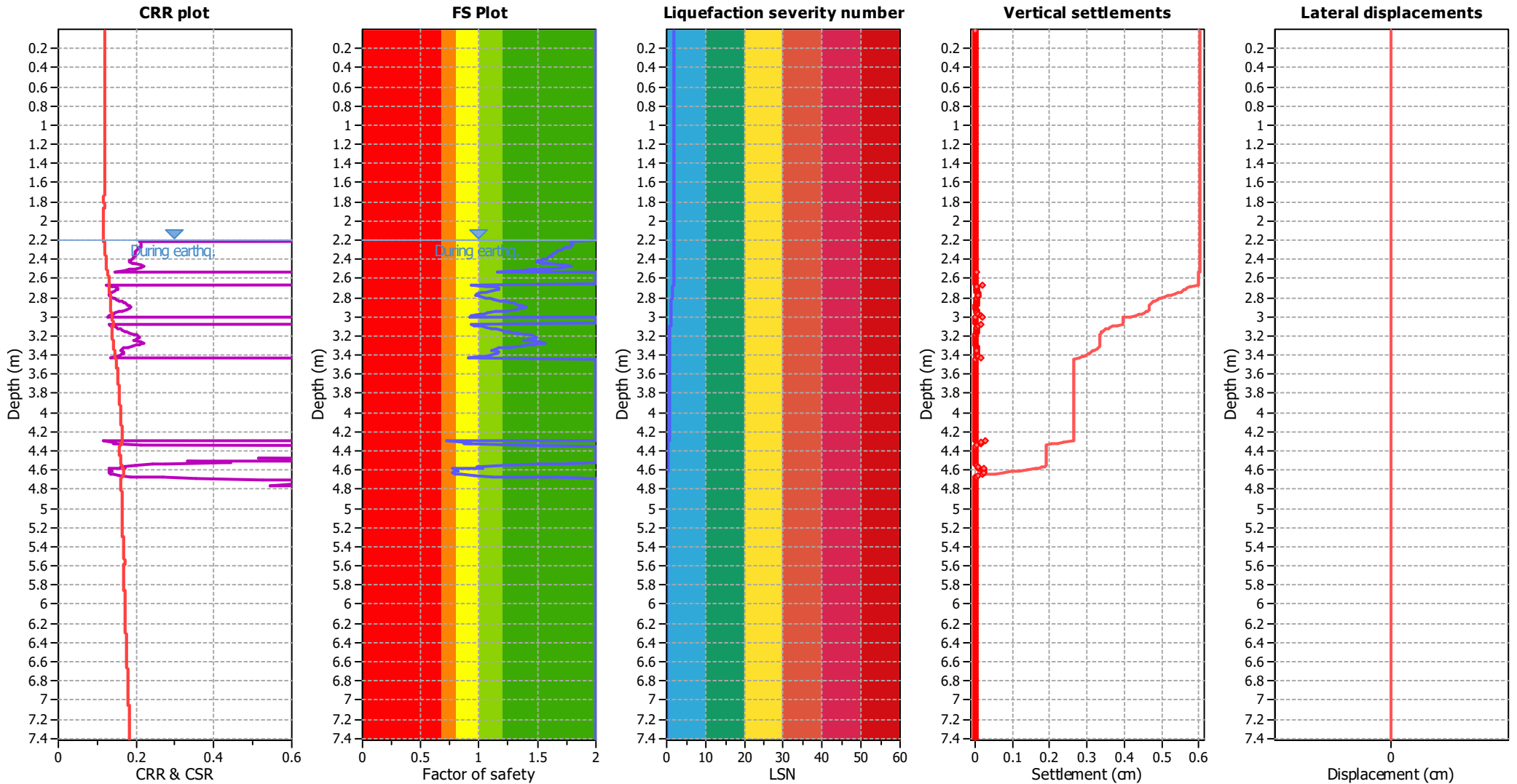
#### F.S. color scheme

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

#### LSN color scheme

- Severe damage
- Major expression of liquefaction
- Moderate to severe exp. of liquefaction
- Moderate expression of liquefaction
- Minor expression of liquefaction
- Little to no expression of liquefaction

### Liquefaction analysis overall plots



**Input parameters and analysis data**

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.20 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K <sub>v</sub> applied:	Yes
Earthquake magnitude M <sub>w</sub> :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.20	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.20 m	Fill height:	N/A	Limit depth:	10.00 m

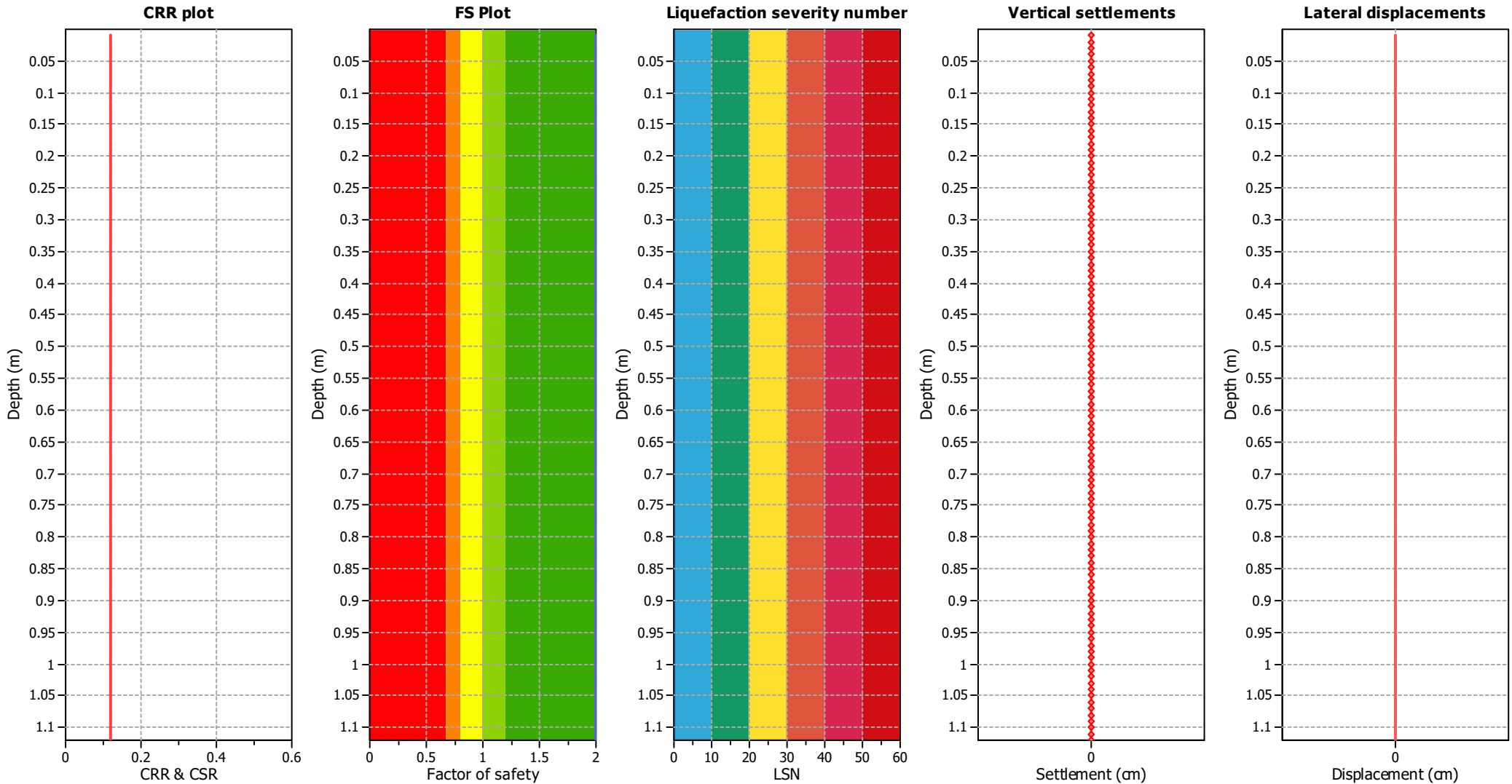
**F.S. color scheme**

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

**LSN color scheme**

- Severe damage
- Major expression of liquefaction
- Moderate to severe exp. of liquefaction
- Moderate expression of liquefaction
- Minor expression of liquefaction
- Little to no expression of liquefaction

### Liquefaction analysis overall plots



#### Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_{\sigma}$ applied:	Yes
Earthquake magnitude $M_w$ :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.20	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.00 m	Fill height:	N/A	Limit depth:	10.00 m

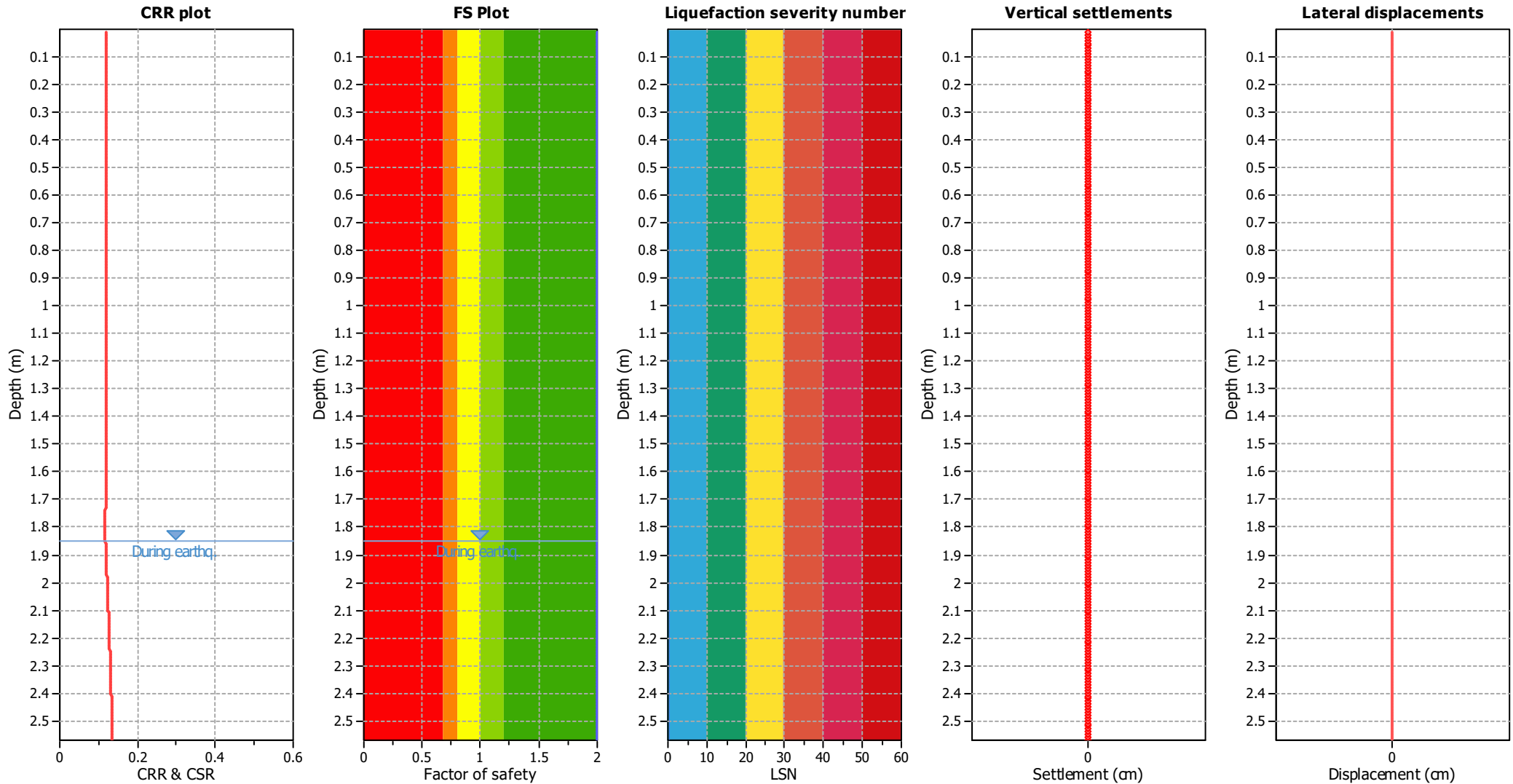
#### F.S. color scheme

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

#### LSN color scheme

- Severe damage
- Major expression of liquefaction
- Moderate to severe exp. of liquefaction
- Moderate expression of liquefaction
- Minor expression of liquefaction
- Little to no expression of liquefaction

### Liquefaction analysis overall plots



#### Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (earthq.):	1.85 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_f$ applied:	Yes
Earthquake magnitude $M_w$ :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.20	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.85 m	Fill height:	N/A	Limit depth:	10.00 m

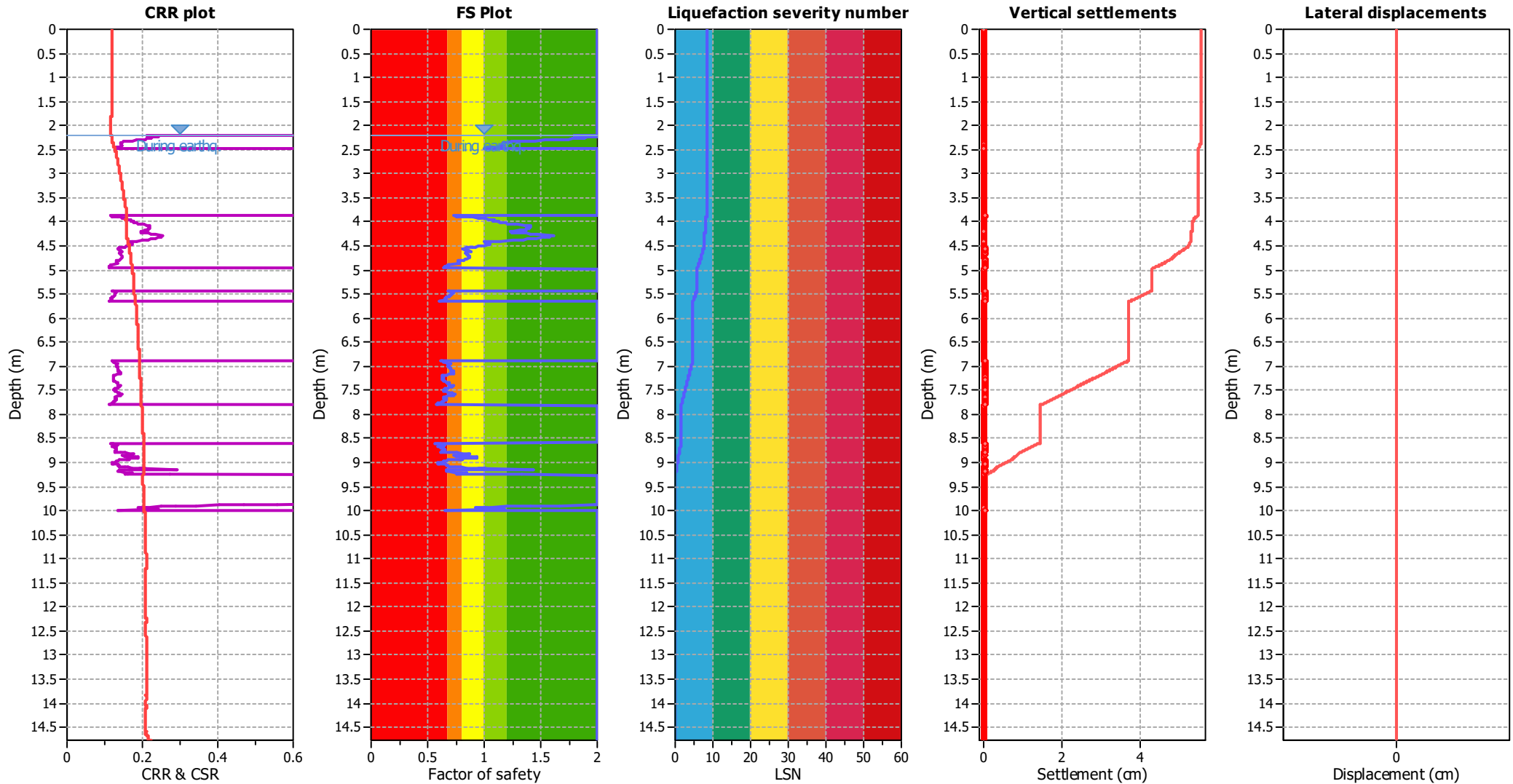
#### F.S. color scheme

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

#### LSN color scheme

- Severe damage
- Major expression of liquefaction
- Moderate to severe exp. of liquefaction
- Moderate expression of liquefaction
- Minor expression of liquefaction
- Little to no expression of liquefaction

### Liquefaction analysis overall plots



**Input parameters and analysis data**

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.20 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_v$ applied:	Yes
Earthquake magnitude $M_w$ :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.20	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.20 m	Fill height:	N/A	Limit depth:	10.00 m

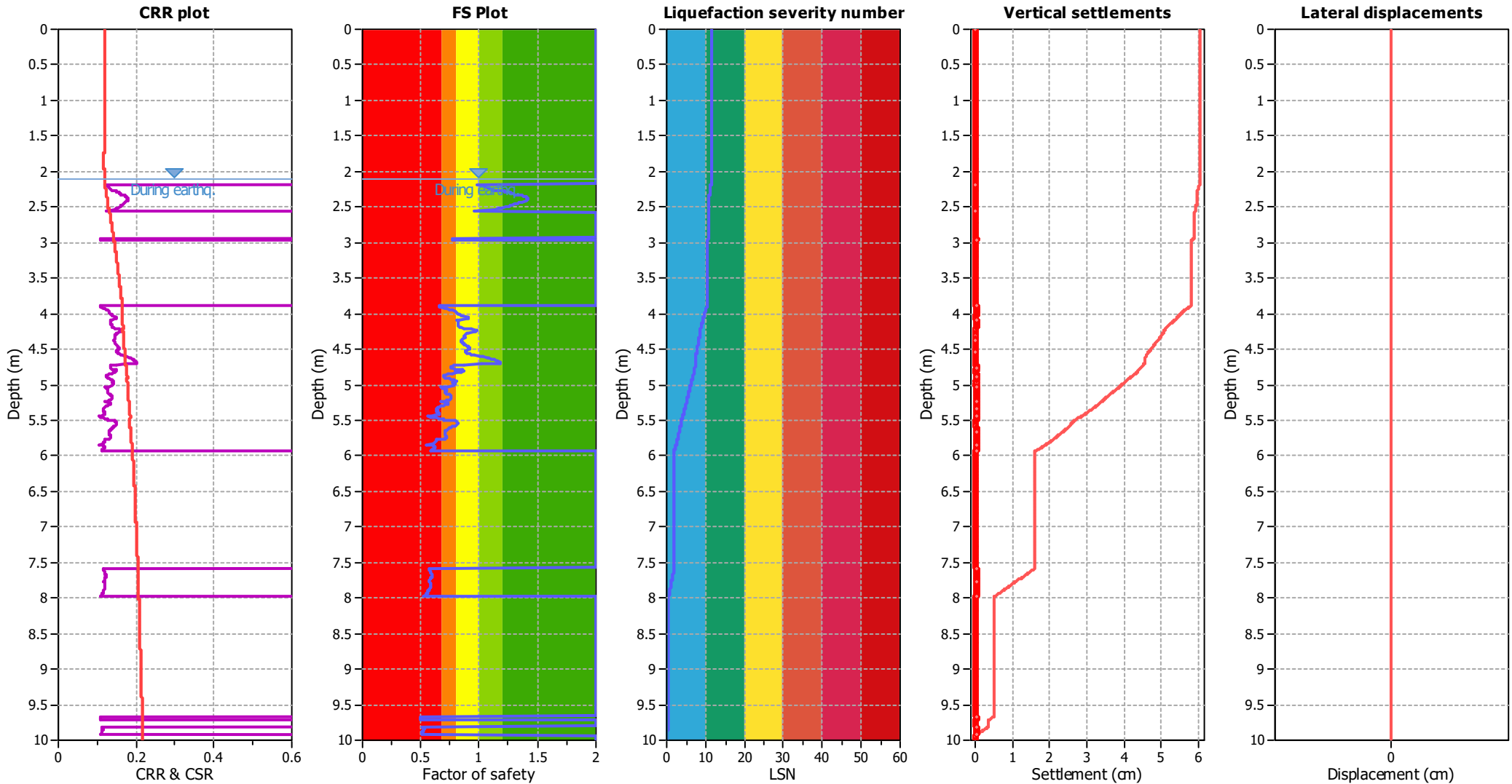
**F.S. color scheme**

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

**LSN color scheme**

- Severe damage
- Major expression of liquefaction
- Moderate to severe exp. of liquefaction
- Moderate expression of liquefaction
- Minor expression of liquefaction
- Little to no expression of liquefaction

### Liquefaction analysis overall plots



#### Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.10 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_f$ applied:	Yes
Earthquake magnitude $M_w$ :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.20	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.10 m	Fill height:	N/A	Limit depth:	10.00 m

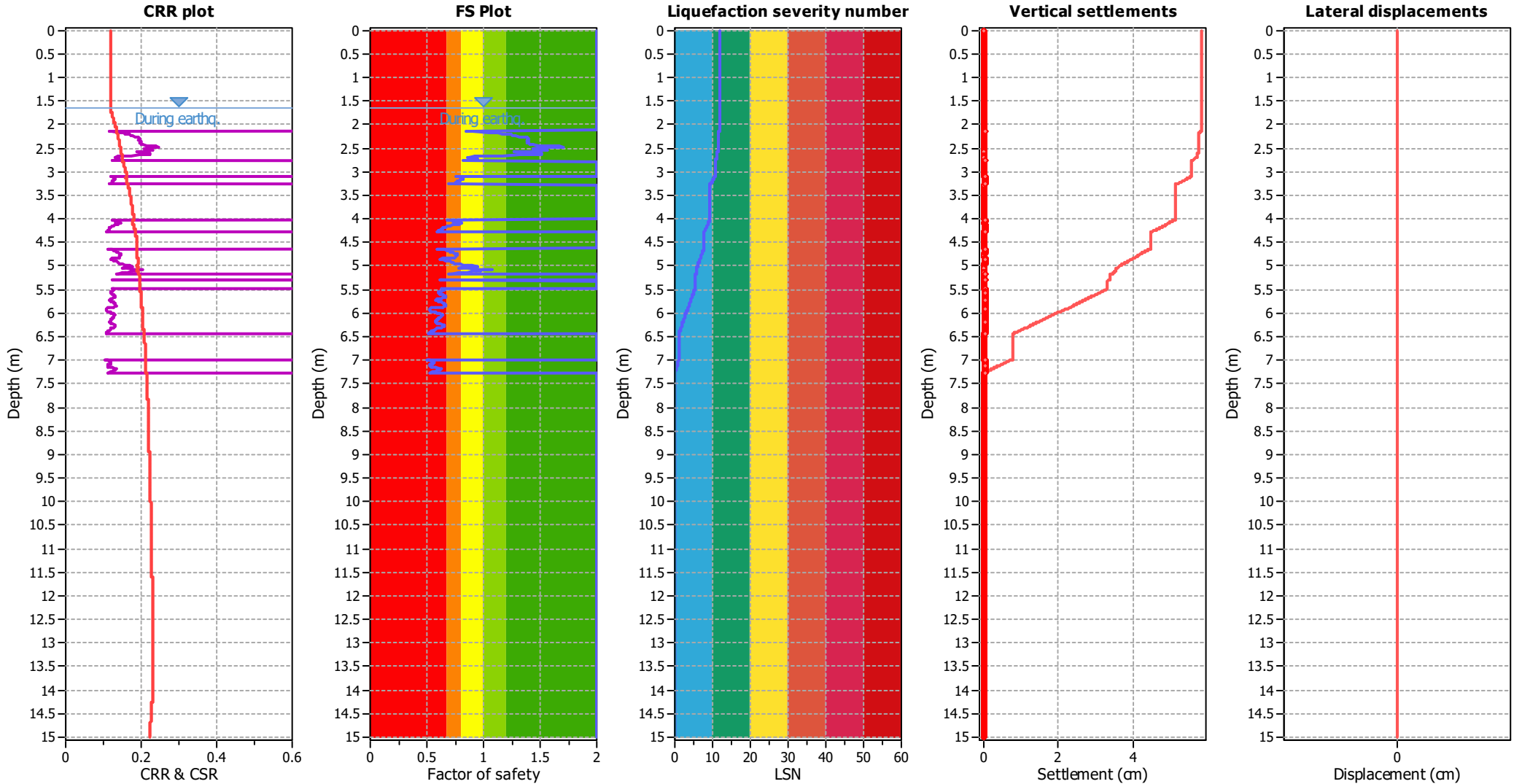
#### F.S. color scheme

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

#### LSN color scheme

- Severe damage
- Major expression of liquefaction
- Moderate to severe exp. of liquefaction
- Moderate expression of liquefaction
- Minor expression of liquefaction
- Little to no expression of liquefaction

### Liquefaction analysis overall plots



**Input parameters and analysis data**

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.65 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_f$ applied:	Yes
Earthquake magnitude $M_w$ :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.20	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.65 m	Fill height:	N/A	Limit depth:	10.00 m

**F.S. color scheme**

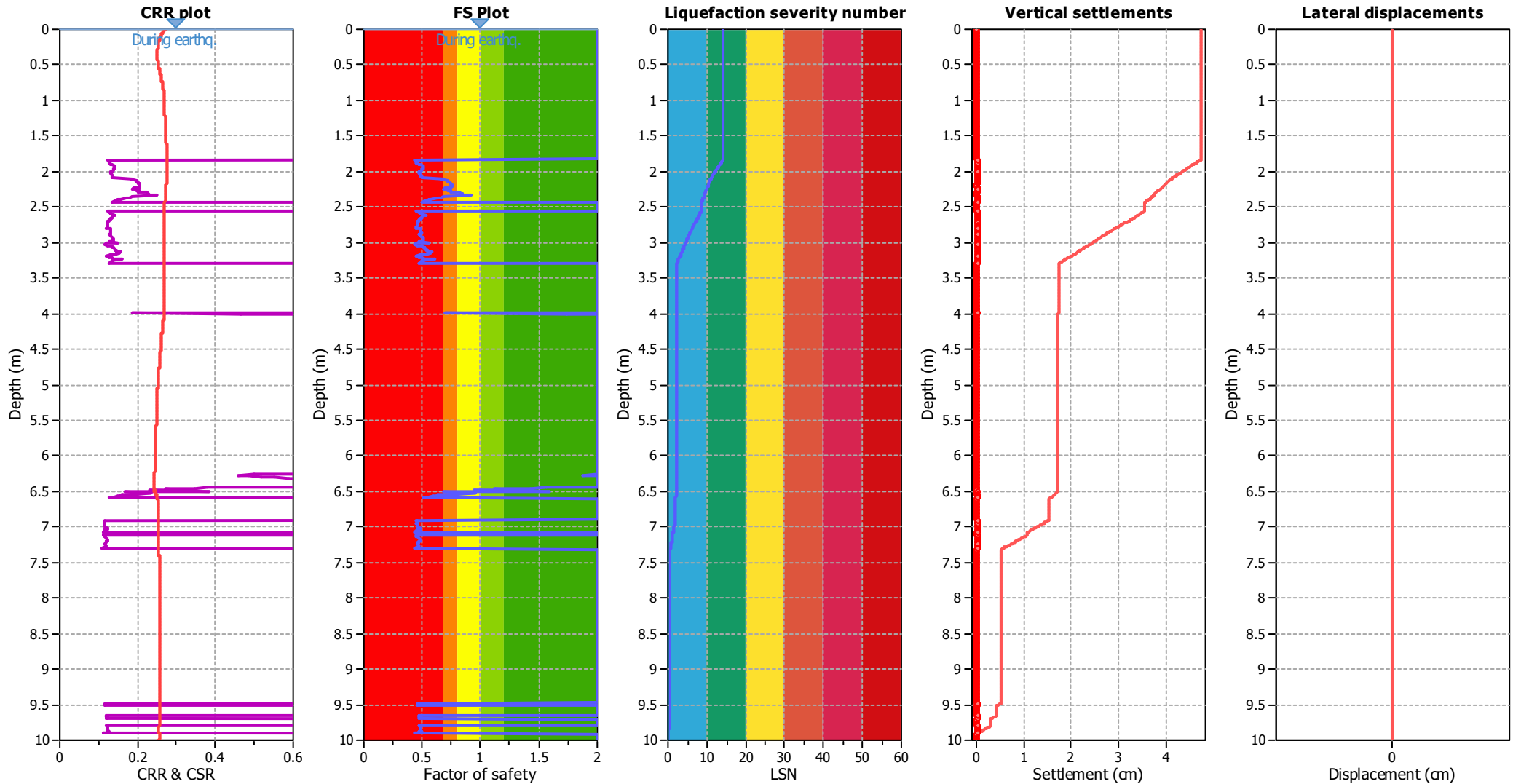
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

**LSN color scheme**

- Severe damage
- Major expression of liquefaction
- Moderate to severe exp. of liquefaction
- Moderate expression of liquefaction
- Minor expression of liquefaction
- Little to no expression of liquefaction



### Liquefaction analysis overall plots



#### Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	0.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_d$ applied:	Yes
Earthquake magnitude $M_w$ :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.20	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	0.00 m	Fill height:	N/A	Limit depth:	10.00 m

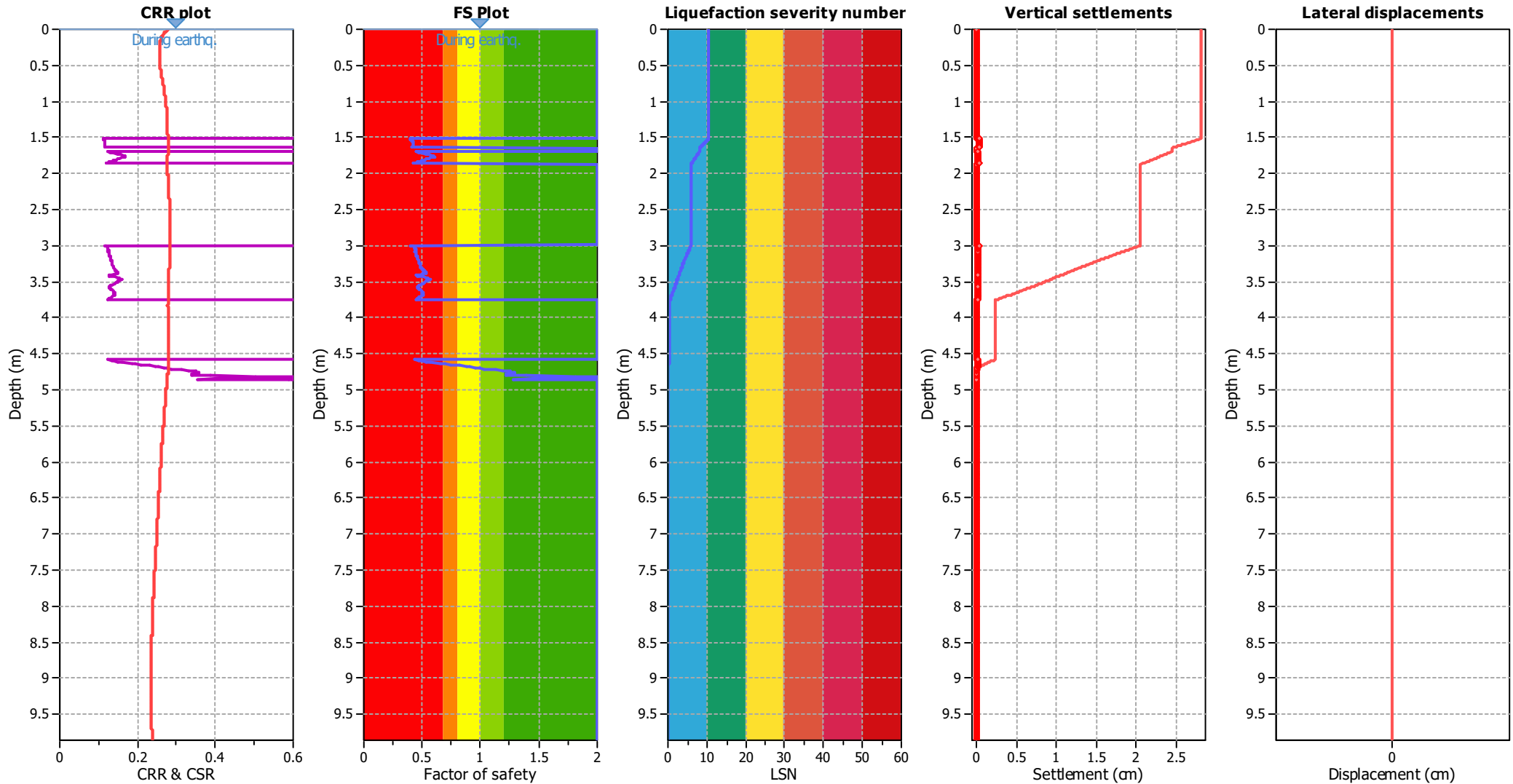
#### F.S. color scheme

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

#### LSN color scheme

- Severe damage
- Major expression of liquefaction
- Moderate to severe exp. of liquefaction
- Moderate expression of liquefaction
- Minor expression of liquefaction
- Little to no expression of liquefaction

### Liquefaction analysis overall plots



#### Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	0.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_v$ applied:	Yes
Earthquake magnitude $M_w$ :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.20	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	0.00 m	Fill height:	N/A	Limit depth:	10.00 m

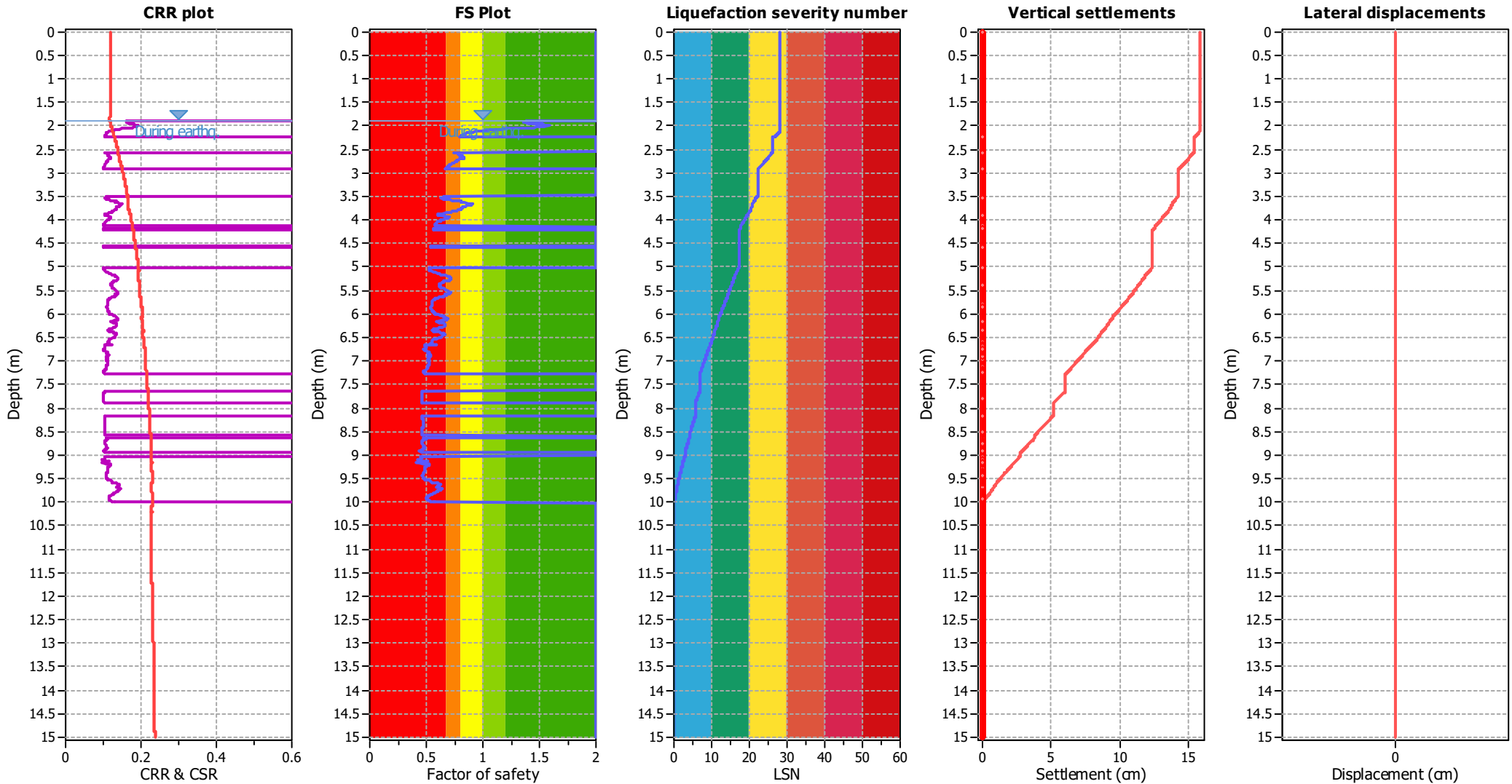
#### F.S. color scheme

<span style="color: red;">■</span>	Almost certain it will liquefy
<span style="color: orange;">■</span>	Very likely to liquefy
<span style="color: yellow;">■</span>	Liquefaction and no liq. are equally likely
<span style="color: lightgreen;">■</span>	Unlike to liquefy
<span style="color: green;">■</span>	Almost certain it will not liquefv

#### LSN color scheme

<span style="color: red;">■</span>	Severe damage
<span style="color: darkred;">■</span>	Major expression of liquefaction
<span style="color: brown;">■</span>	Moderate to severe exp. of liquefaction
<span style="color: orange;">■</span>	Moderate expression of liquefaction
<span style="color: yellow;">■</span>	Minor expression of liquefaction
<span style="color: lightblue;">■</span>	Little to no expression of liquefaction

### Liquefaction analysis overall plots



**Input parameters and analysis data**

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.90 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_f$ applied:	Yes
Earthquake magnitude $M_w$ :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.20	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.90 m	Fill height:	N/A	Limit depth:	10.00 m

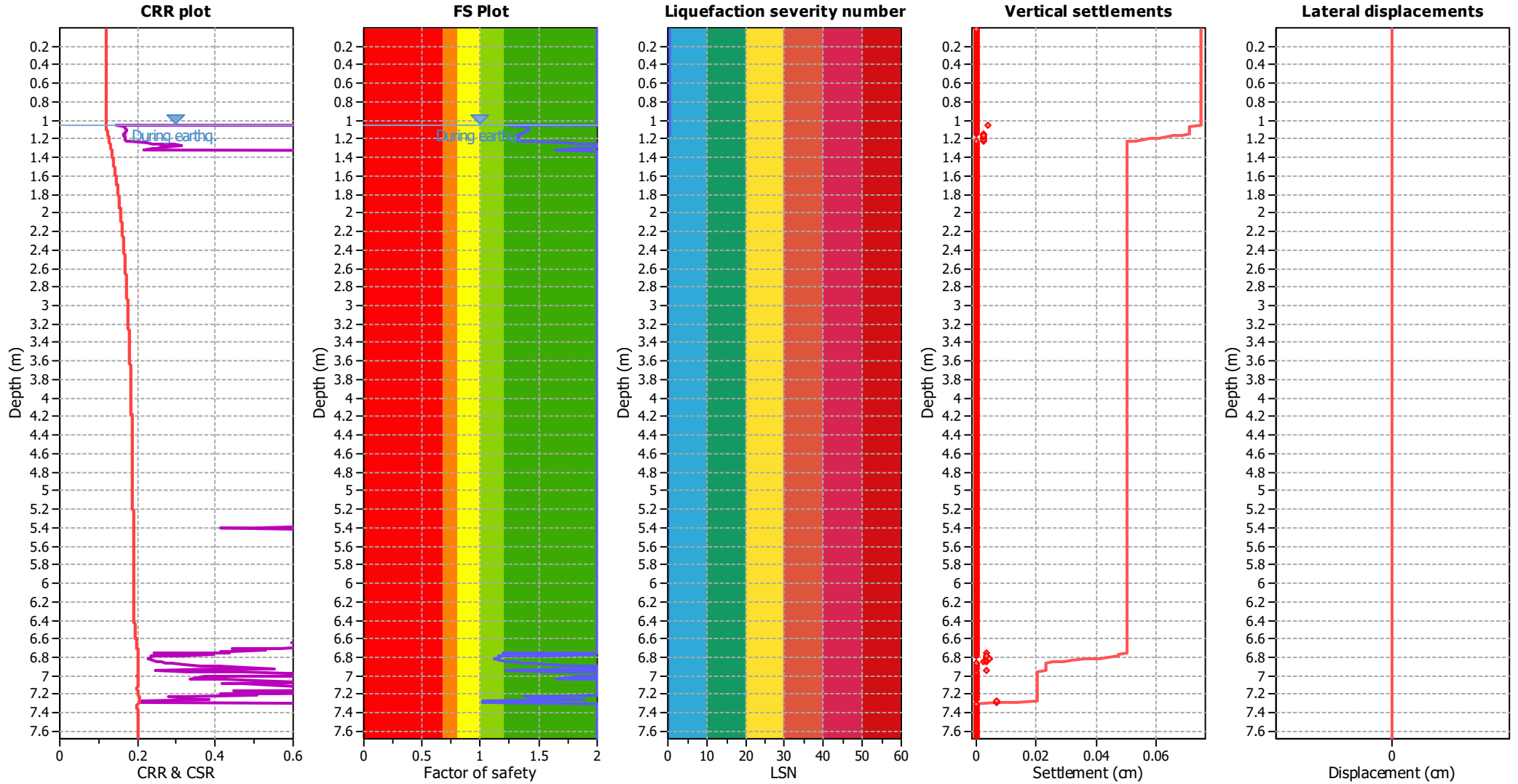
**F.S. color scheme**

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

**LSN color scheme**

- Severe damage
- Major expression of liquefaction
- Moderate to severe exp. of liquefaction
- Moderate expression of liquefaction
- Minor expression of liquefaction
- Little to no expression of liquefaction

### Liquefaction analysis overall plots



**Input parameters and analysis data**

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.05 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_v$ applied:	Yes
Earthquake magnitude $M_w$ :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.20	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.05 m	Fill height:	N/A	Limit depth:	10.00 m

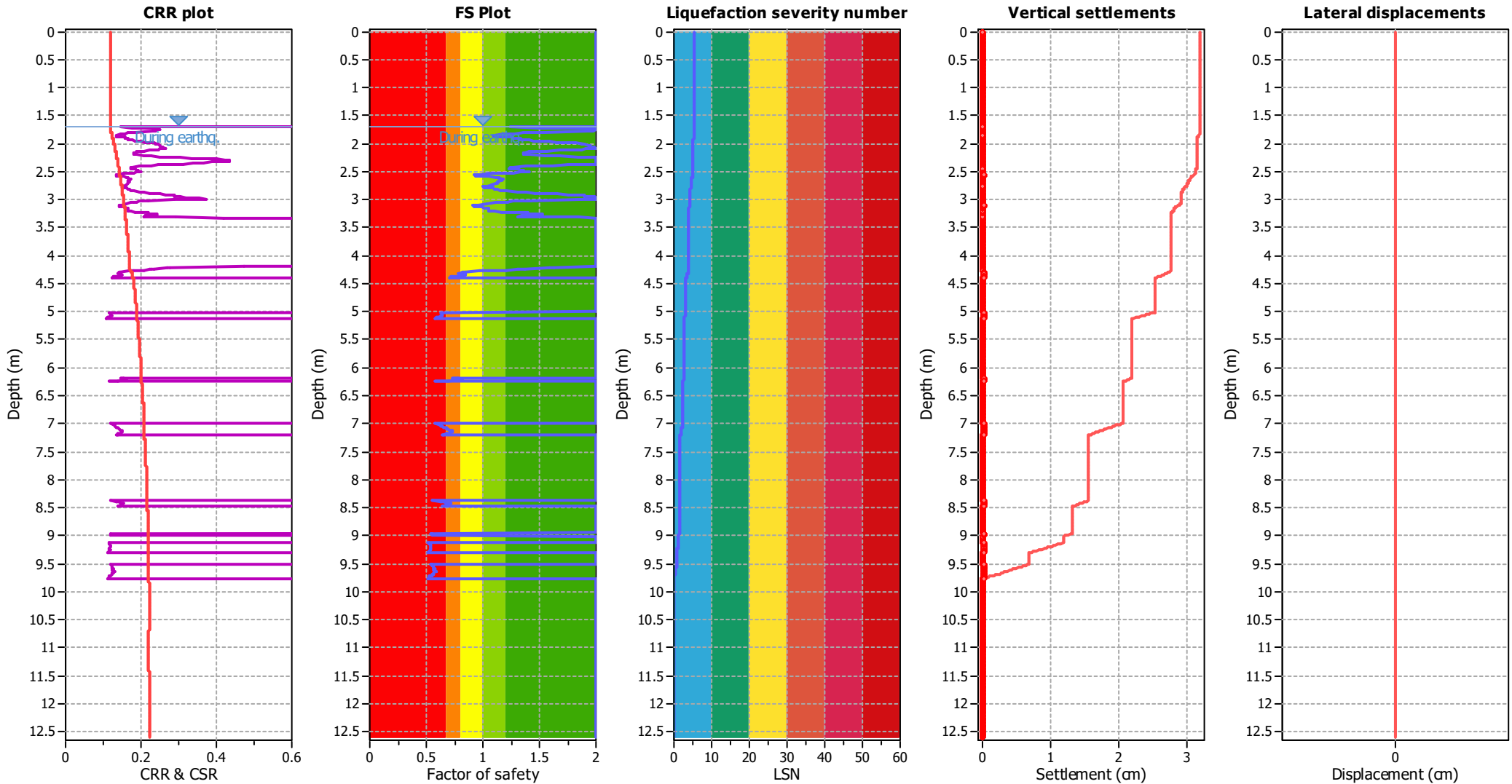
**F.S. color scheme**

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

**LSN color scheme**

- Severe damage
- Major expression of liquefaction
- Moderate to severe exp. of liquefaction
- Moderate expression of liquefaction
- Minor expression of liquefaction
- Little to no expression of liquefaction

### Liquefaction analysis overall plots



**Input parameters and analysis data**

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_v$ applied:	Yes
Earthquake magnitude $M_w$ :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.20	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	10.00 m

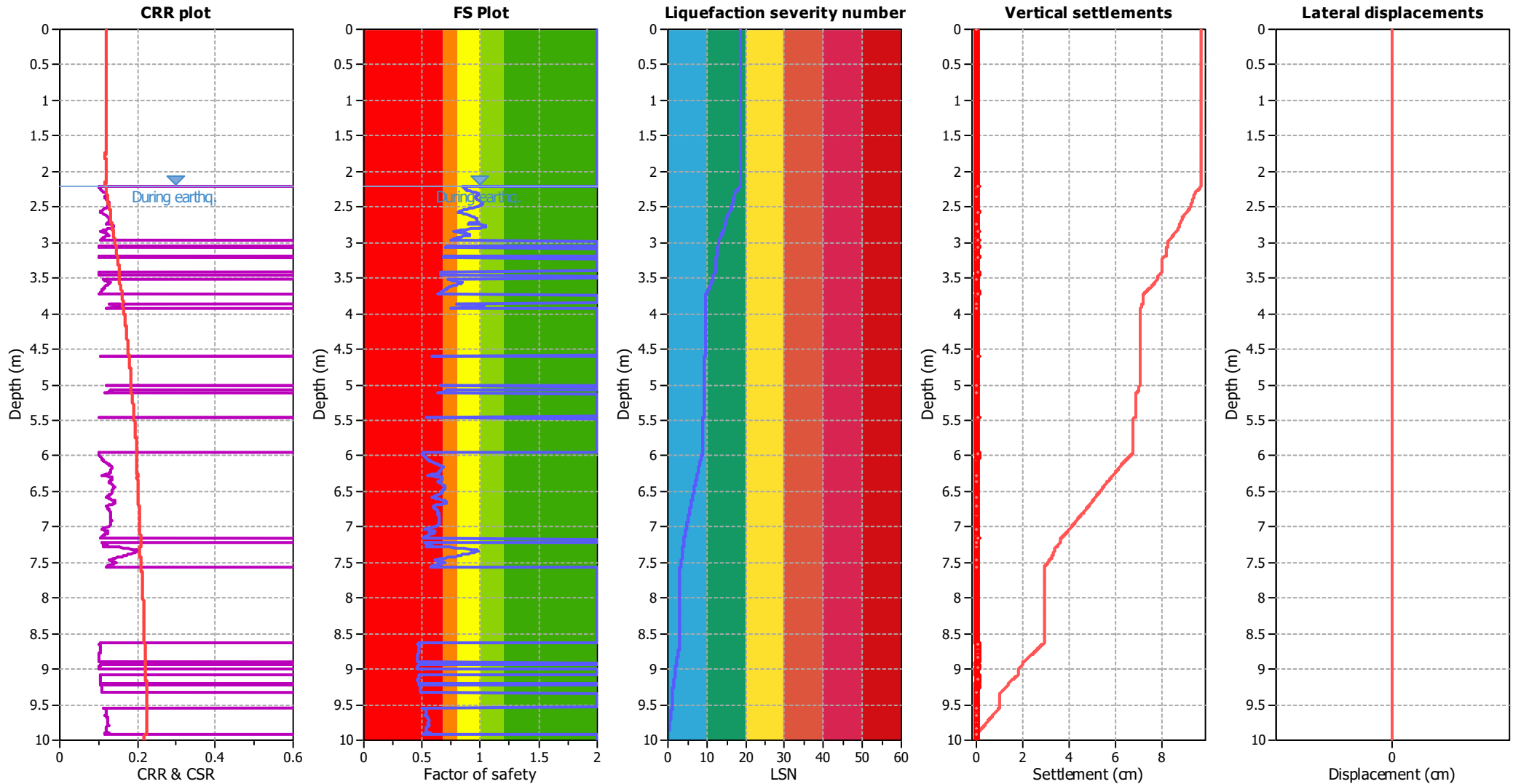
**F.S. color scheme**

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

**LSN color scheme**

- Severe damage
- Major expression of liquefaction
- Moderate to severe exp. of liquefaction
- Moderate expression of liquefaction
- Minor expression of liquefaction
- Little to no expression of liquefaction

### Liquefaction analysis overall plots



**Input parameters and analysis data**

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.20 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_D$ applied:	Yes
Earthquake magnitude $M_w$ :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.20	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.20 m	Fill height:	N/A	Limit depth:	10.00 m

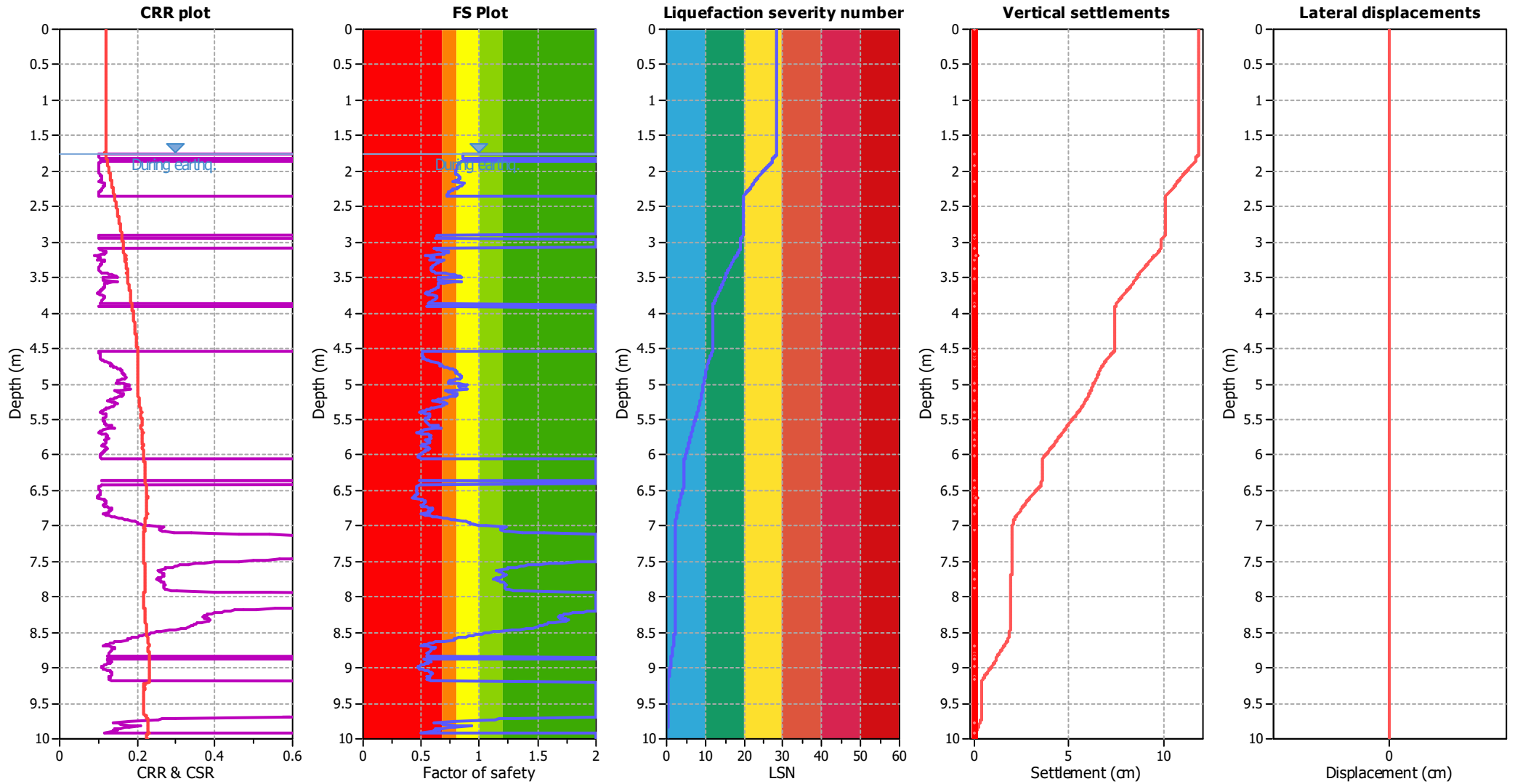
**F.S. color scheme**

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

**LSN color scheme**

- Severe damage
- Major expression of liquefaction
- Moderate to severe exp. of liquefaction
- Moderate expression of liquefaction
- Minor expression of liquefaction
- Little to no expression of liquefaction

### Liquefaction analysis overall plots



#### Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.75 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_d$ applied:	Yes
Earthquake magnitude $M_w$ :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.20	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.75 m	Fill height:	N/A	Limit depth:	10.00 m

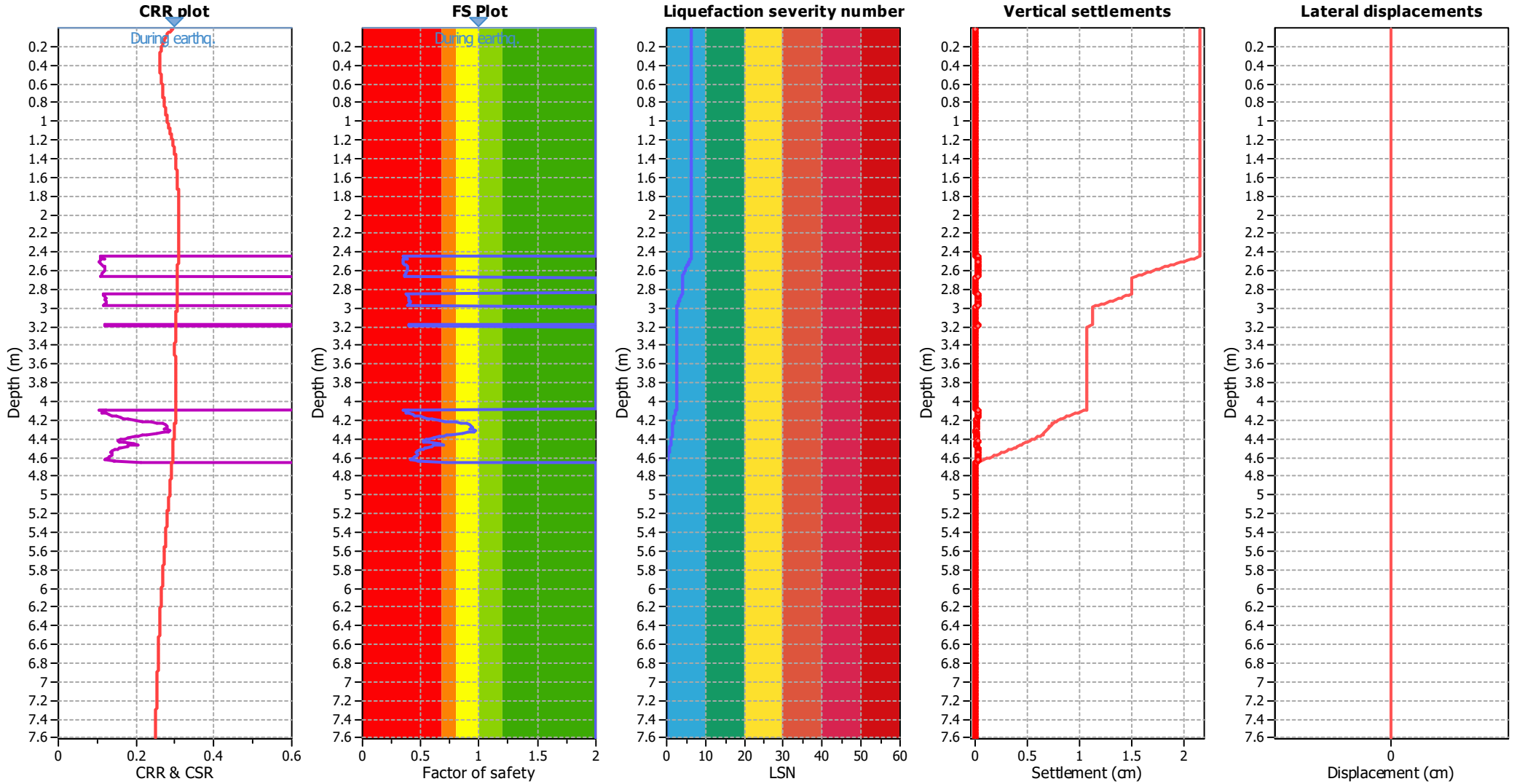
#### F.S. color scheme

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

#### LSN color scheme

- Severe damage
- Major expression of liquefaction
- Moderate to severe exp. of liquefaction
- Moderate expression of liquefaction
- Minor expression of liquefaction
- Little to no expression of liquefaction

### Liquefaction analysis overall plots



**Input parameters and analysis data**

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	0.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_f$ applied:	Yes
Earthquake magnitude $M_w$ :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.20	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	0.00 m	Fill height:	N/A	Limit depth:	10.00 m

**F.S. color scheme**

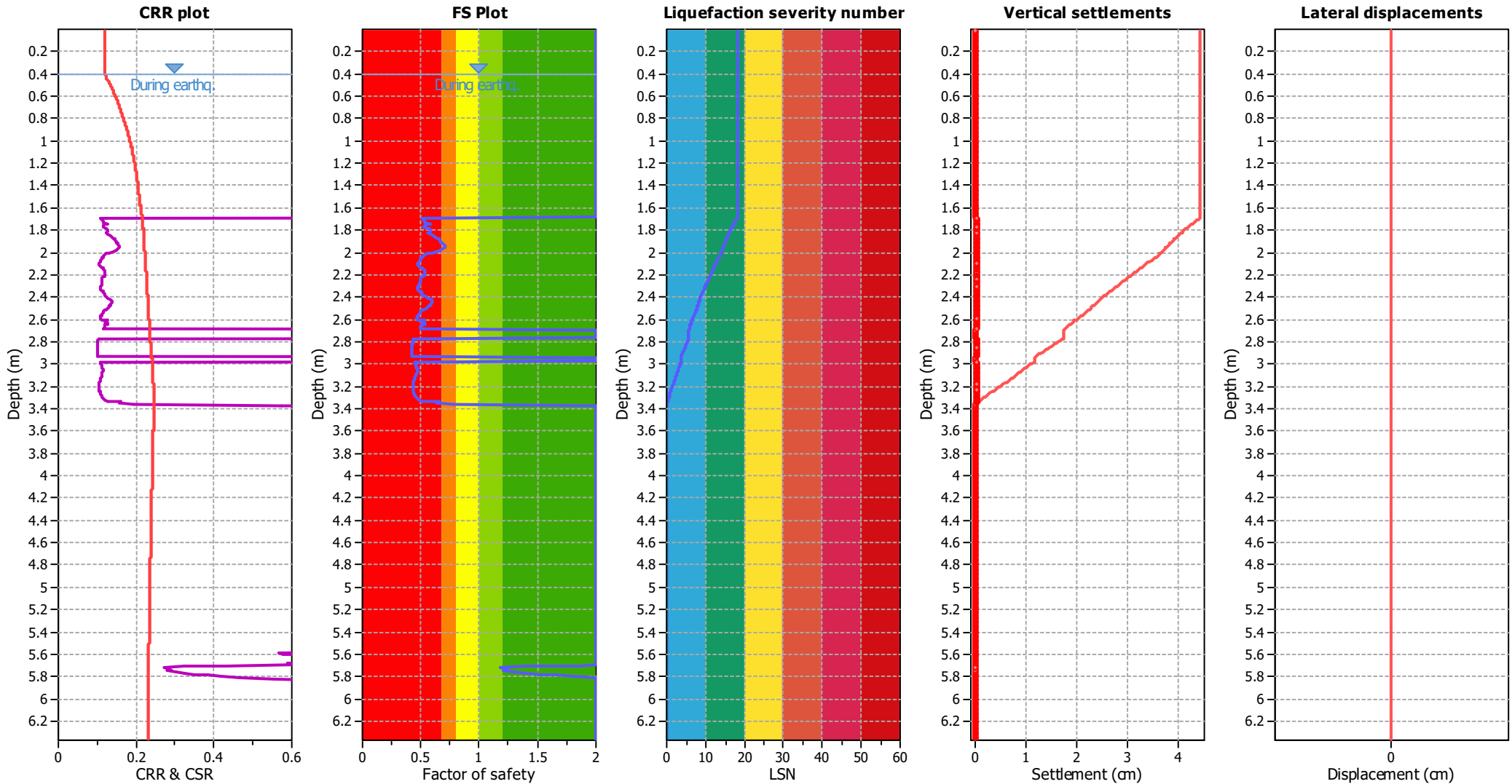
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

**LSN color scheme**

- Severe damage
- Major expression of liquefaction
- Moderate to severe exp. of liquefaction
- Moderate expression of liquefaction
- Minor expression of liquefaction
- Little to no expression of liquefaction



### Liquefaction analysis overall plots



**Input parameters and analysis data**

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	0.40 m
Fines correction method:	B&I (2014)	Average results interval:	3
Points to test:	Based on Ic value	Ic cut-off value:	2.60
Earthquake magnitude $M_w$ :	7.50	Unit weight calculation:	Based on SBT
Peak ground acceleration:	0.20	Use fill:	No
Depth to water table (insitu):	0.40 m	Fill height:	N/A

Fill weight:	N/A
Transition detect. applied:	No
$K_\sigma$ applied:	Yes
Clay like behavior applied:	Sands only
Limit depth applied:	Yes
Limit depth:	10.00 m

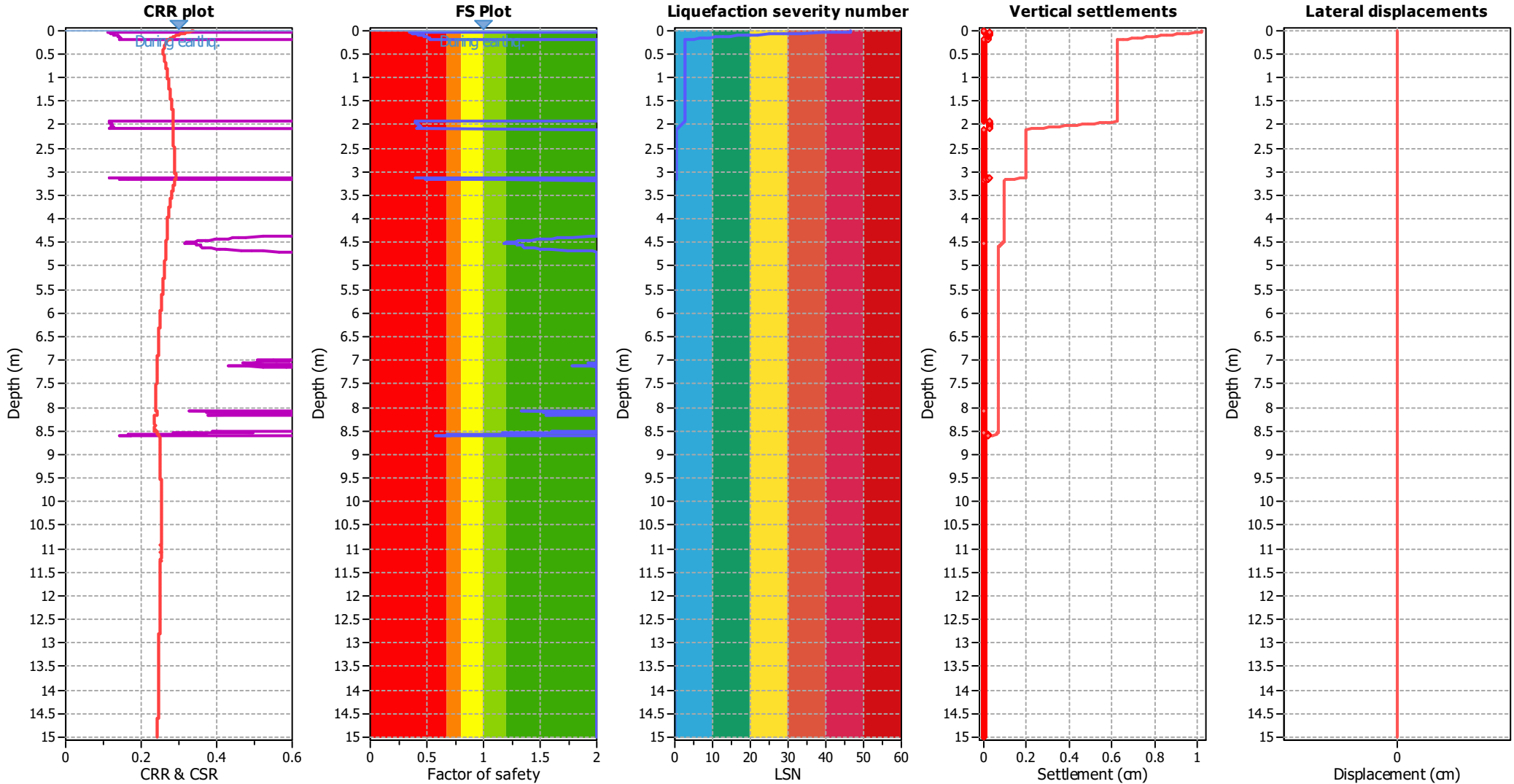
**F.S. color scheme**

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

**LSN color scheme**

- Severe damage
- Major expression of liquefaction
- Moderate to severe exp. of liquefaction
- Moderate expression of liquefaction
- Minor expression of liquefaction
- Little to no expression of liquefaction

### Liquefaction analysis overall plots



**Input parameters and analysis data**

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	0.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K <sub>σ</sub> applied:	Yes
Earthquake magnitude M <sub>w</sub> :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.20	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	0.00 m	Fill height:	N/A	Limit depth:	10.00 m

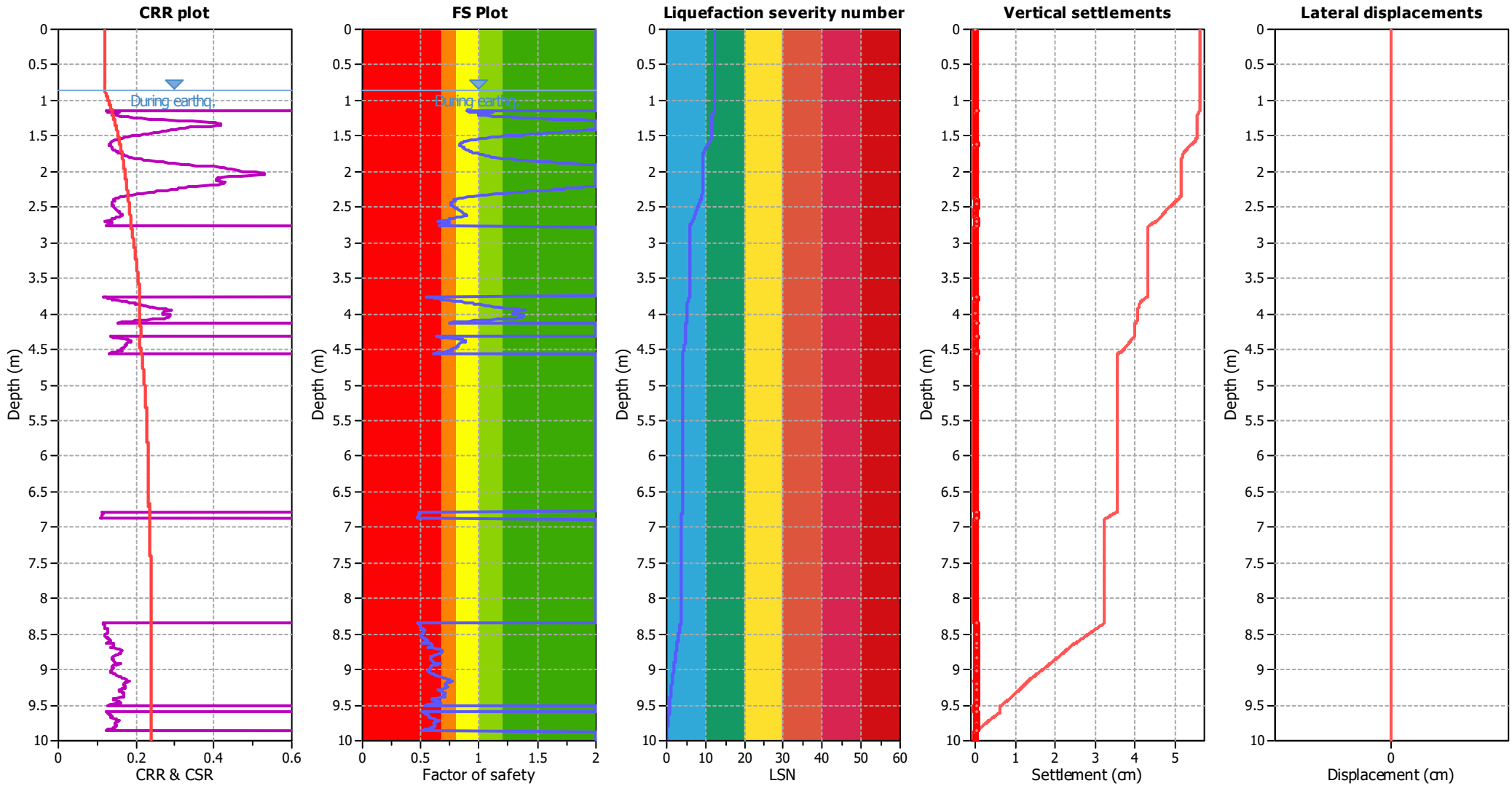
**F.S. color scheme**

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

**LSN color scheme**

- Severe damage
- Major expression of liquefaction
- Moderate to severe exp. of liquefaction
- Moderate expression of liquefaction
- Minor expression of liquefaction
- Little to no expression of liquefaction

### Liquefaction analysis overall plots



**Input parameters and analysis data**

Analysis method:	B&I (2014)	Depth to GWT (earthq.):	0.85 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_f$ applied:	Yes
Earthquake magnitude $M_w$ :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.20	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	0.85 m	Fill height:	N/A	Limit depth:	10.00 m

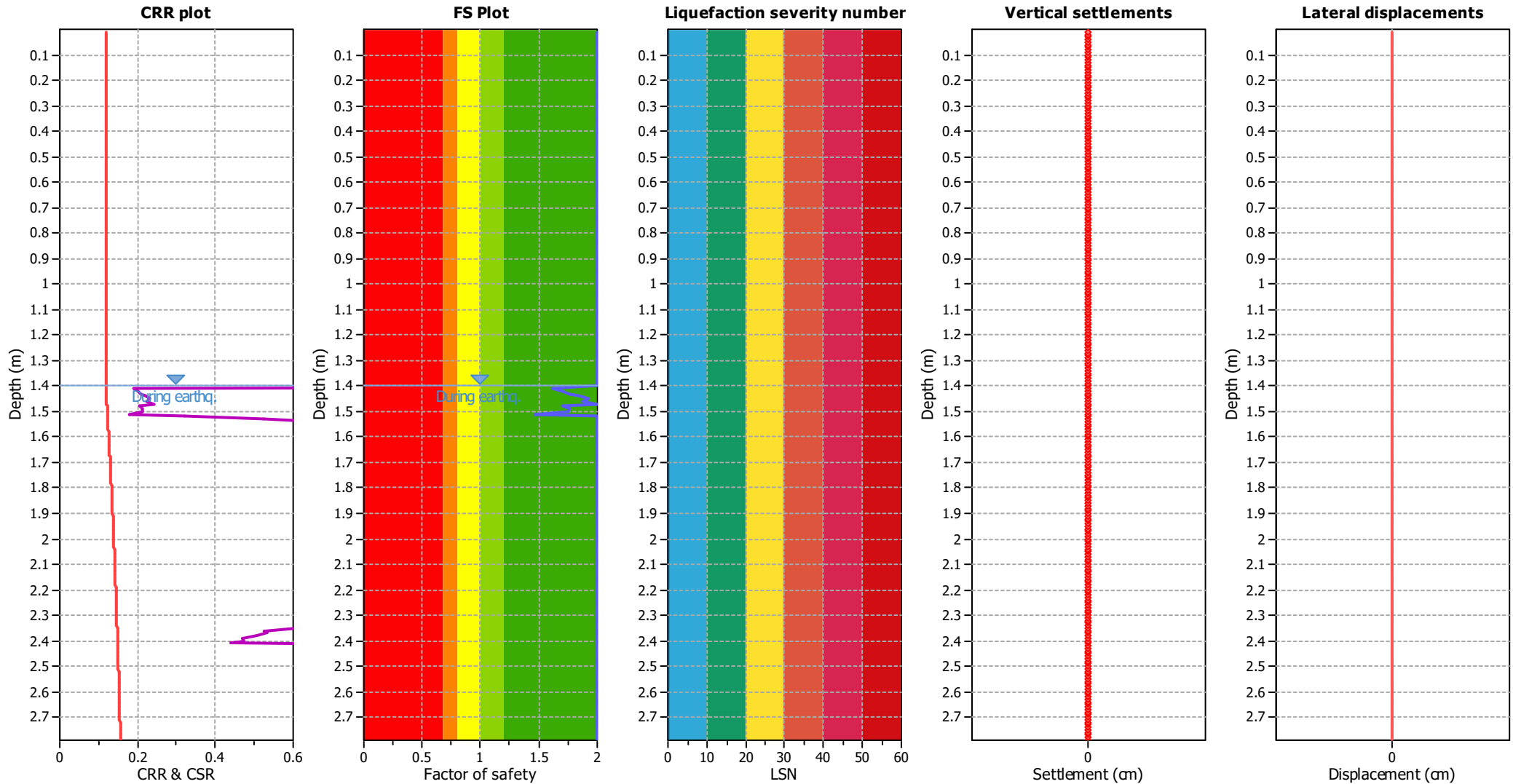
**F.S. color scheme**

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

**LSN color scheme**

- Severe damage
- Major expression of liquefaction
- Moderate to severe exp. of liquefaction
- Moderate expression of liquefaction
- Minor expression of liquefaction
- Little to no expression of liquefaction

### Liquefaction analysis overall plots



**Input parameters and analysis data**

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.40 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_d$ applied:	Yes
Earthquake magnitude $M_w$ :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.20	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.40 m	Fill height:	N/A	Limit depth:	10.00 m

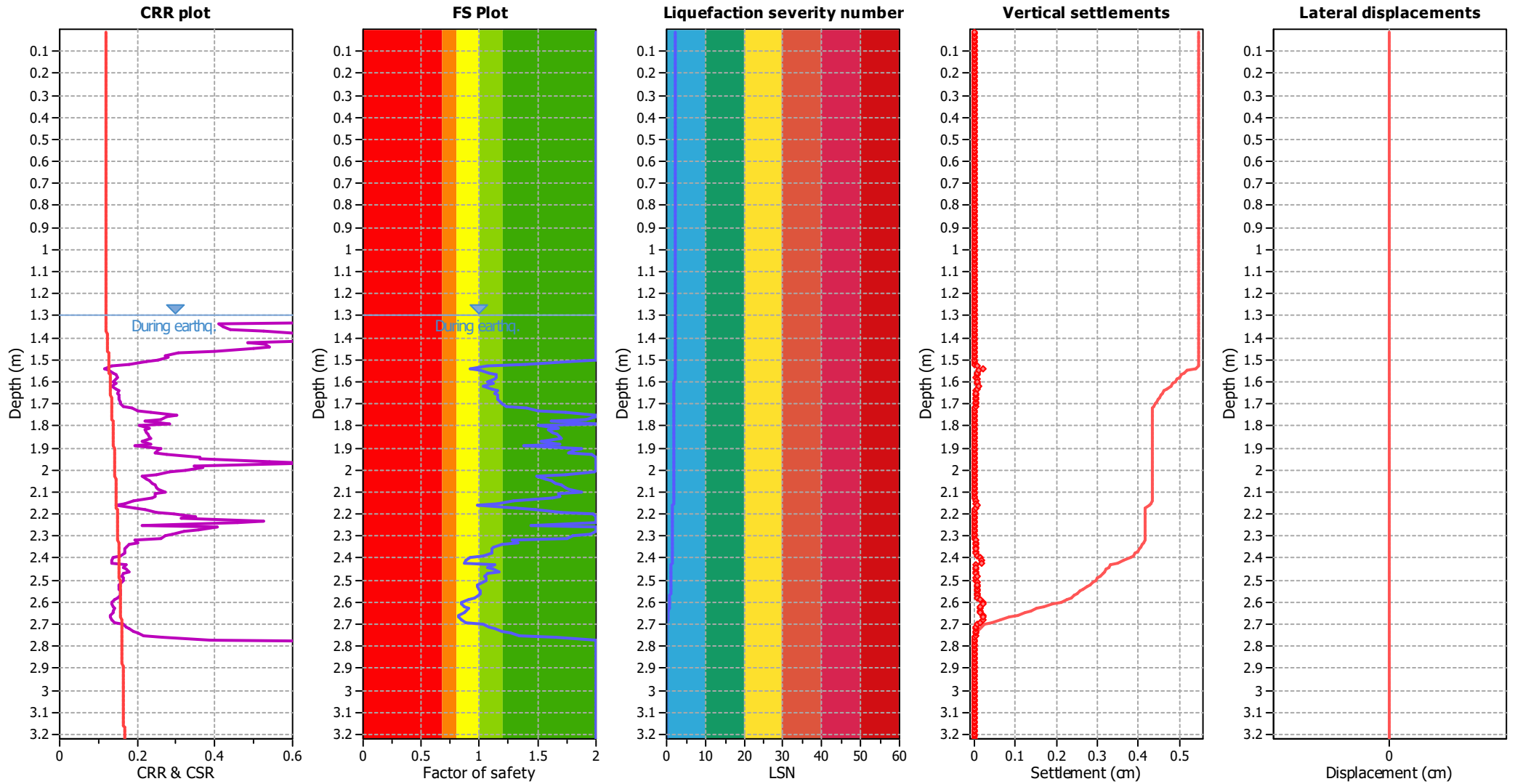
**F.S. color scheme**

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

**LSN color scheme**

- Severe damage
- Major expression of liquefaction
- Moderate to severe exp. of liquefaction
- Moderate expression of liquefaction
- Minor expression of liquefaction
- Little to no expression of liquefaction

### Liquefaction analysis overall plots



**Input parameters and analysis data**

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.30 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_f$ applied:	Yes
Earthquake magnitude $M_w$ :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.20	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.30 m	Fill height:	N/A	Limit depth:	10.00 m

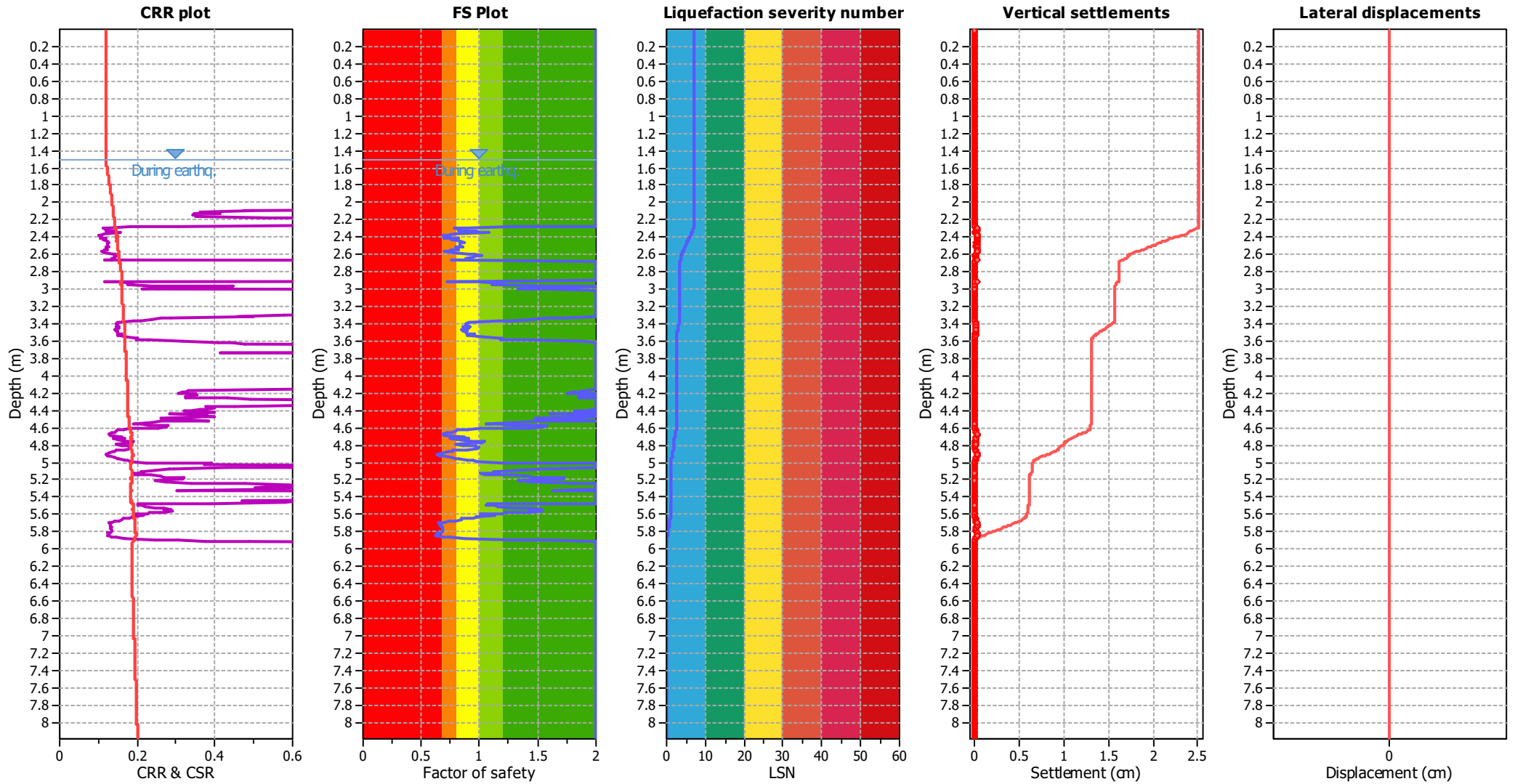
**F.S. color scheme**

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

**LSN color scheme**

- Severe damage
- Major expression of liquefaction
- Moderate to severe exp. of liquefaction
- Moderate expression of liquefaction
- Minor expression of liquefaction
- Little to no expression of liquefaction

### Liquefaction analysis overall plots



**Input parameters and analysis data**

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.50 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_f$ applied:	Yes
Earthquake magnitude $M_w$ :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.20	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	10.00 m

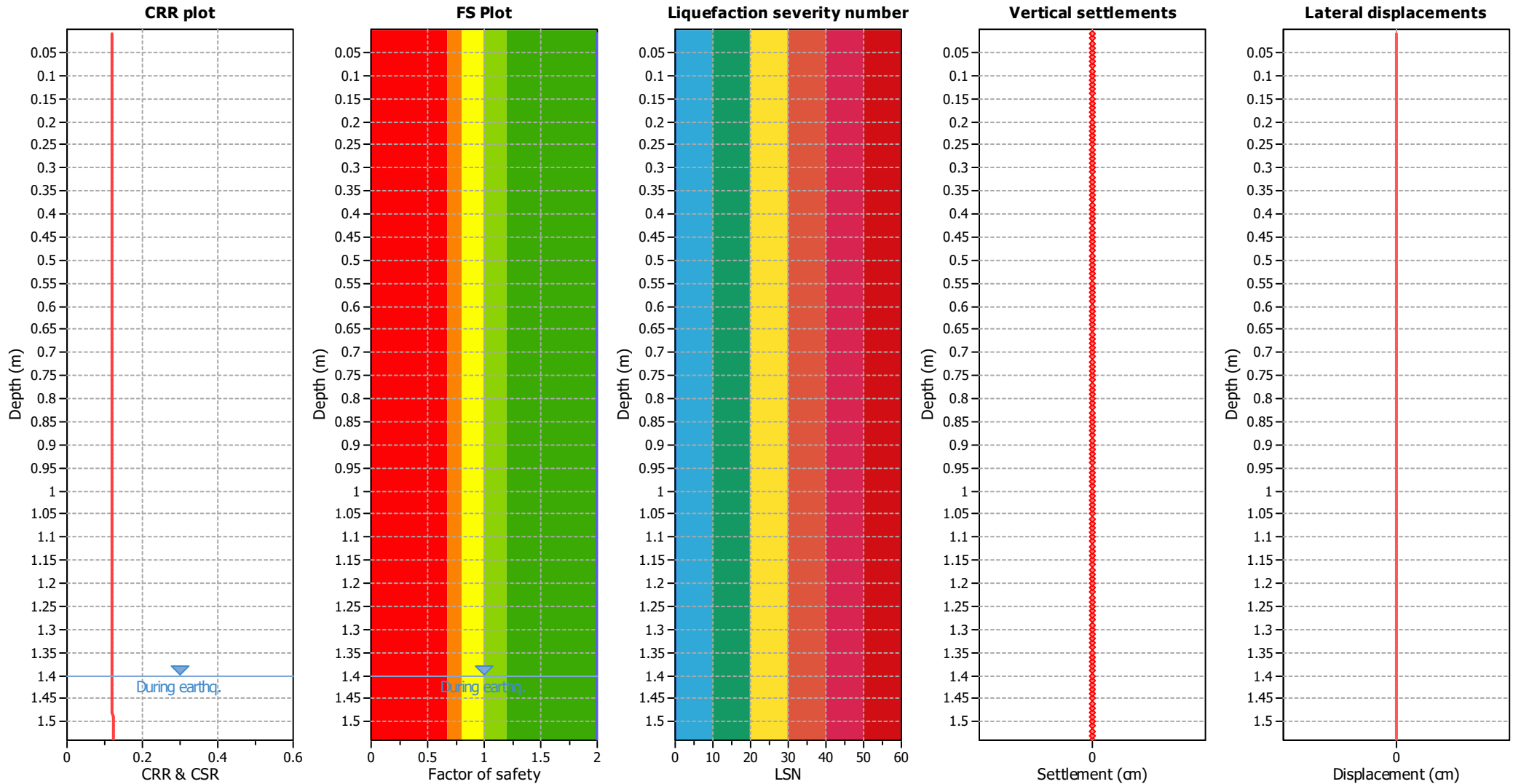
**F.S. color scheme**

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- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

**LSN color scheme**

- Severe damage
- Major expression of liquefaction
- Moderate to severe exp. of liquefaction
- Moderate expression of liquefaction
- Minor expression of liquefaction
- Little to no expression of liquefaction

### Liquefaction analysis overall plots



#### Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.40 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_f$ applied:	Yes
Earthquake magnitude $M_w$ :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.20	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.40 m	Fill height:	N/A	Limit depth:	10.00 m

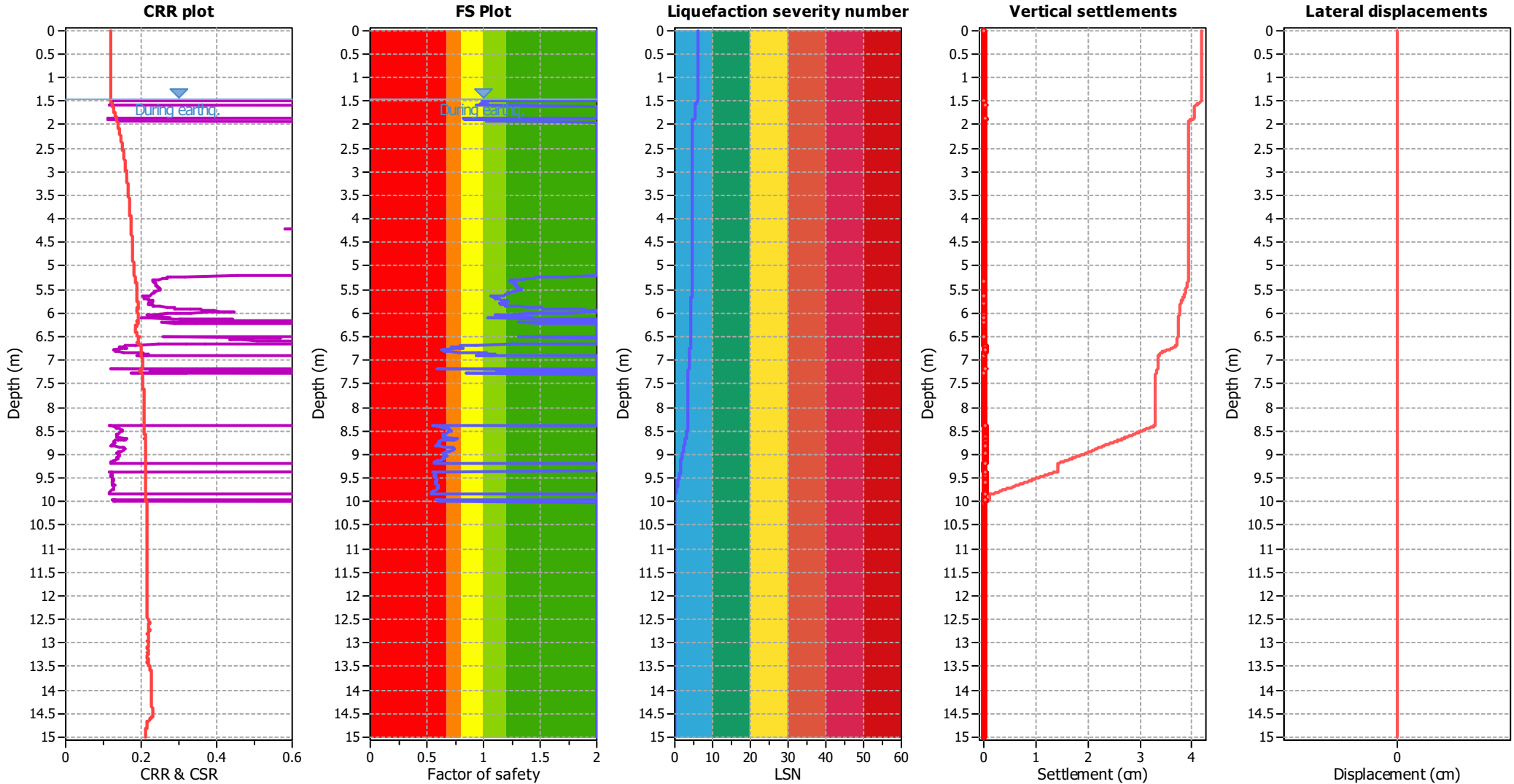
#### F.S. color scheme

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

#### LSN color scheme

- Severe damage
- Major expression of liquefaction
- Moderate to severe exp. of liquefaction
- Moderate expression of liquefaction
- Minor expression of liquefaction
- Little to no expression of liquefaction

### Liquefaction analysis overall plots



#### Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.45 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_v$ applied:	Yes
Earthquake magnitude $M_w$ :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.20	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.45 m	Fill height:	N/A	Limit depth:	10.00 m

#### F.S. color scheme

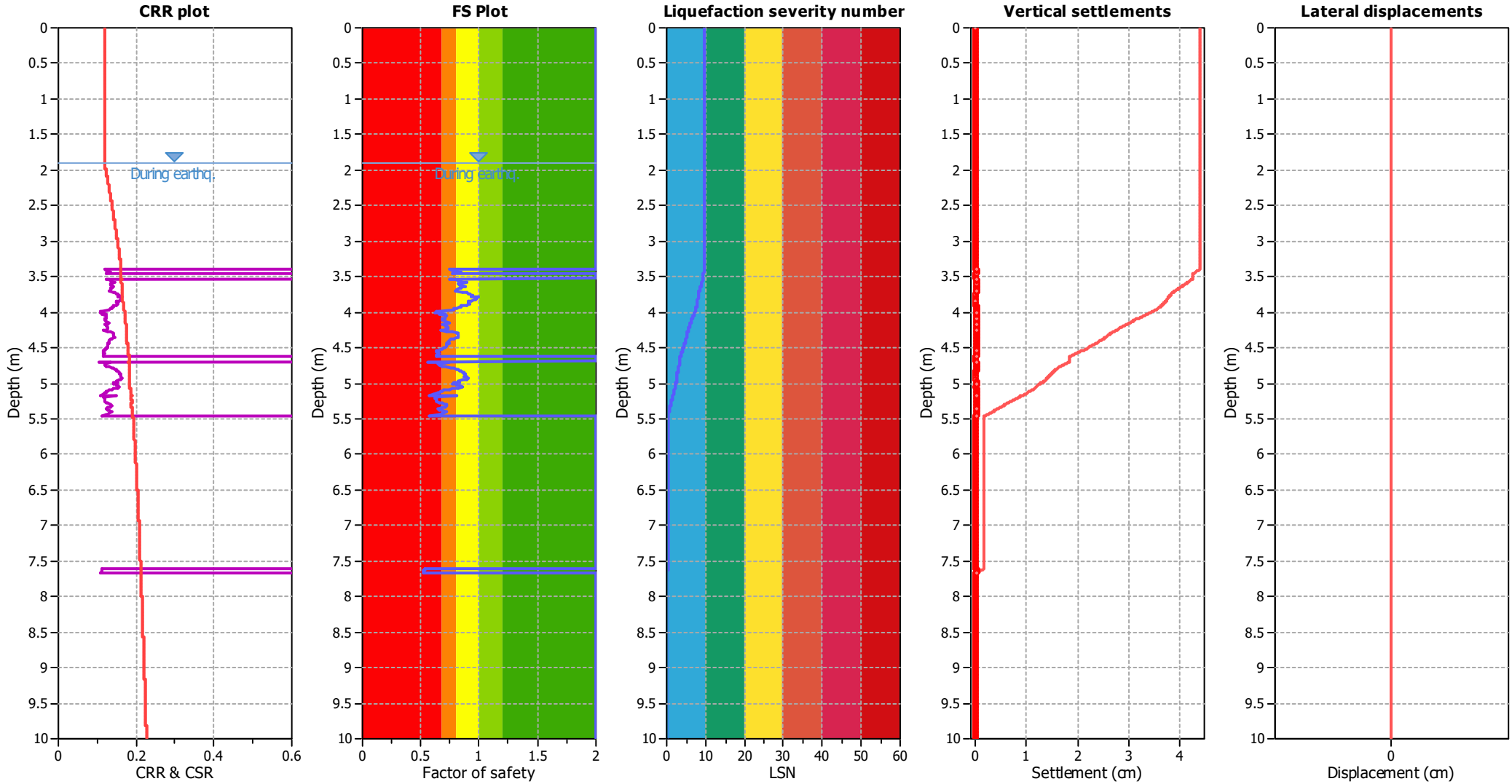
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

#### LSN color scheme

- Severe damage
- Major expression of liquefaction
- Moderate to severe exp. of liquefaction
- Moderate expression of liquefaction
- Minor expression of liquefaction
- Little to no expression of liquefaction



### Liquefaction analysis overall plots



#### Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.90 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_D$ applied:	Yes
Earthquake magnitude $M_w$ :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.20	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.90 m	Fill height:	N/A	Limit depth:	10.00 m

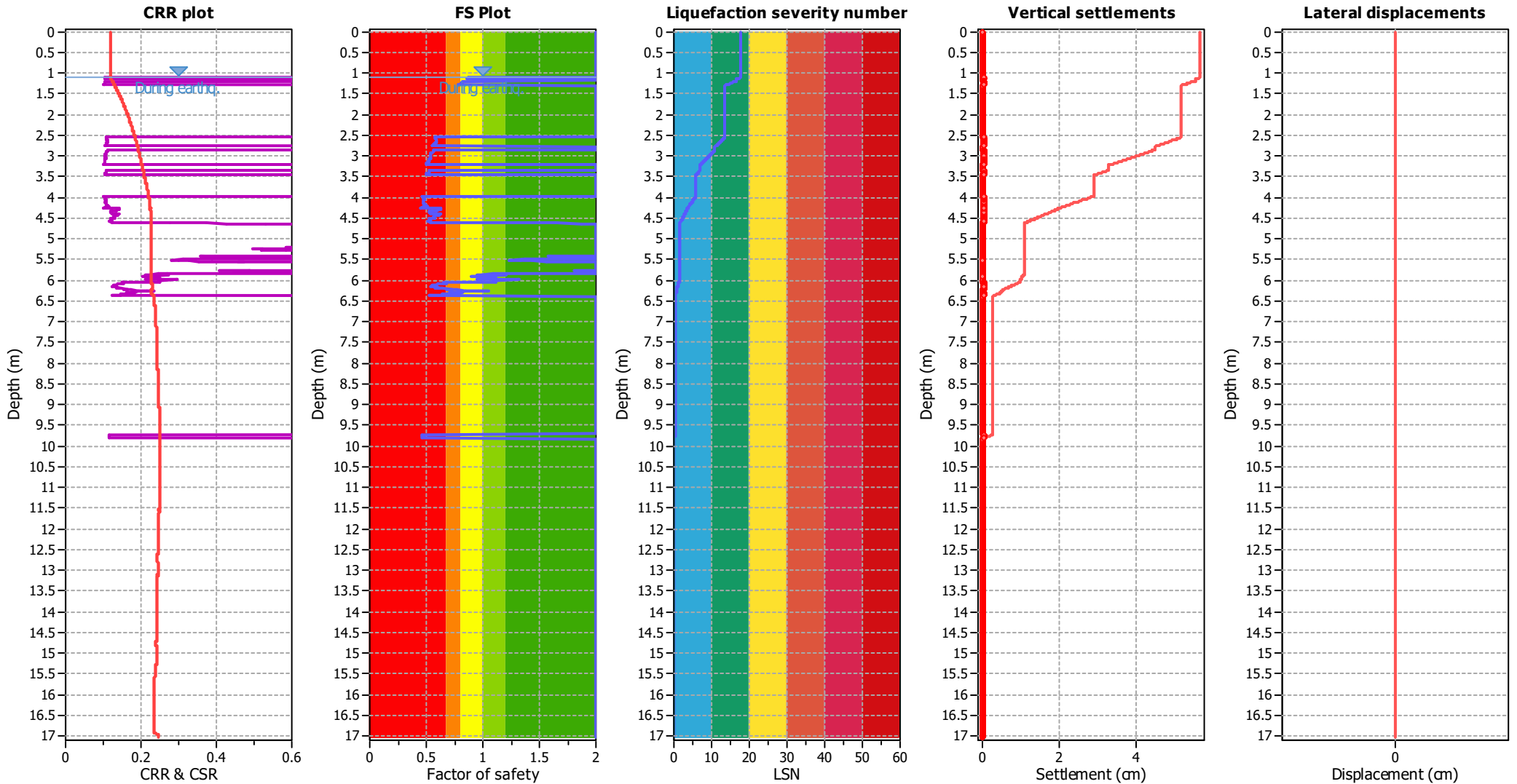
#### F.S. color scheme

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

#### LSN color scheme

- Severe damage
- Major expression of liquefaction
- Moderate to severe exp. of liquefaction
- Moderate expression of liquefaction
- Minor expression of liquefaction
- Little to no expression of liquefaction

### Liquefaction analysis overall plots



**Input parameters and analysis data**

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.10 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_f$ applied:	Yes
Earthquake magnitude $M_w$ :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.20	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.10 m	Fill height:	N/A	Limit depth:	10.00 m

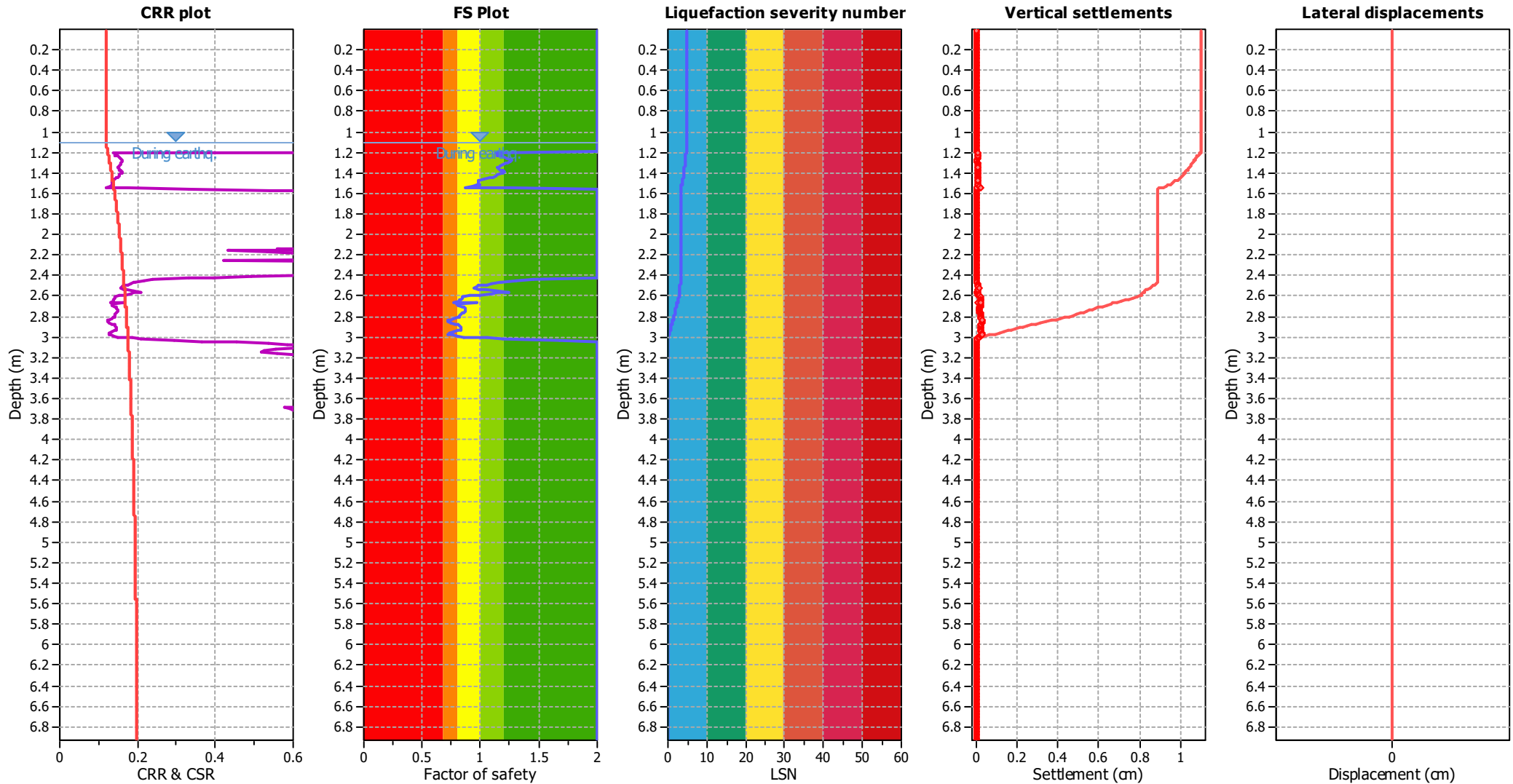
**F.S. color scheme**

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- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

**LSN color scheme**

- Severe damage
- Major expression of liquefaction
- Moderate to severe exp. of liquefaction
- Moderate expression of liquefaction
- Minor expression of liquefaction
- Little to no expression of liquefaction

### Liquefaction analysis overall plots



#### Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.10 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_d$ applied:	Yes
Earthquake magnitude $M_w$ :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.20	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.10 m	Fill height:	N/A	Limit depth:	10.00 m

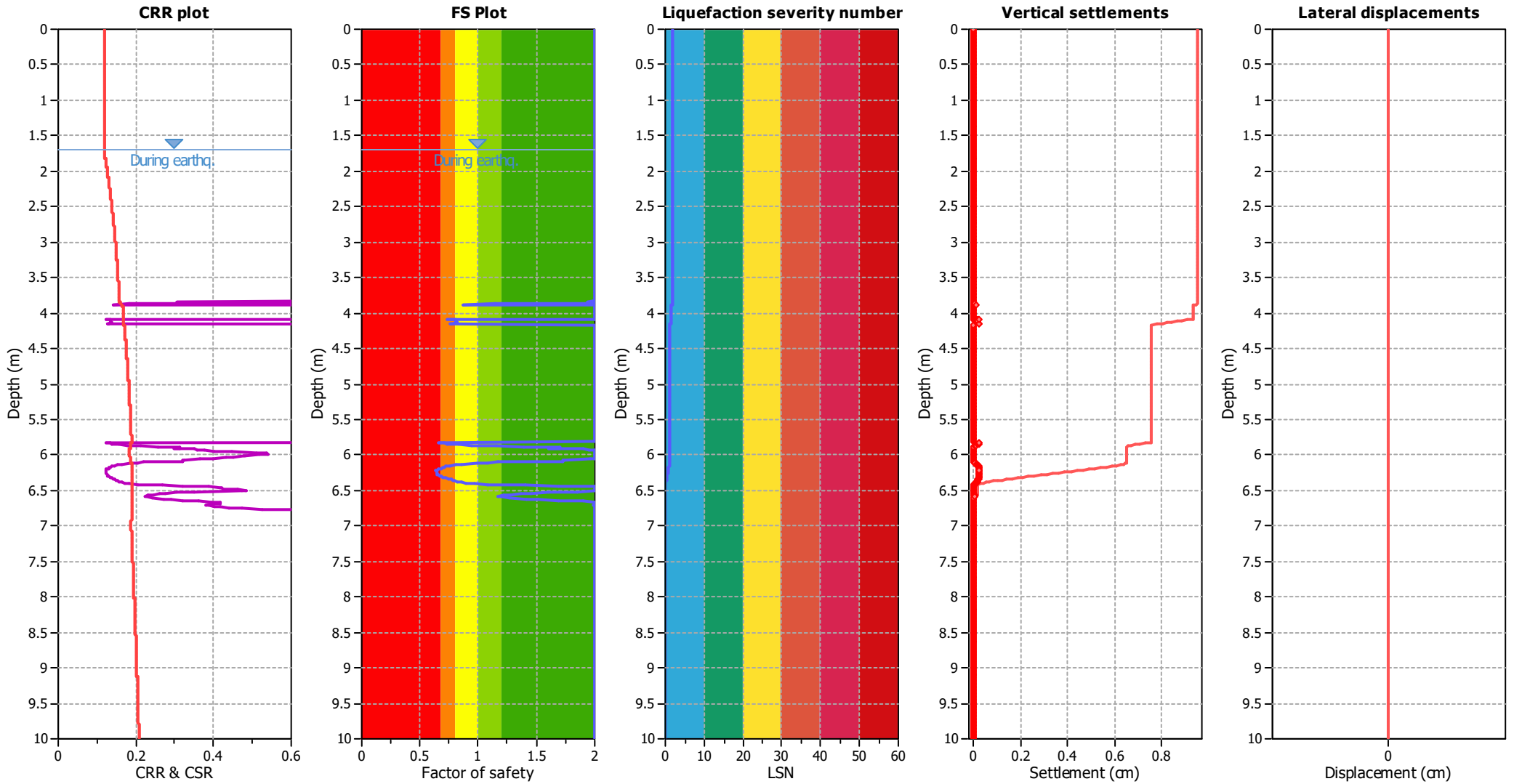
#### F.S. color scheme

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

#### LSN color scheme

- Severe damage
- Major expression of liquefaction
- Moderate to severe exp. of liquefaction
- Moderate expression of liquefaction
- Minor expression of liquefaction
- Little to no expression of liquefaction

### Liquefaction analysis overall plots



**Input parameters and analysis data**

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_d$ applied:	Yes
Earthquake magnitude $M_w$ :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.20	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	10.00 m

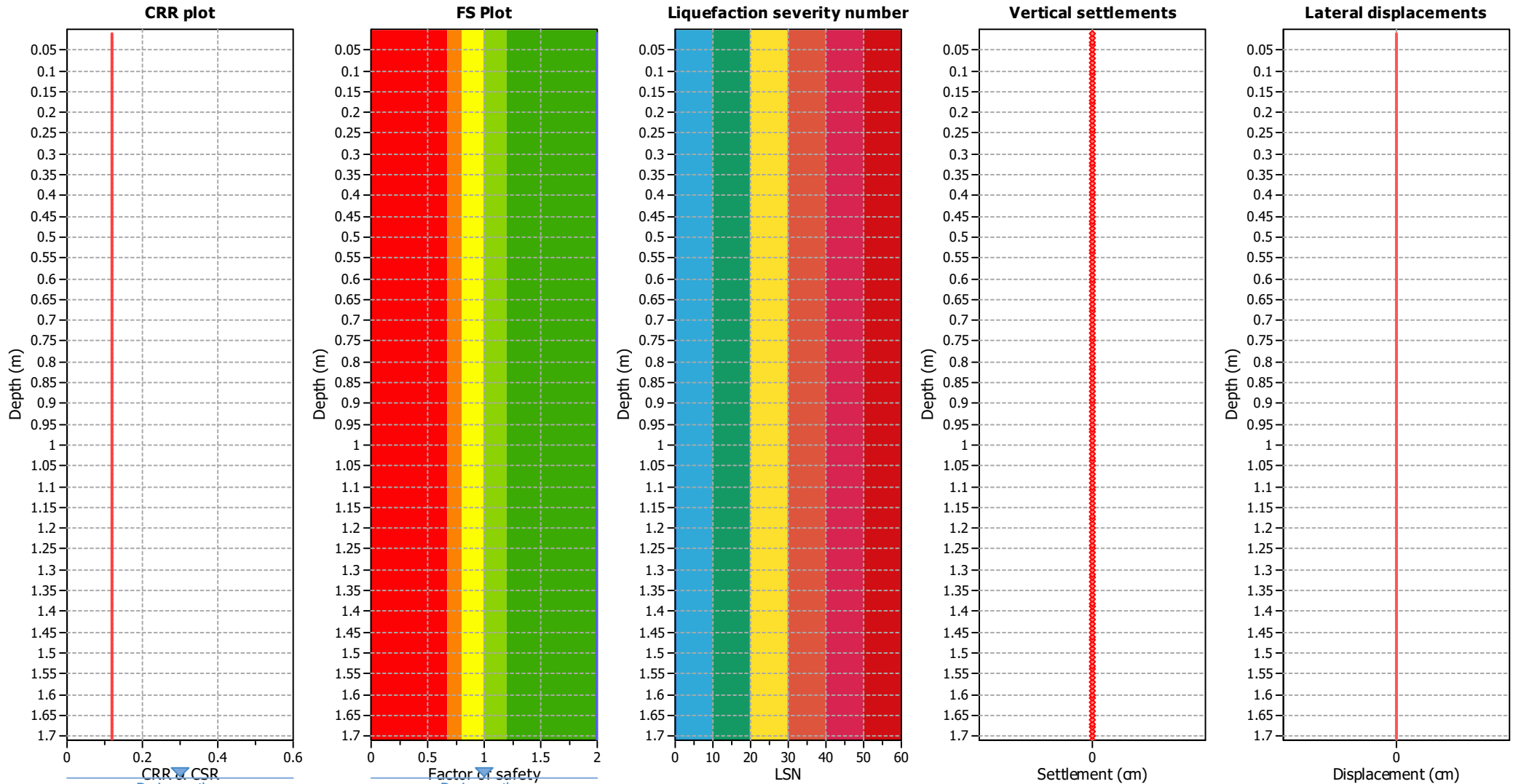
**F.S. color scheme**

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- Liquefaction and no liq. are equally likely
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- Almost certain it will not liquefy

**LSN color scheme**

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- Major expression of liquefaction
- Moderate to severe exp. of liquefaction
- Moderate expression of liquefaction
- Minor expression of liquefaction
- Little to no expression of liquefaction

### Liquefaction analysis overall plots



#### Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.80 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_{\sigma}$ applied:	Yes
Earthquake magnitude $M_w$ :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.20	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.80 m	Fill height:	N/A	Limit depth:	10.00 m

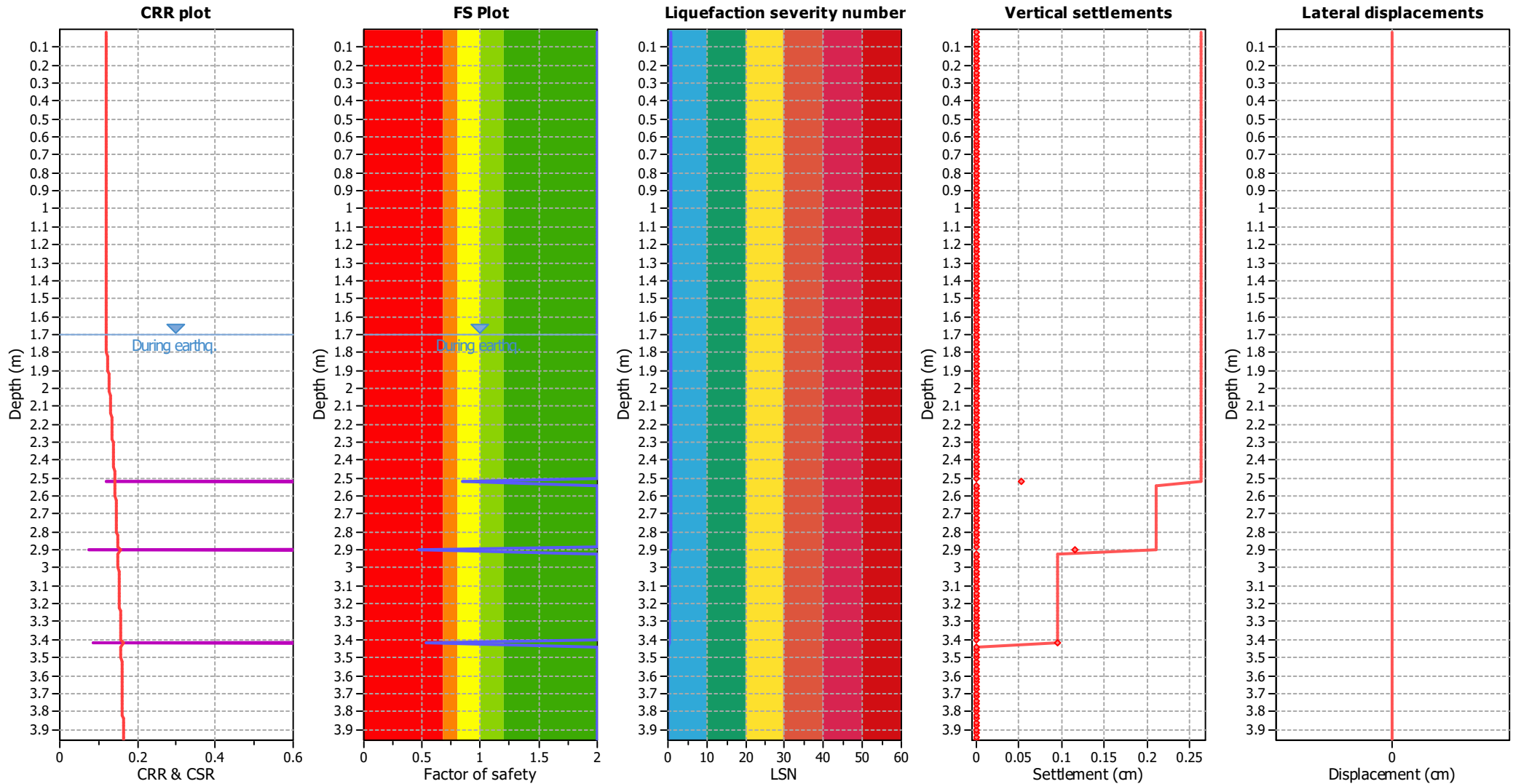
#### F.S. color scheme

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

#### LSN color scheme

- Severe damage
- Major expression of liquefaction
- Moderate to severe exp. of liquefaction
- Moderate expression of liquefaction
- Minor expression of liquefaction
- Little to no expression of liquefaction

### Liquefaction analysis overall plots



**Input parameters and analysis data**

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_f$ applied:	Yes
Earthquake magnitude $M_w$ :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.20	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	10.00 m

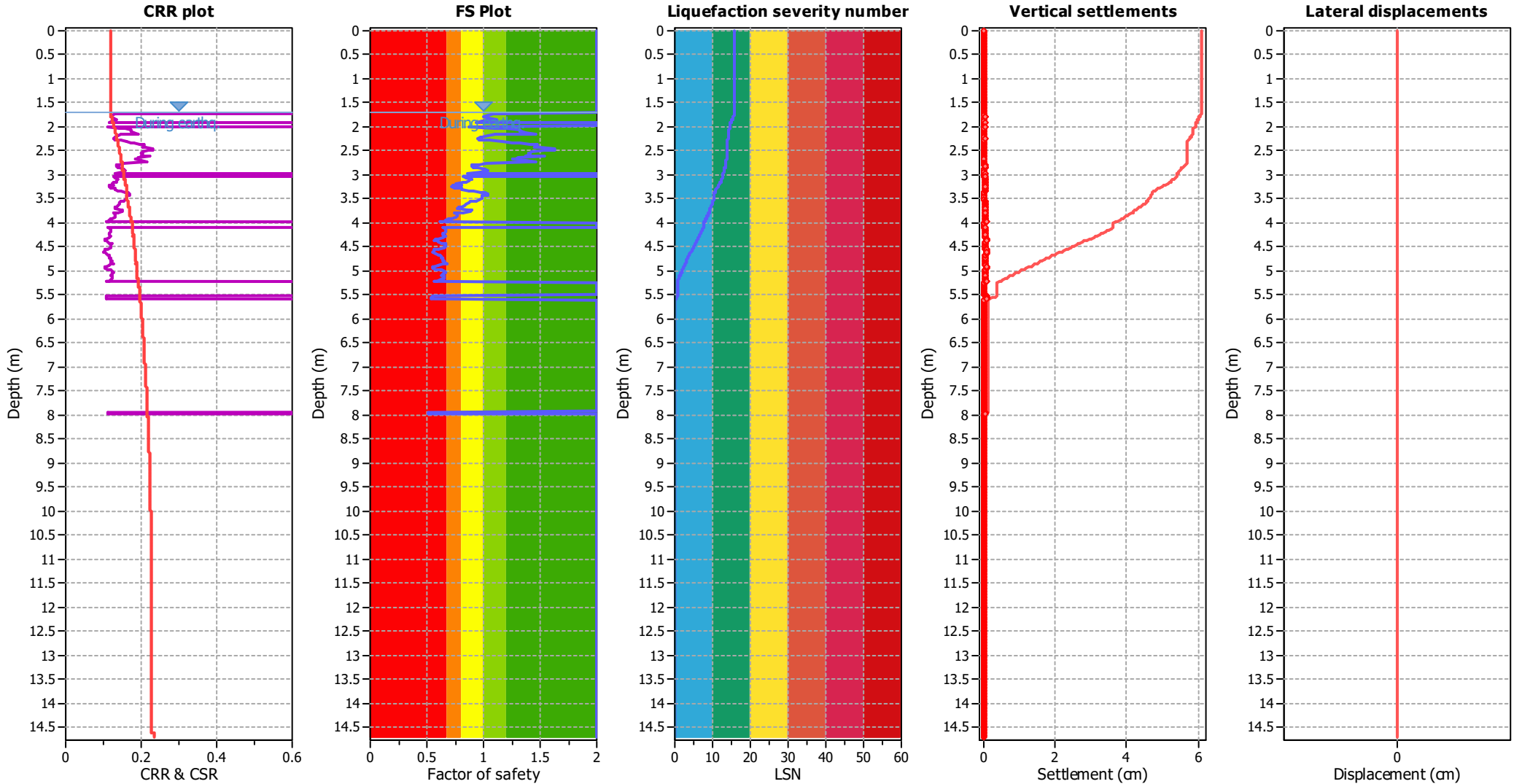
**F.S. color scheme**

- Almost certain it will liquefy
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- Liquefaction and no liq. are equally likely
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- Major expression of liquefaction
- Moderate to severe exp. of liquefaction
- Moderate expression of liquefaction
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- Little to no expression of liquefaction

### Liquefaction analysis overall plots



**Input parameters and analysis data**

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_v$ applied:	Yes
Earthquake magnitude $M_w$ :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.20	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	10.00 m

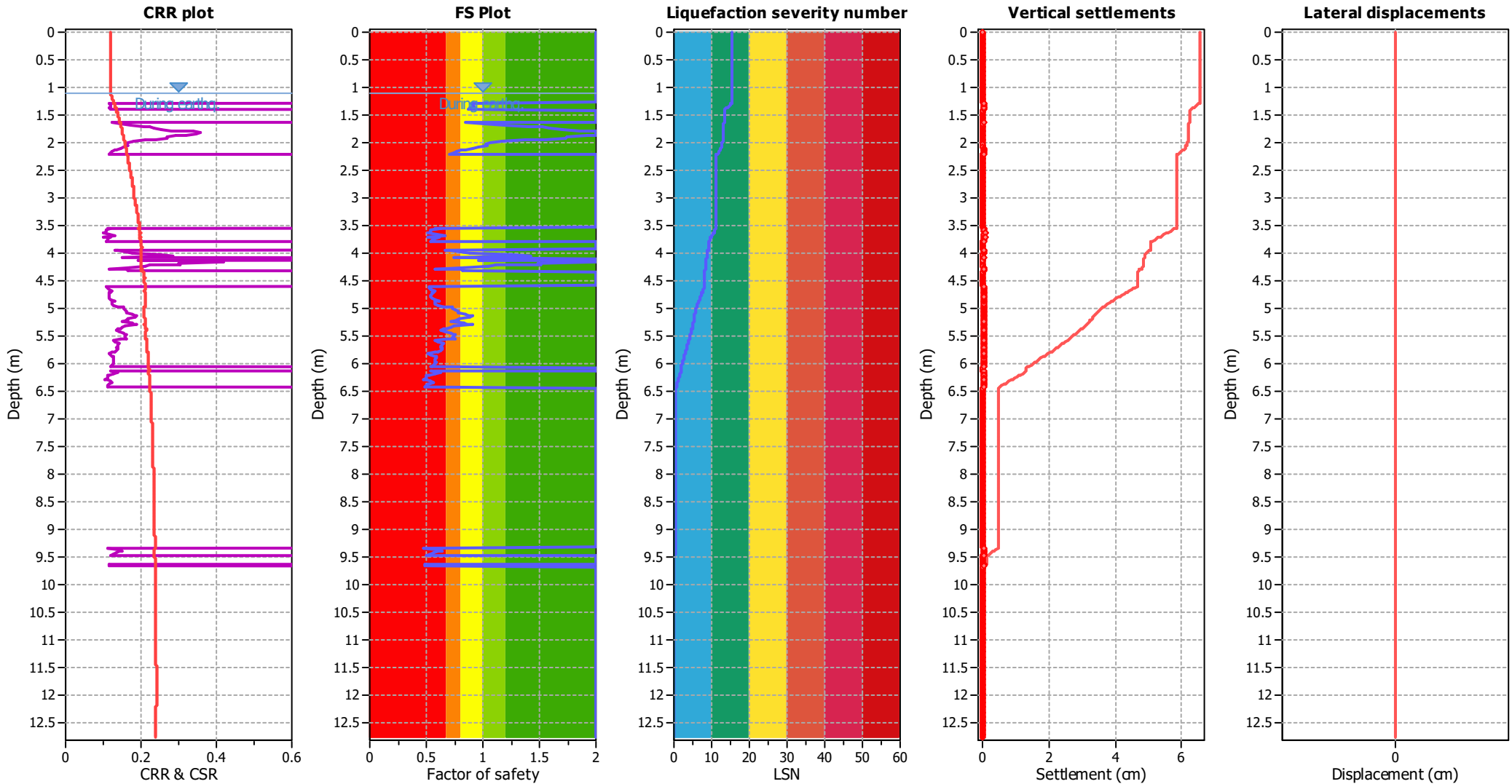
**F.S. color scheme**

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- Moderate expression of liquefaction
- Minor expression of liquefaction
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### Liquefaction analysis overall plots



**Input parameters and analysis data**

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.10 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_f$ applied:	Yes
Earthquake magnitude $M_w$ :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.20	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.10 m	Fill height:	N/A	Limit depth:	10.00 m

**F.S. color scheme**

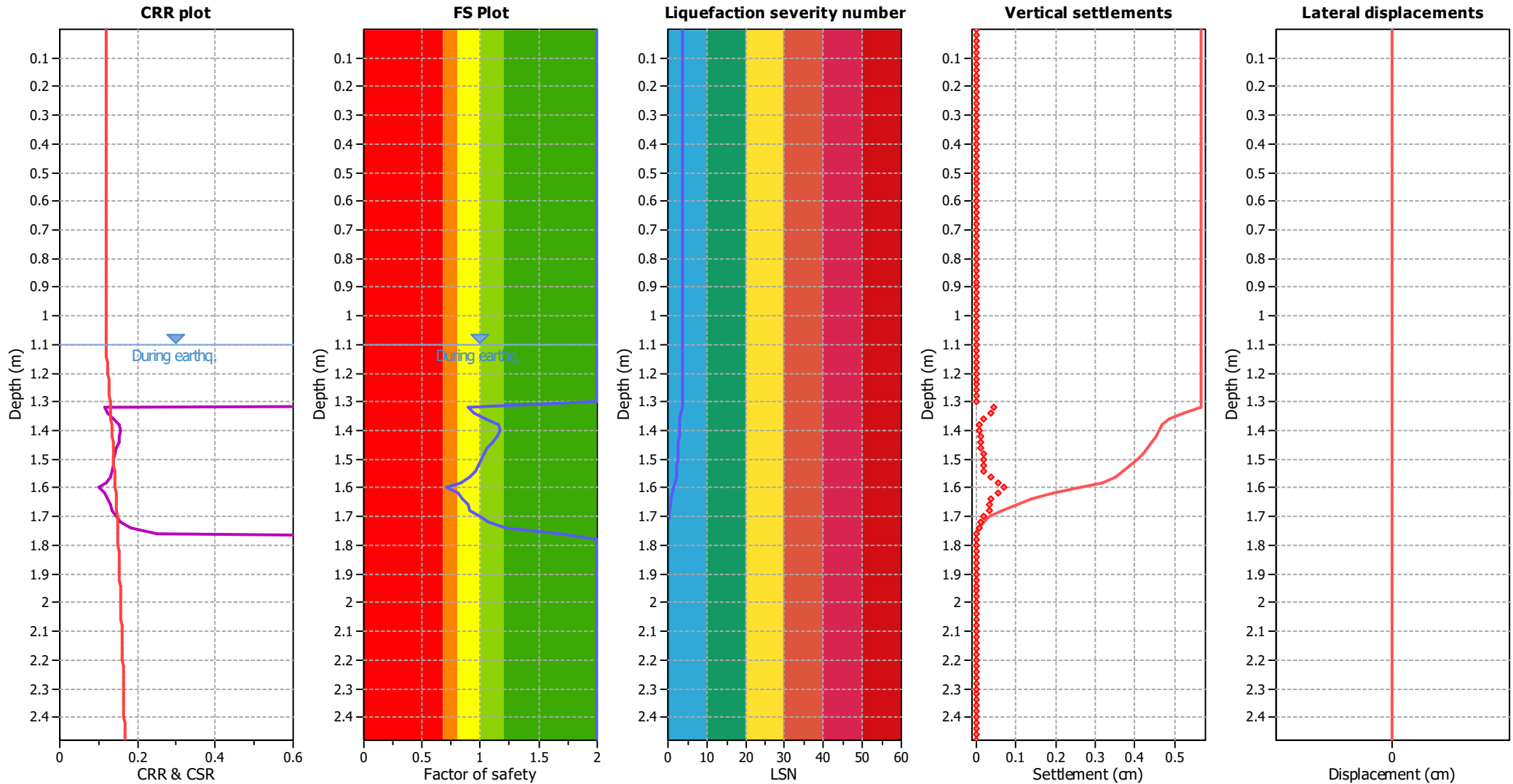
- Almost certain it will liquefy
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- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

**LSN color scheme**

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### Liquefaction analysis overall plots



**Input parameters and analysis data**

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.10 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_v$ applied:	Yes
Earthquake magnitude $M_w$ :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.20	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.10 m	Fill height:	N/A	Limit depth:	10.00 m

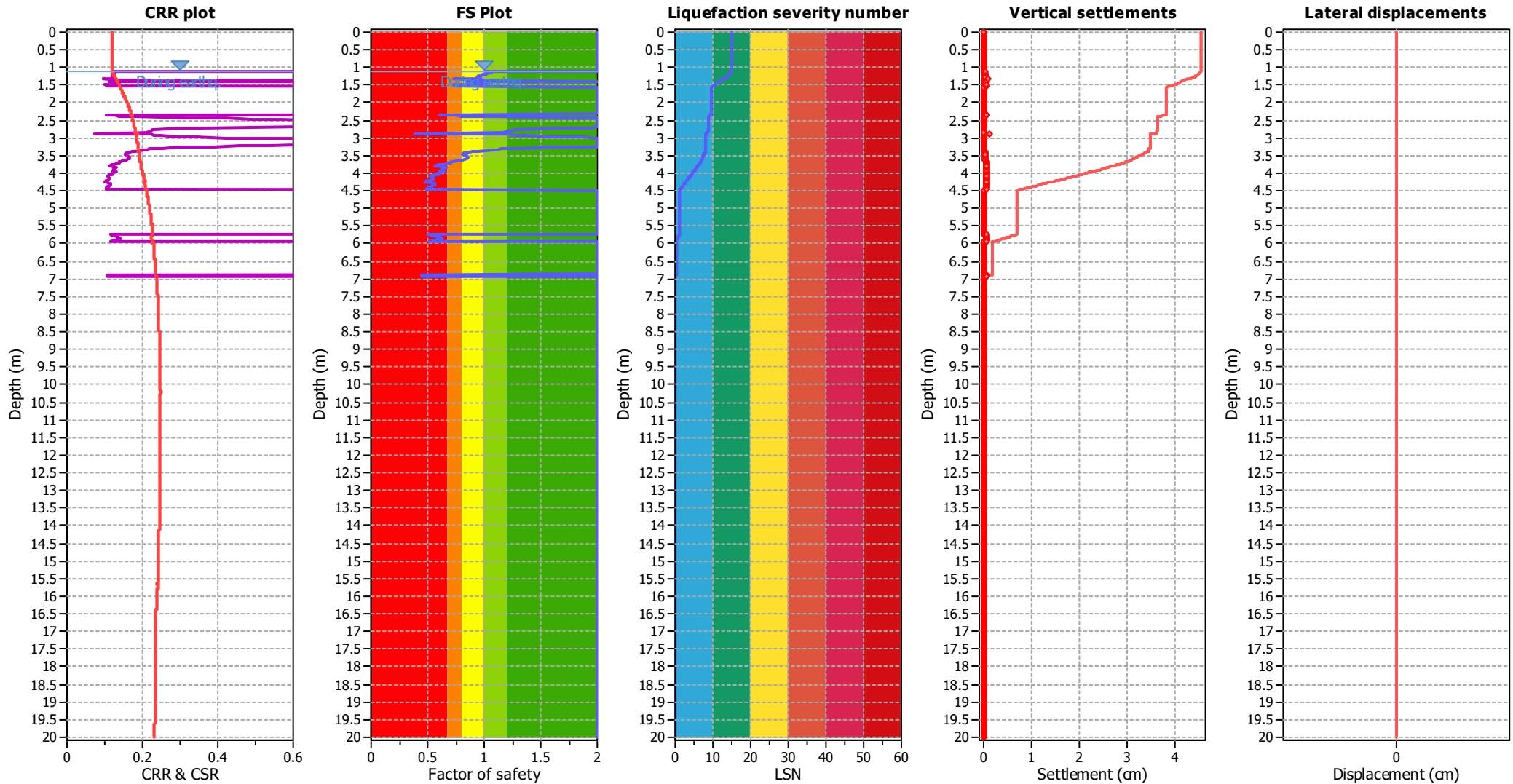
**F.S. color scheme**

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### Liquefaction analysis overall plots



**Input parameters and analysis data**

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.10 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K <sub>v</sub> applied:	Yes
Earthquake magnitude M <sub>w</sub> :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.20	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.10 m	Fill height:	N/A	Limit depth:	10.00 m

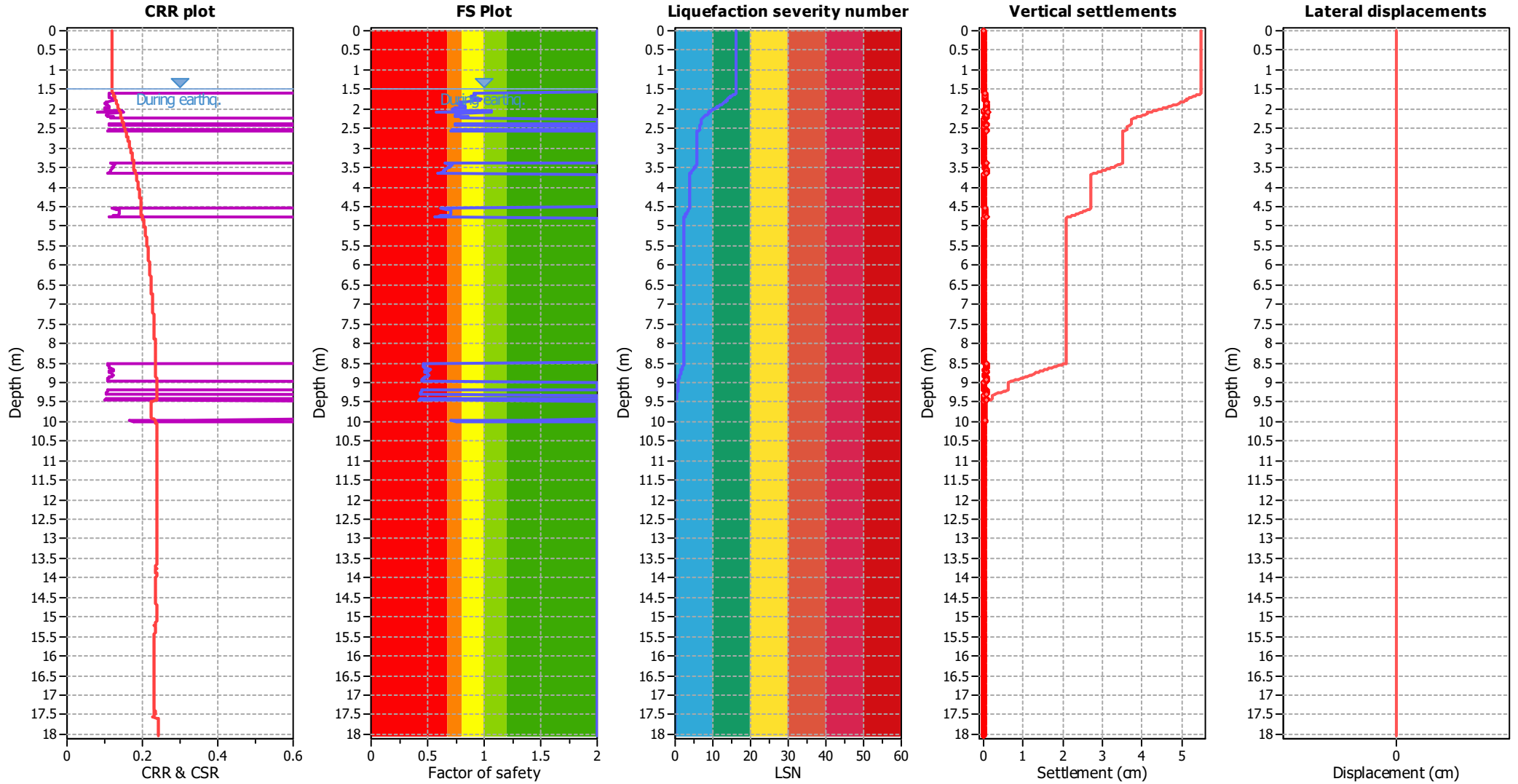
**F.S. color scheme**

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### Liquefaction analysis overall plots



**Input parameters and analysis data**

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.50 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K <sub>v</sub> applied:	Yes
Earthquake magnitude M <sub>w</sub> :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.20	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	10.00 m

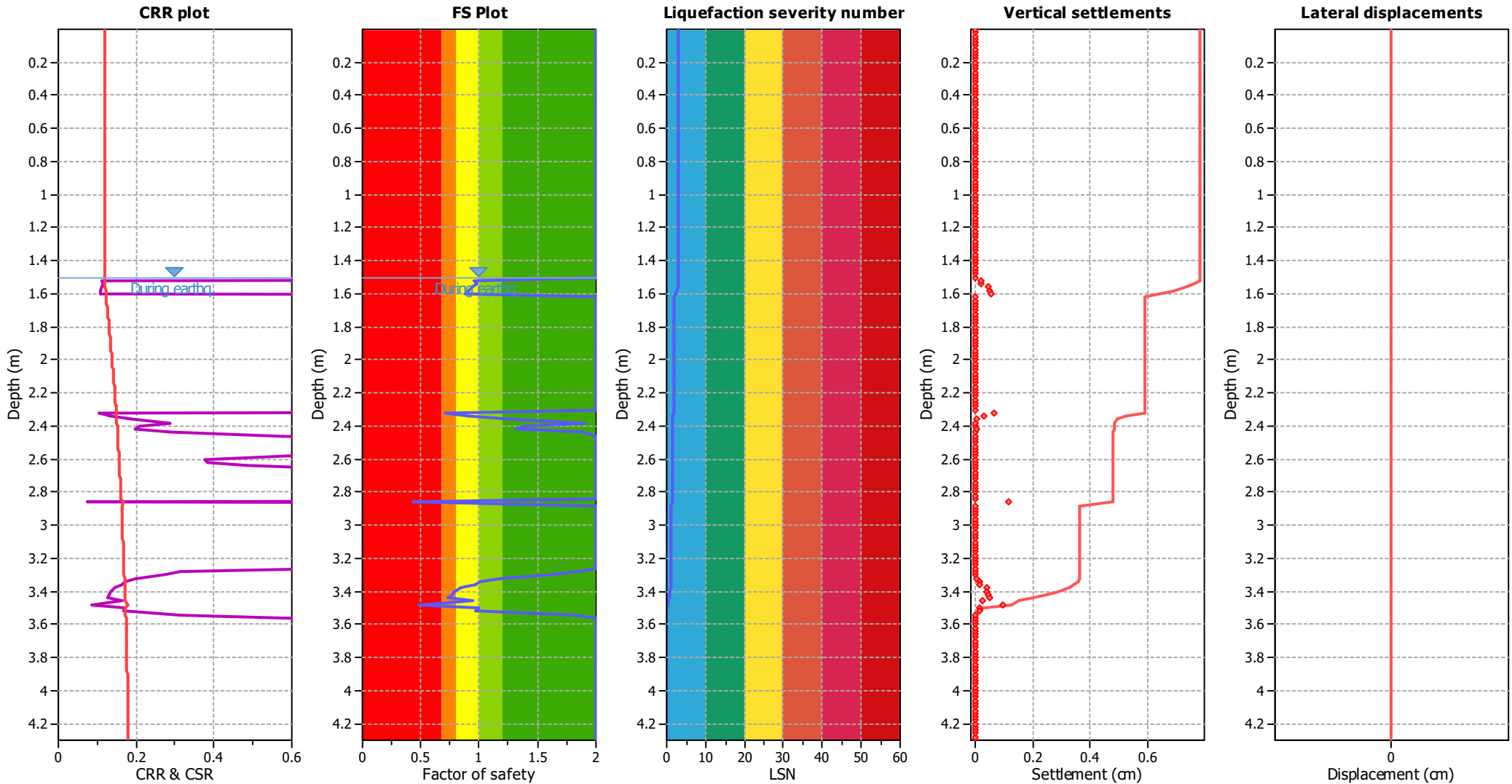
**F.S. color scheme**

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

**LSN color scheme**

- Severe damage
- Major expression of liquefaction
- Moderate to severe exp. of liquefaction
- Moderate expression of liquefaction
- Minor expression of liquefaction
- Little to no expression of liquefaction

### Liquefaction analysis overall plots



**Input parameters and analysis data**

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.50 m
Fines correction method:	B&I (2014)	Average results interval:	3
Points to test:	Based on Ic value	Ic cut-off value:	2.60
Earthquake magnitude $M_w$ :	7.50	Unit weight calculation:	Based on SBT
Peak ground acceleration:	0.20	Use fill:	No
Depth to water table (insitu):	1.50 m	Fill height:	N/A

Fill weight:	N/A
Transition detect. applied:	No
$K_v$ applied:	Yes
Clay like behavior applied:	Sands only
Limit depth applied:	Yes
Limit depth:	10.00 m

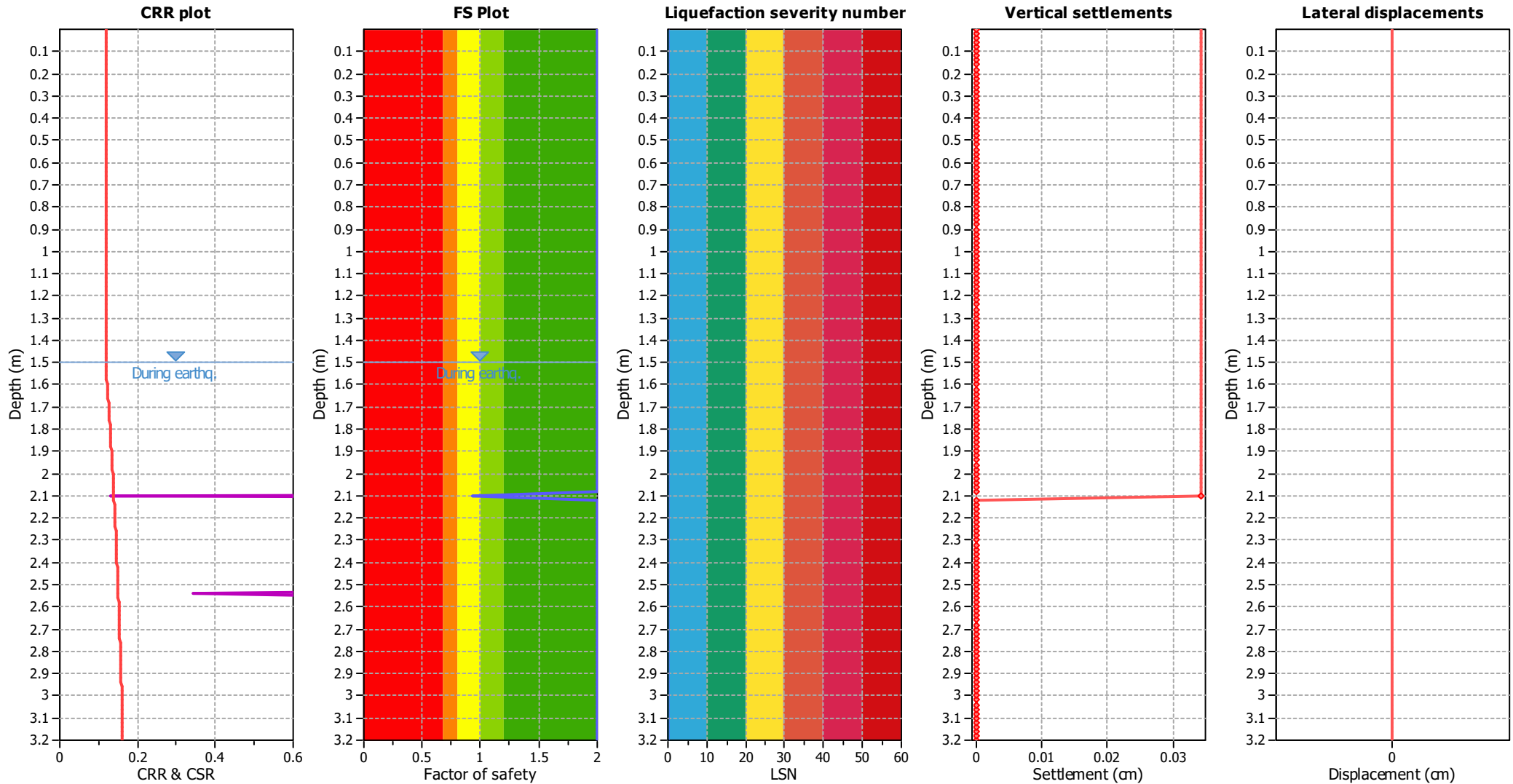
**F.S. color scheme**

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- Very likely to liquefy
- Liquefaction and no liq. are equally likely
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**LSN color scheme**

- Severe damage
- Major expression of liquefaction
- Moderate to severe exp. of liquefaction
- Moderate expression of liquefaction
- Minor expression of liquefaction
- Little to no expression of liquefaction

### Liquefaction analysis overall plots



**Input parameters and analysis data**

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.50 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_d$ applied:	Yes
Earthquake magnitude $M_w$ :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.20	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	10.00 m

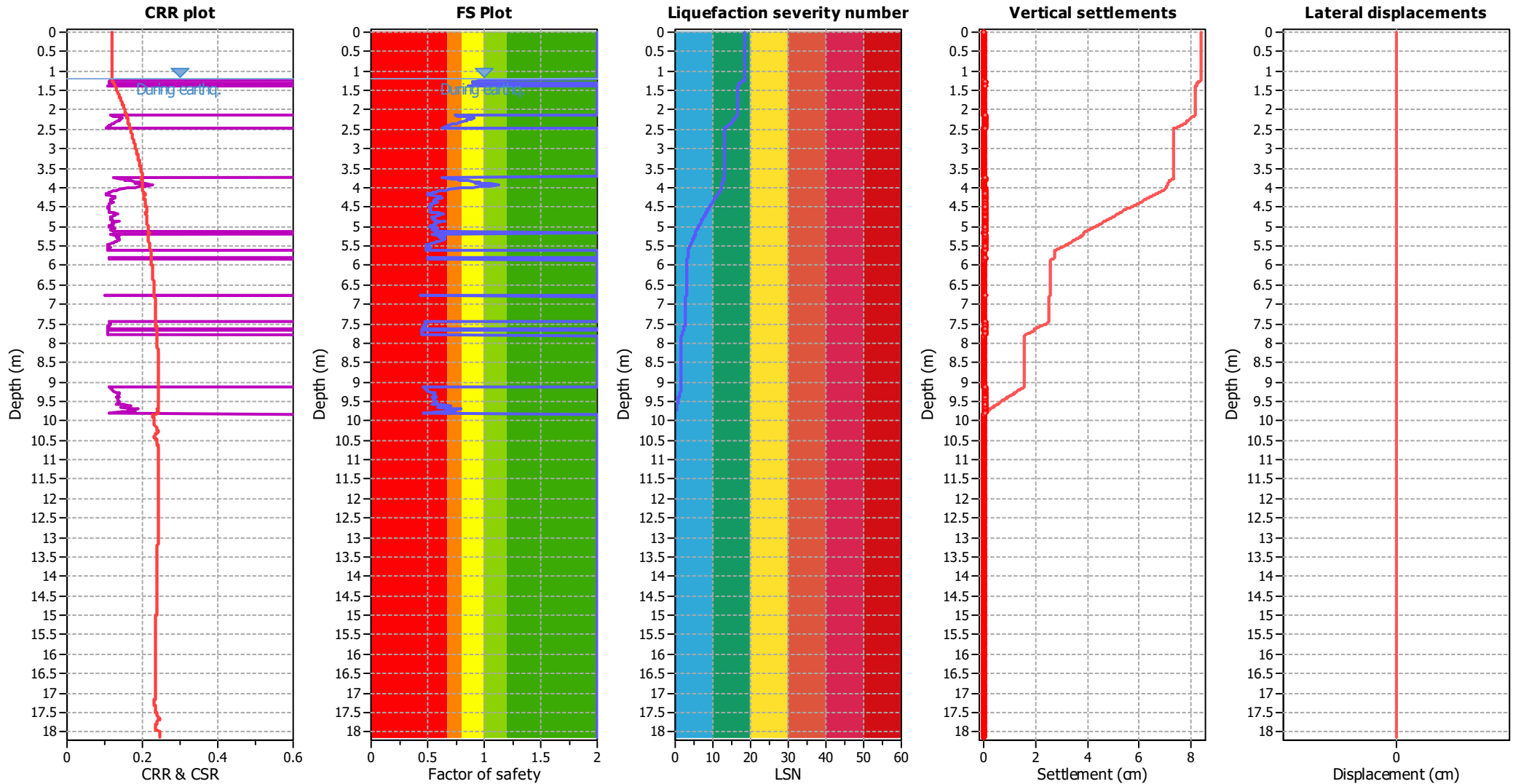
**F.S. color scheme**

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- Minor expression of liquefaction
- Little to no expression of liquefaction

### Liquefaction analysis overall plots



**Input parameters and analysis data**

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.20 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_{\sigma}$ applied:	Yes
Earthquake magnitude $M_w$ :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.20	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.20 m	Fill height:	N/A	Limit depth:	10.00 m

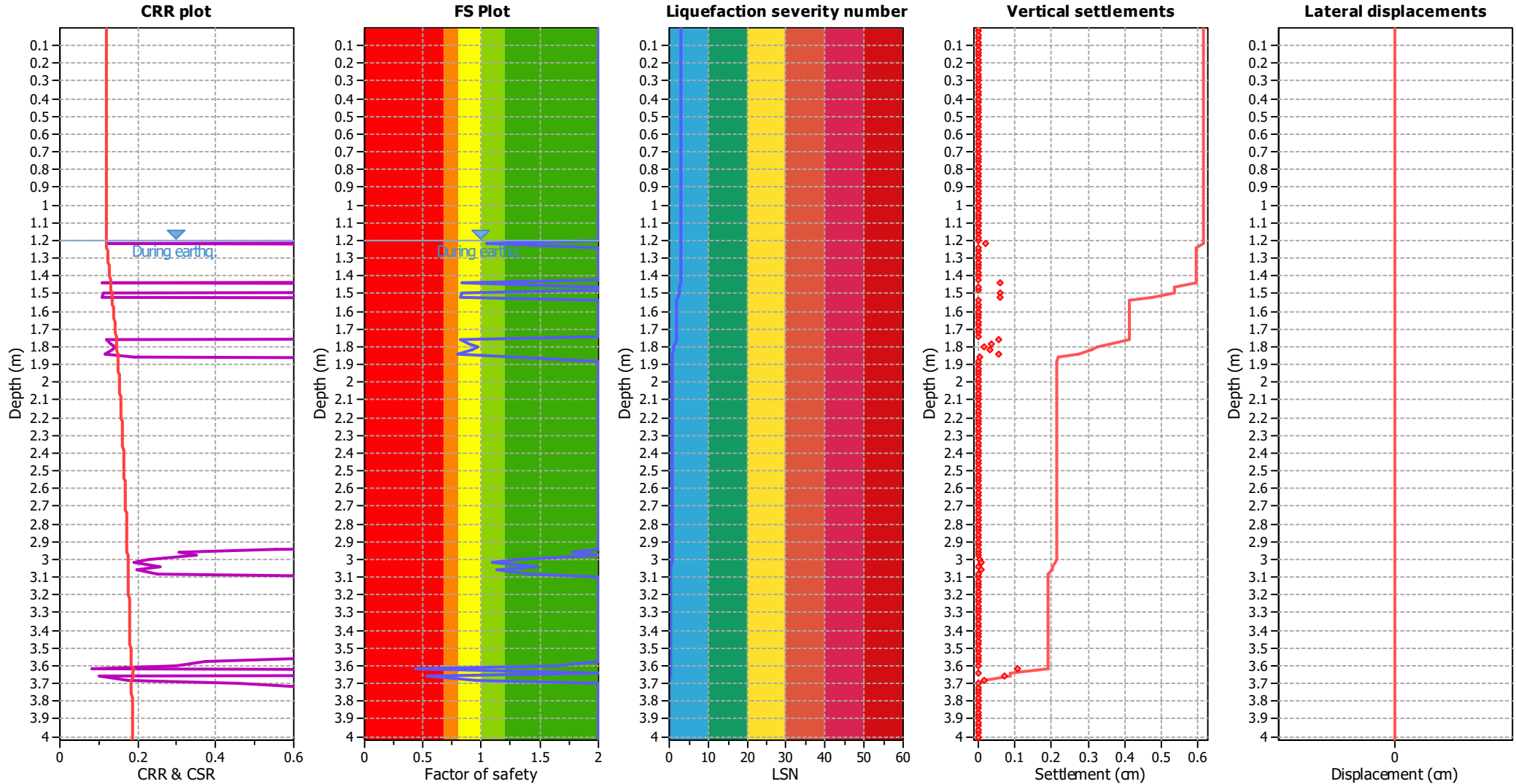
**F.S. color scheme**

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- Very likely to liquefy
- Liquefaction and no liq. are equally likely
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**LSN color scheme**

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- Major expression of liquefaction
- Moderate to severe exp. of liquefaction
- Moderate expression of liquefaction
- Minor expression of liquefaction
- Little to no expression of liquefaction

### Liquefaction analysis overall plots



**Input parameters and analysis data**

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.20 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_f$ applied:	Yes
Earthquake magnitude $M_w$ :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.20	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.20 m	Fill height:	N/A	Limit depth:	10.00 m

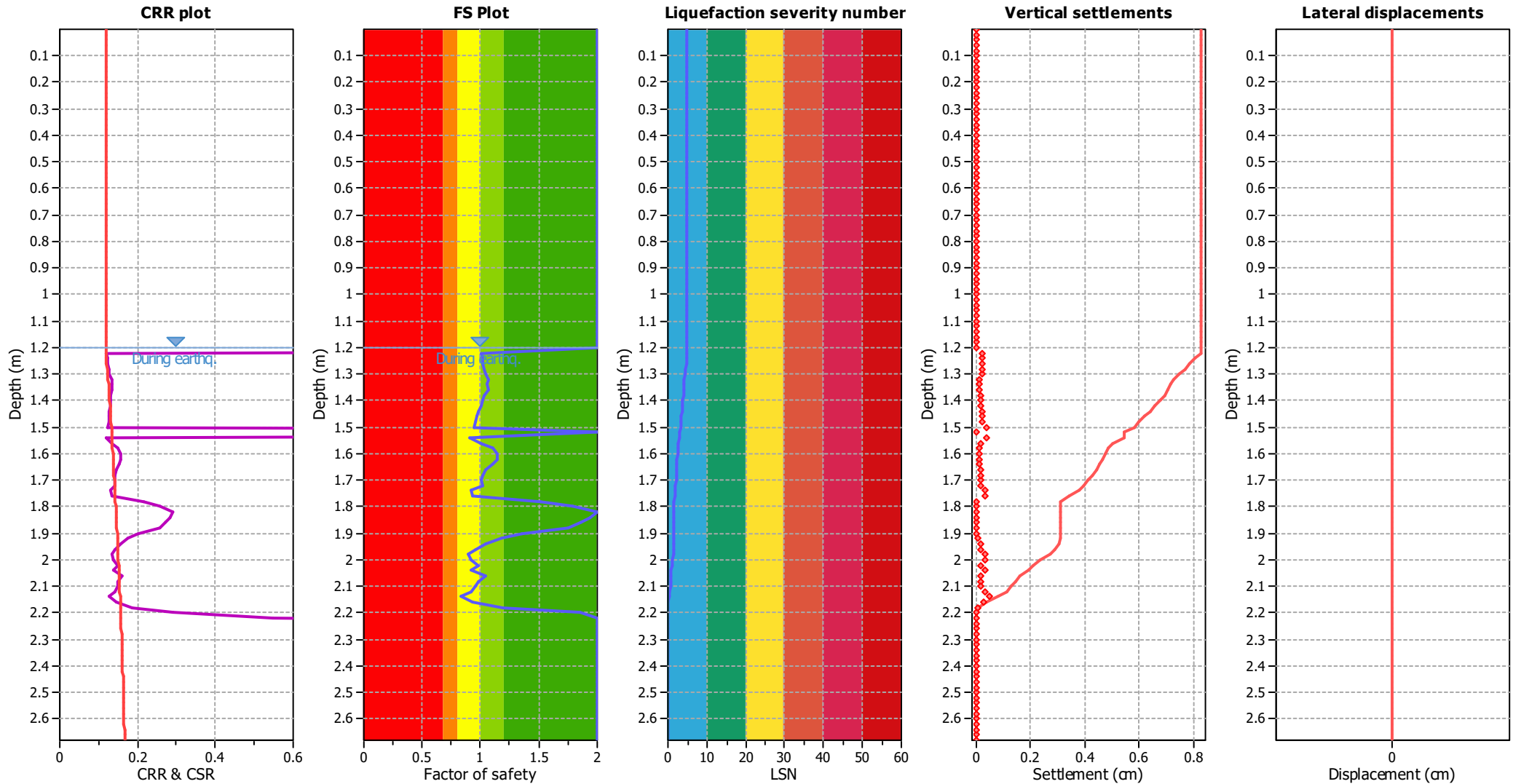
**F.S. color scheme**

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- Very likely to liquefy
- Liquefaction and no liq. are equally likely
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- Major expression of liquefaction
- Moderate to severe exp. of liquefaction
- Moderate expression of liquefaction
- Minor expression of liquefaction
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### Liquefaction analysis overall plots



**Input parameters and analysis data**

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.20 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_f$ applied:	Yes
Earthquake magnitude $M_w$ :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.20	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.20 m	Fill height:	N/A	Limit depth:	10.00 m

**F.S. color scheme**

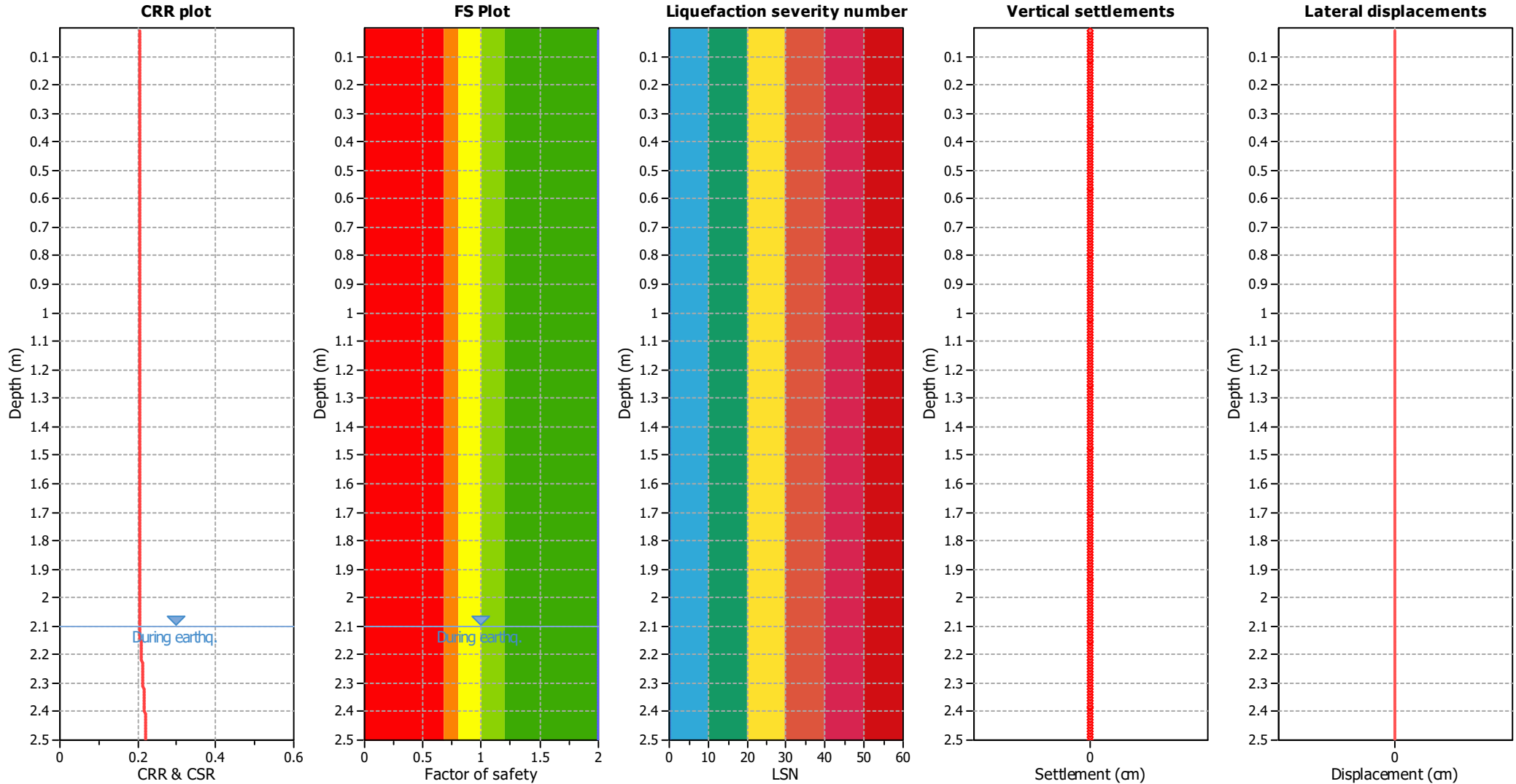
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- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

**LSN color scheme**

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- Moderate to severe exp. of liquefaction
- Moderate expression of liquefaction
- Minor expression of liquefaction
- Little to no expression of liquefaction



### Liquefaction analysis overall plots



**Input parameters and analysis data**

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.10 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_f$ applied:	Yes
Earthquake magnitude $M_w$ :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.10 m	Fill height:	N/A	Limit depth:	10.00 m

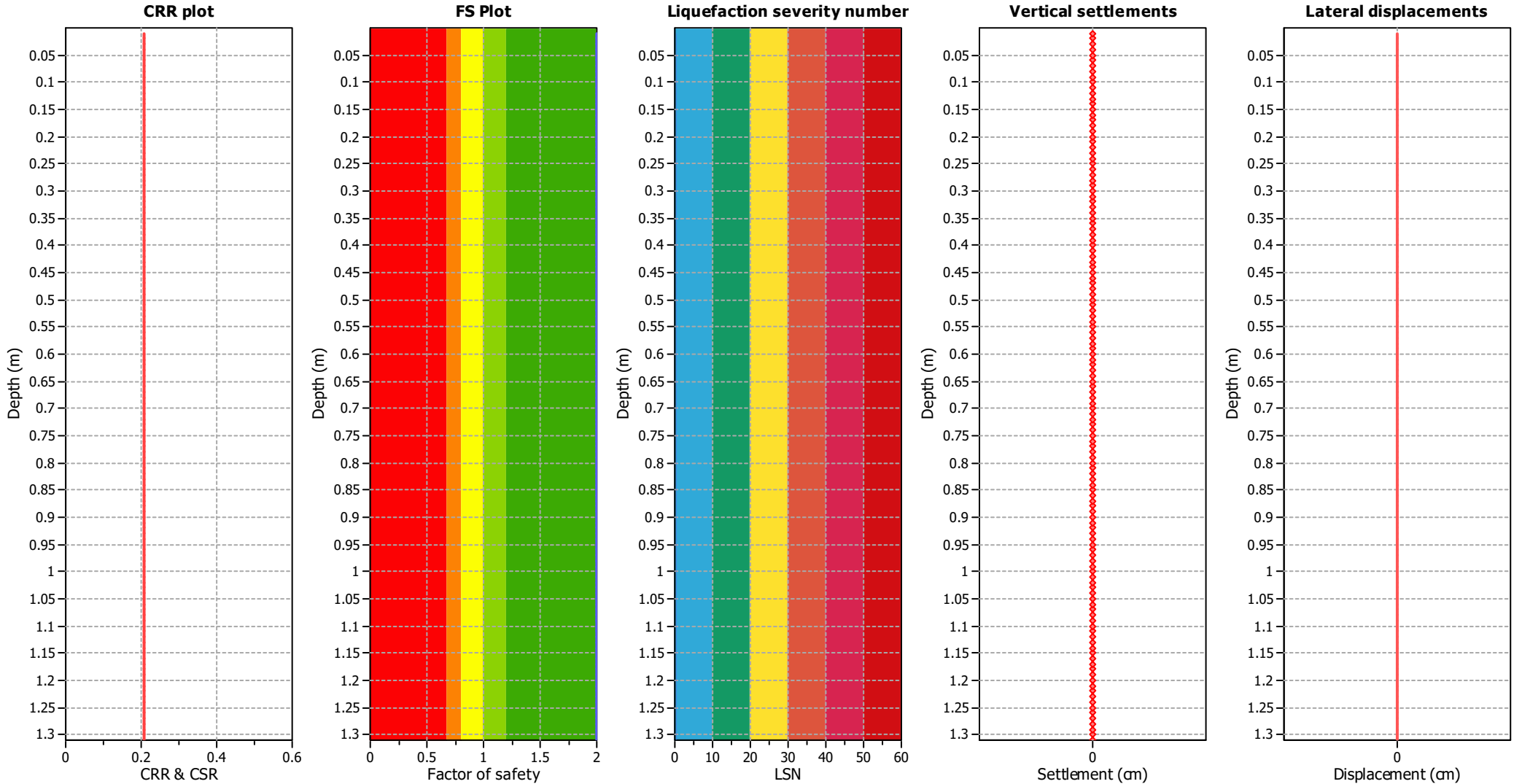
**F.S. color scheme**

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- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

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- Moderate to severe exp. of liquefaction
- Moderate expression of liquefaction
- Minor expression of liquefaction
- Little to no expression of liquefaction

### Liquefaction analysis overall plots



**Input parameters and analysis data**

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.10 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_{\sigma}$ applied:	Yes
Earthquake magnitude $M_w$ :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.10 m	Fill height:	N/A	Limit depth:	10.00 m

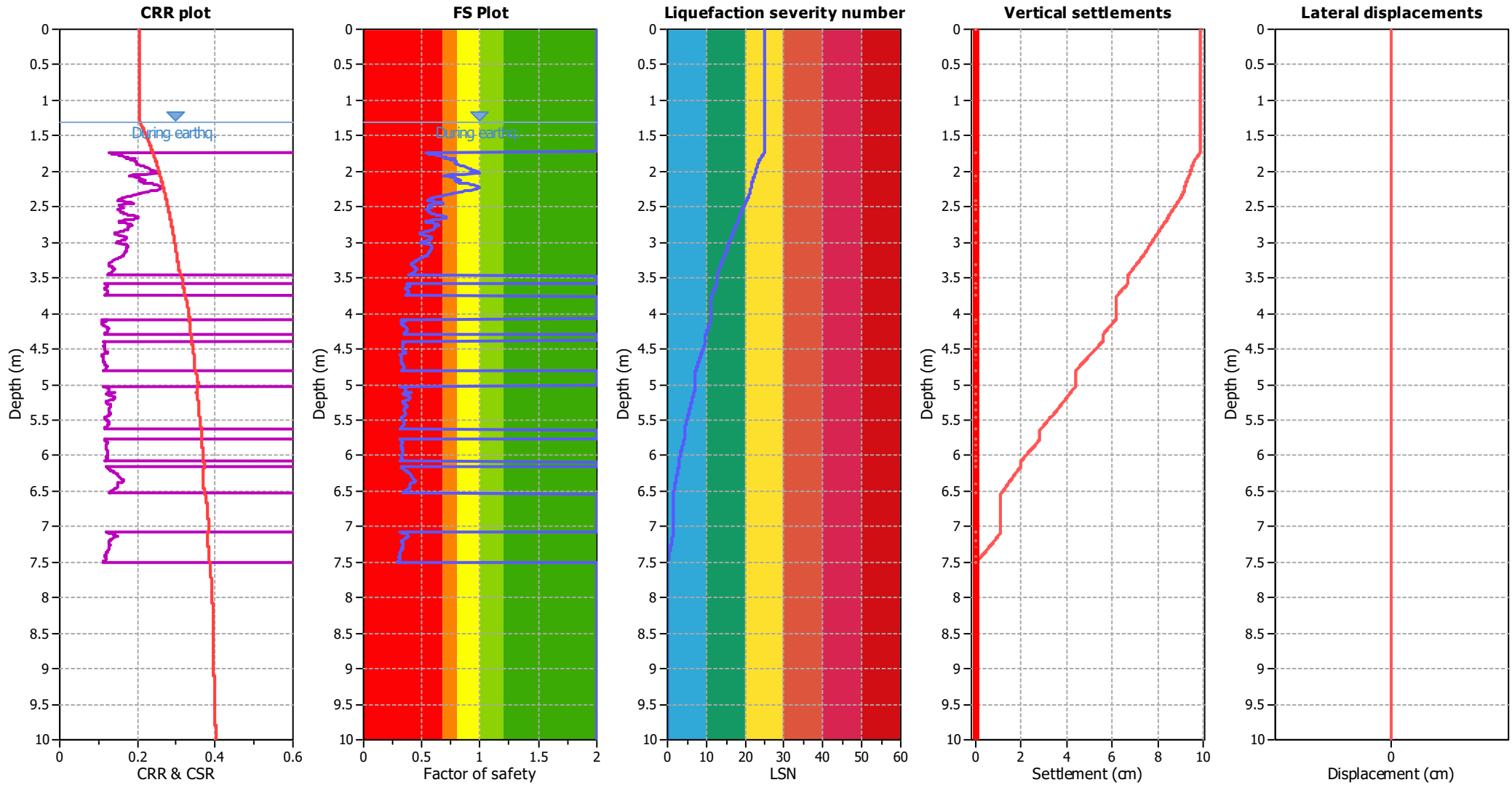
**F.S. color scheme**

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- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
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**LSN color scheme**

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- Moderate to severe exp. of liquefaction
- Moderate expression of liquefaction
- Minor expression of liquefaction
- Little to no expression of liquefaction

### Liquefaction analysis overall plots



**Input parameters and analysis data**

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.30 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_d$ applied:	Yes
Earthquake magnitude $M_w$ :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.30 m	Fill height:	N/A	Limit depth:	10.00 m

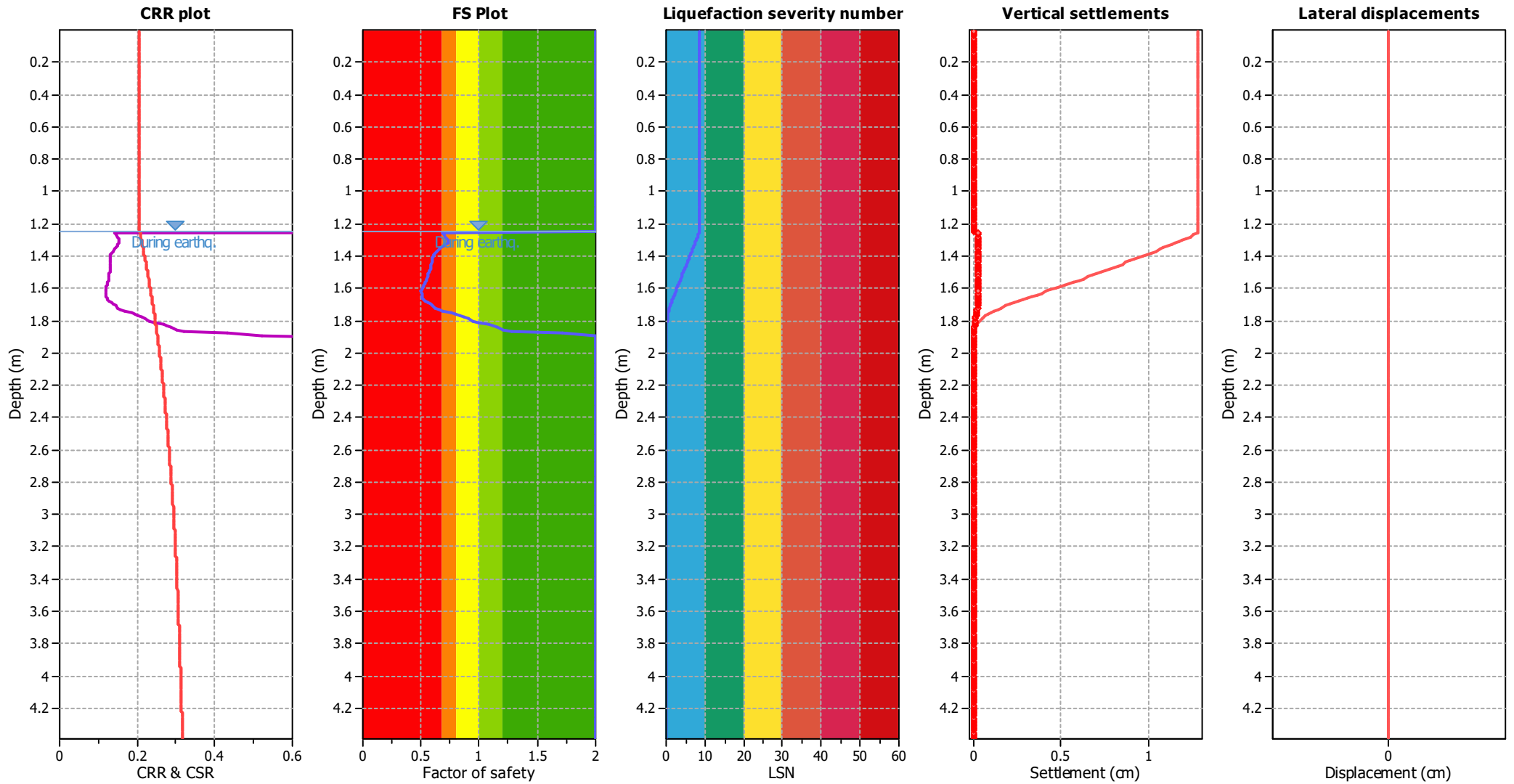
**F.S. color scheme**

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- Liquefaction and no liq. are equally likely
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- Moderate to severe exp. of liquefaction
- Moderate expression of liquefaction
- Minor expression of liquefaction
- Little to no expression of liquefaction

### Liquefaction analysis overall plots



#### Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.25 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_f$ applied:	Yes
Earthquake magnitude $M_w$ :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.25 m	Fill height:	N/A	Limit depth:	10.00 m

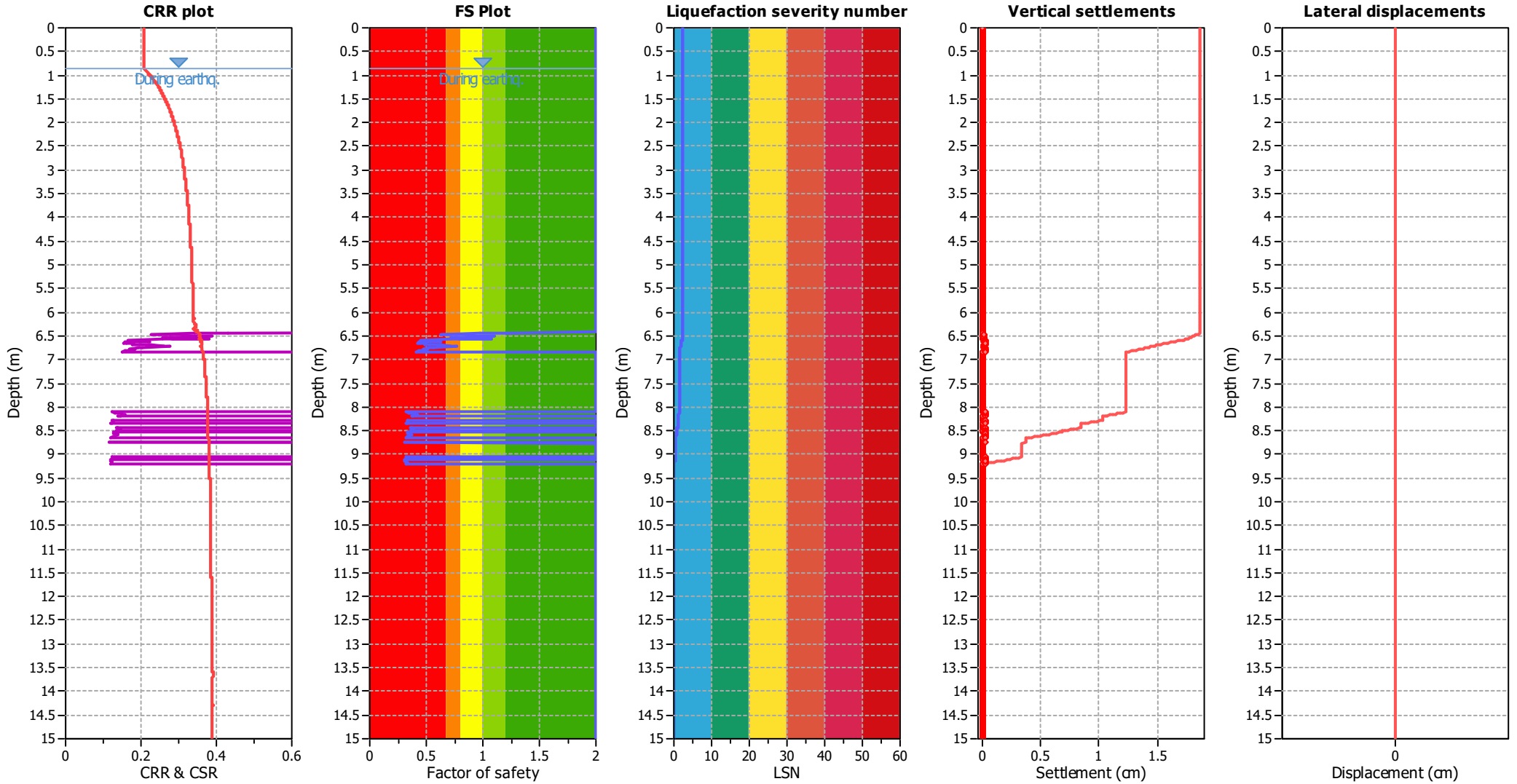
#### F.S. color scheme

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- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

#### LSN color scheme

- Severe damage
- Major expression of liquefaction
- Moderate to severe exp. of liquefaction
- Moderate expression of liquefaction
- Minor expression of liquefaction
- Little to no expression of liquefaction

### Liquefaction analysis overall plots



**Input parameters and analysis data**

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	0.85 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_v$ applied:	Yes
Earthquake magnitude $M_w$ :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	0.85 m	Fill height:	N/A	Limit depth:	10.00 m

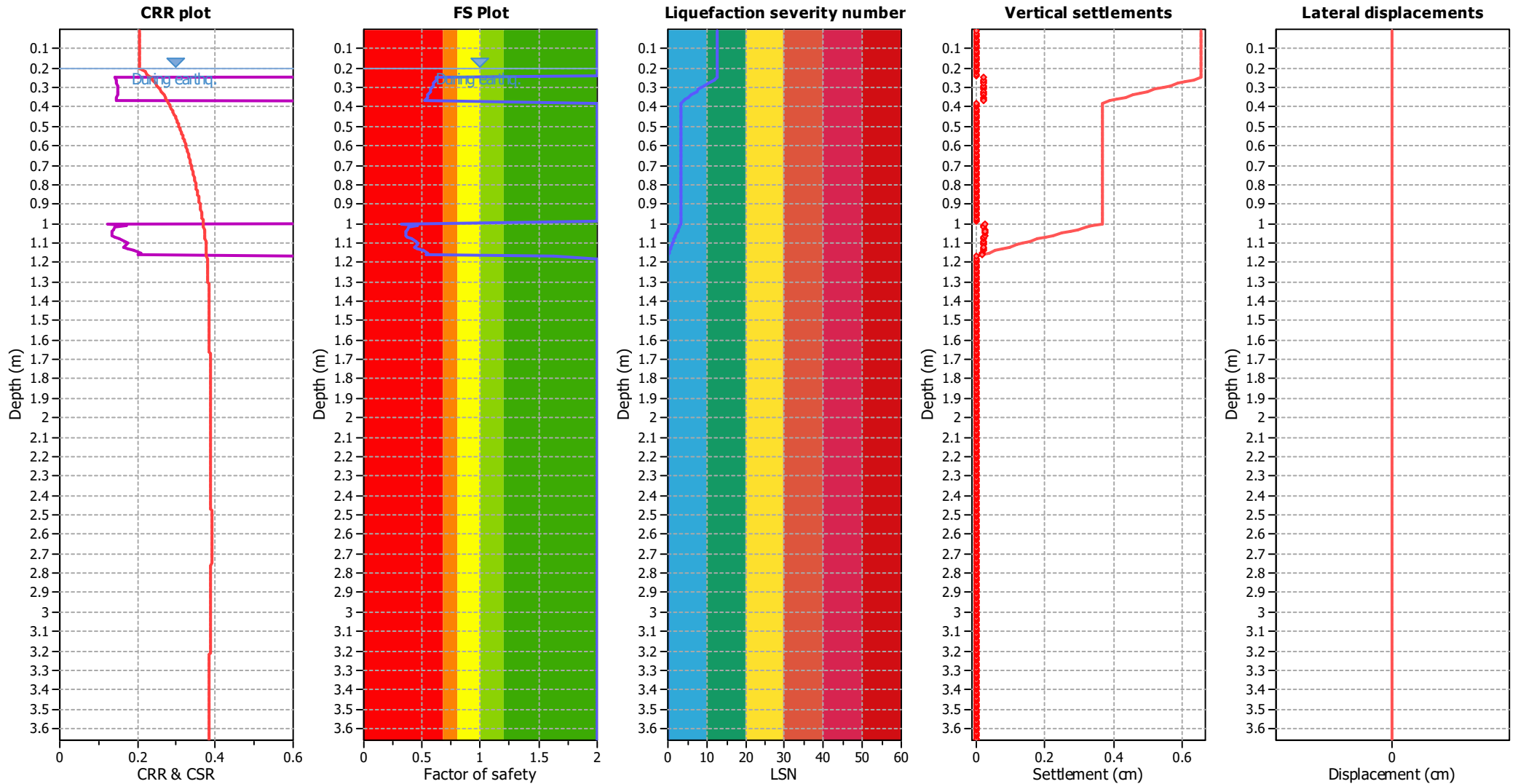
**F.S. color scheme**

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- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

**LSN color scheme**

- Severe damage
- Major expression of liquefaction
- Moderate to severe exp. of liquefaction
- Moderate expression of liquefaction
- Minor expression of liquefaction
- Little to no expression of liquefaction

### Liquefaction analysis overall plots



**Input parameters and analysis data**

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	0.20 m
Fines correction method:	B&I (2014)	Average results interval:	3
Points to test:	Based on Ic value	Ic cut-off value:	2.60
Earthquake magnitude $M_w$ :	7.50	Unit weight calculation:	Based on SBT
Peak ground acceleration:	0.35	Use fill:	No
Depth to water table (insitu):	0.20 m	Fill height:	N/A

Fill weight:	N/A
Transition detect. applied:	No
$K_f$ applied:	Yes
Clay like behavior applied:	Sands only
Limit depth applied:	Yes
Limit depth:	10.00 m

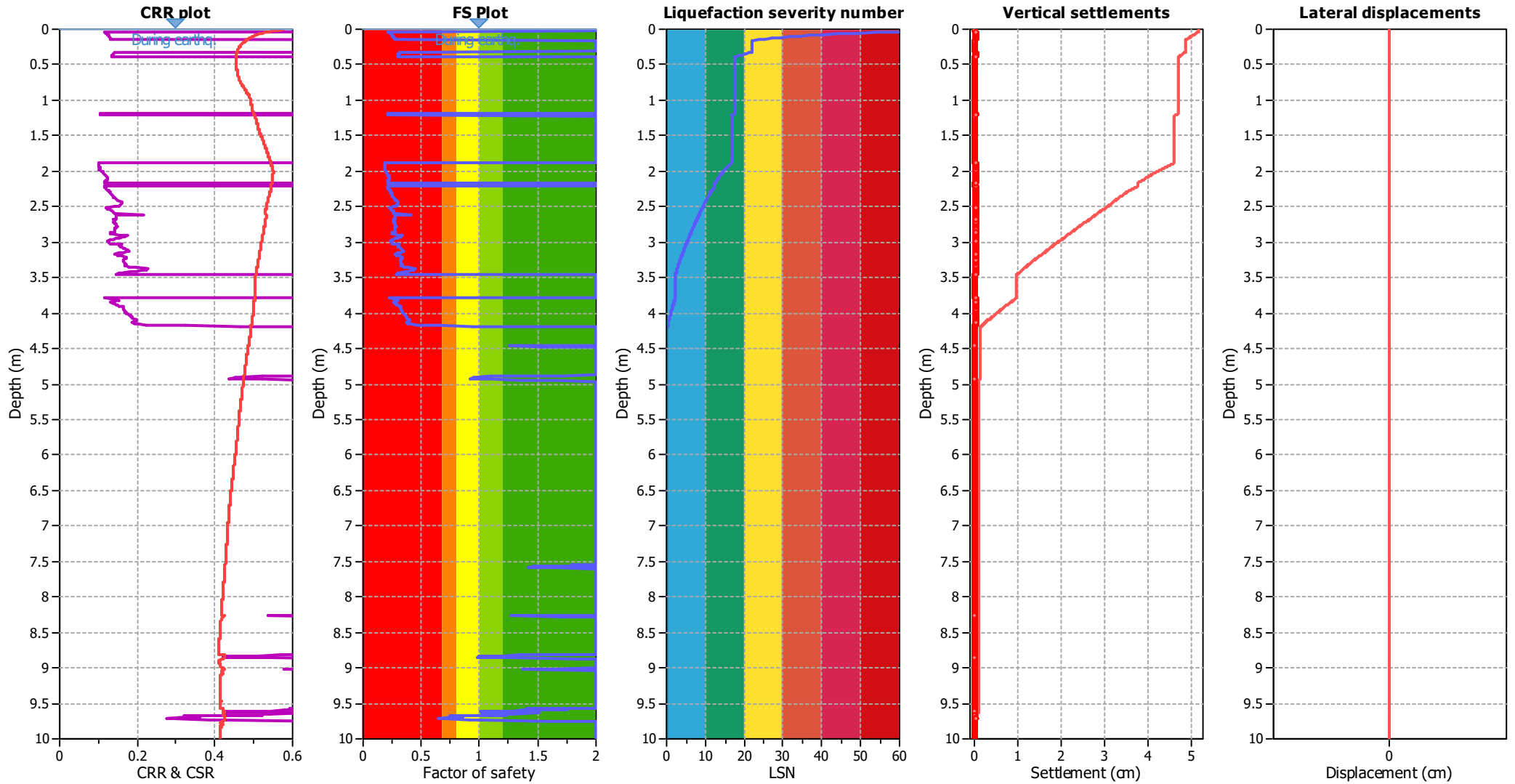
**F.S. color scheme**

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- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

**LSN color scheme**

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- Moderate expression of liquefaction
- Minor expression of liquefaction
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### Liquefaction analysis overall plots



#### Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	0.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_d$ applied:	Yes
Earthquake magnitude $M_w$ :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	0.00 m	Fill height:	N/A	Limit depth:	10.00 m

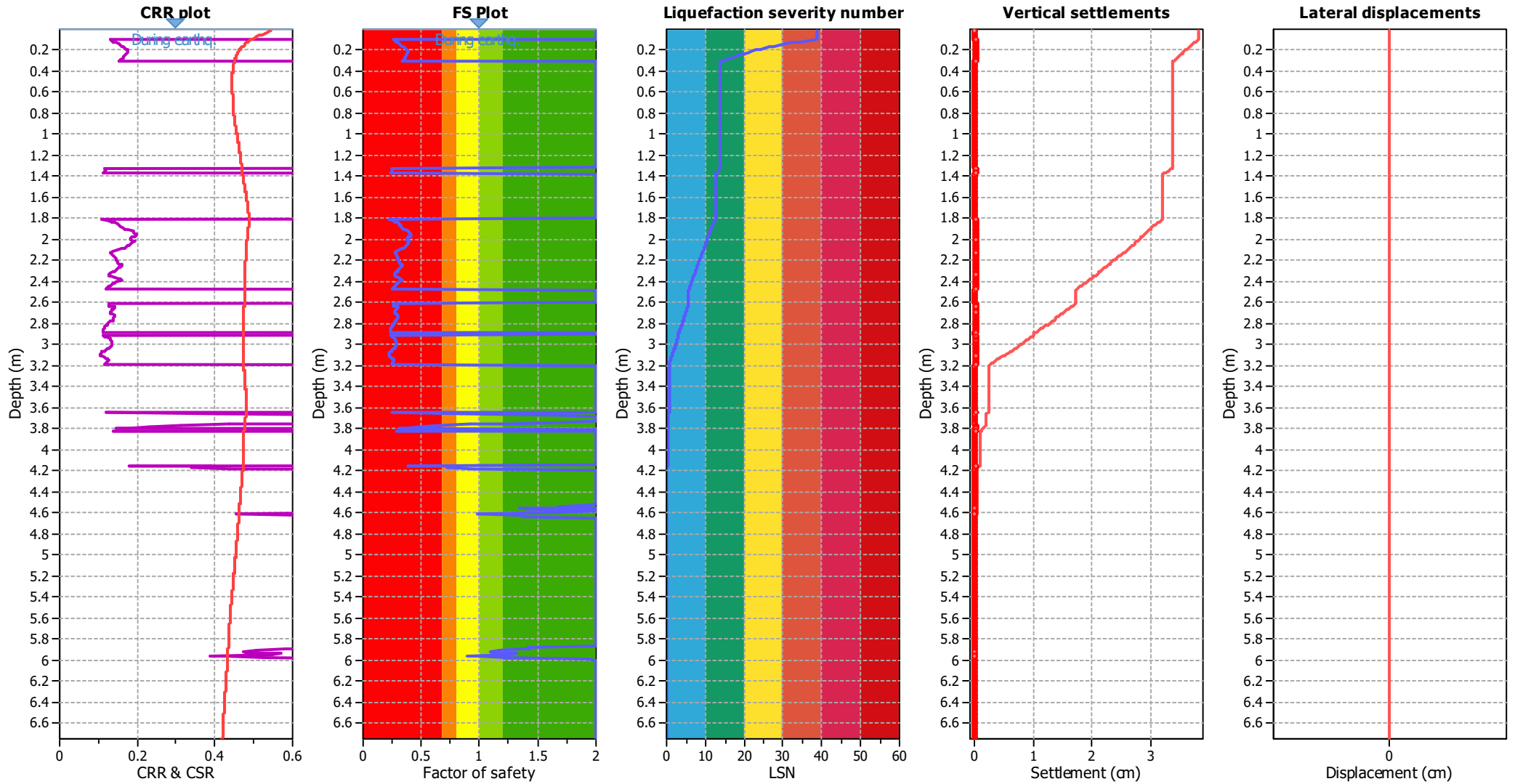
#### F.S. color scheme

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#### LSN color scheme

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### Liquefaction analysis overall plots



#### Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	0.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_d$ applied:	Yes
Earthquake magnitude $M_w$ :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	0.00 m	Fill height:	N/A	Limit depth:	10.00 m

#### F.S. color scheme

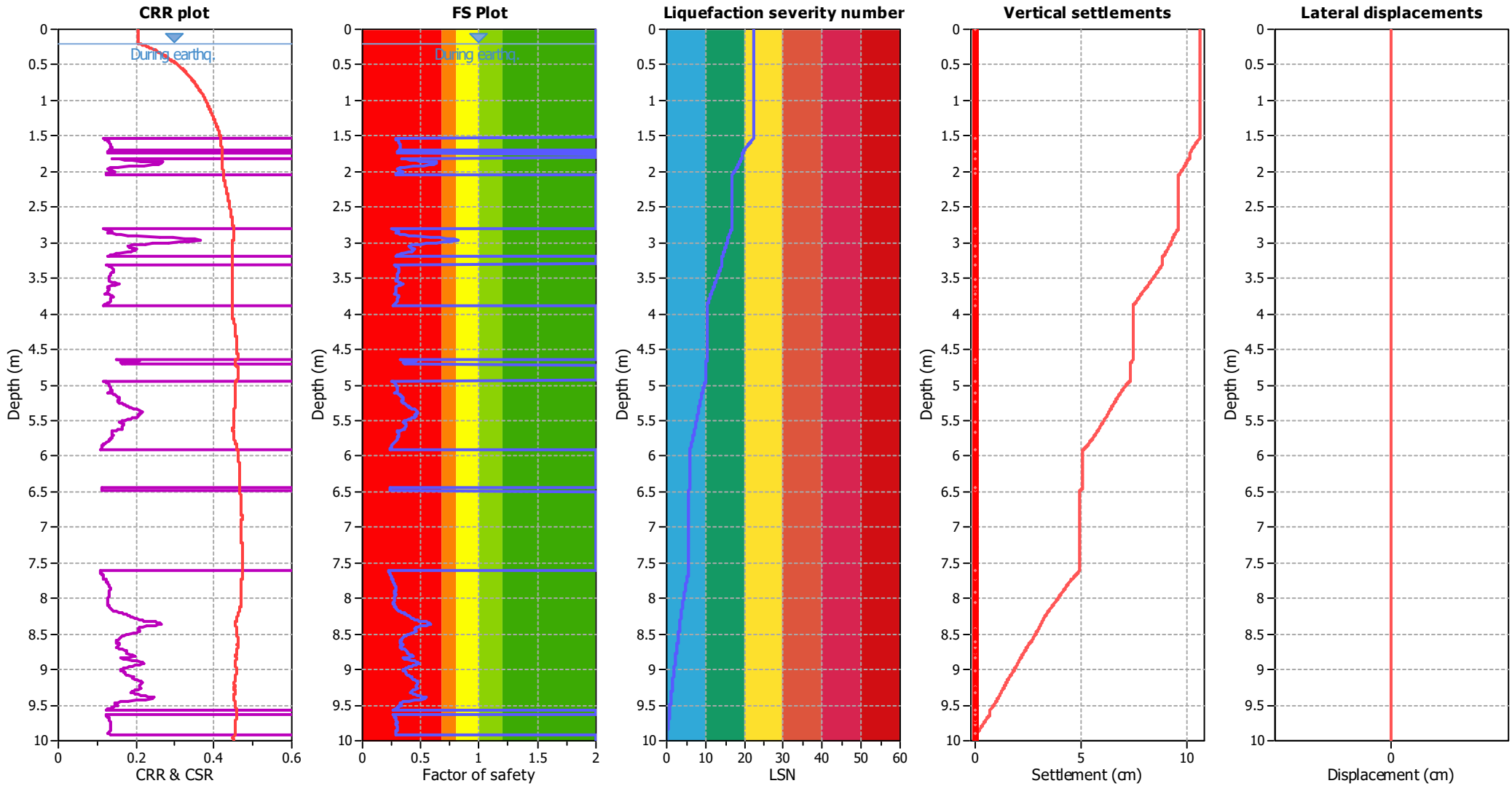
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- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
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#### LSN color scheme

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- Moderate to severe exp. of liquefaction
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- Little to no expression of liquefaction



### Liquefaction analysis overall plots



**Input parameters and analysis data**

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	0.20 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_{\sigma}$ applied:	Yes
Earthquake magnitude $M_w$ :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	0.20 m	Fill height:	N/A	Limit depth:	10.00 m

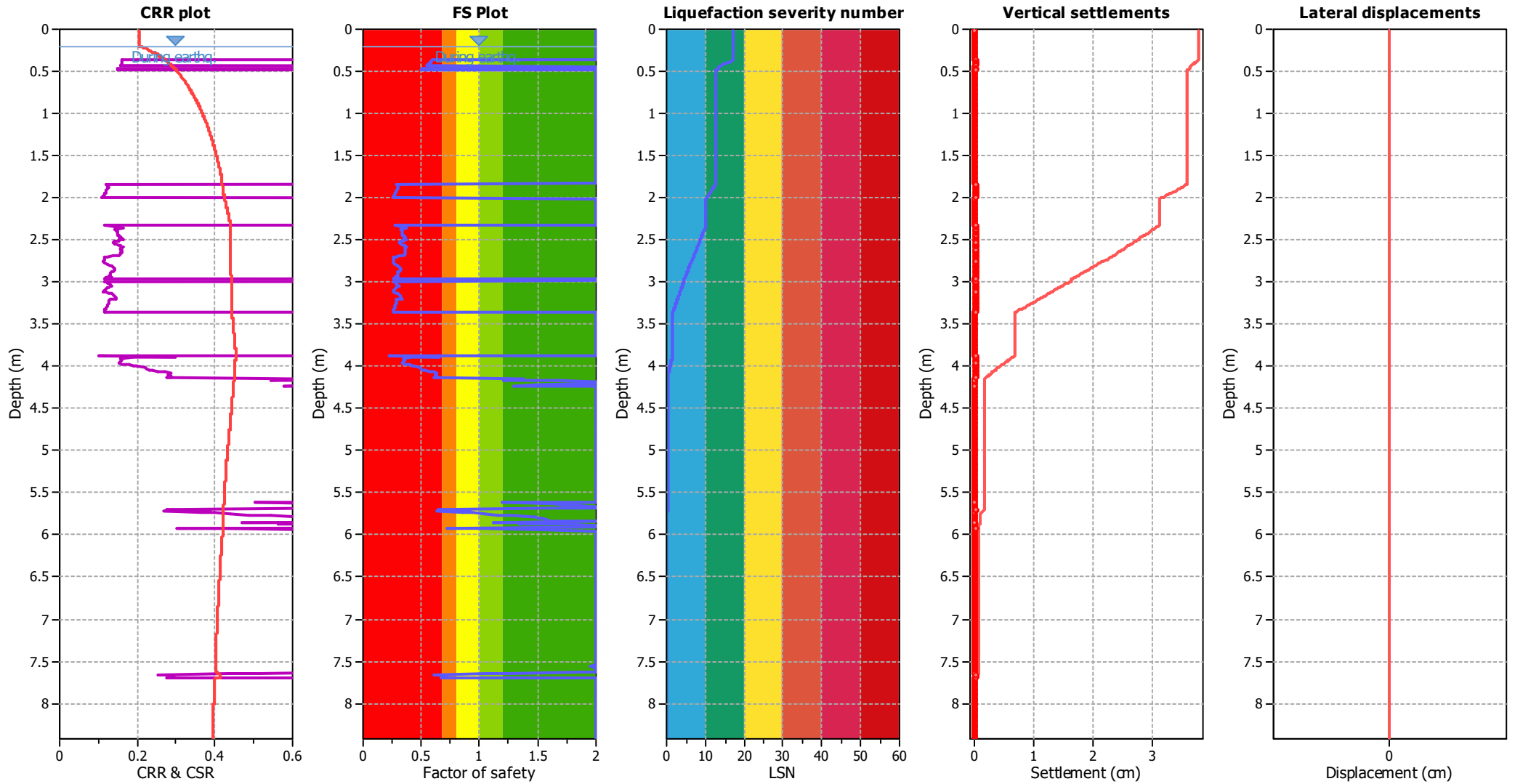
**F.S. color scheme**

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### Liquefaction analysis overall plots



**Input parameters and analysis data**

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	0.20 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K <sub>v</sub> applied:	Yes
Earthquake magnitude M <sub>w</sub> :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	0.20 m	Fill height:	N/A	Limit depth:	10.00 m

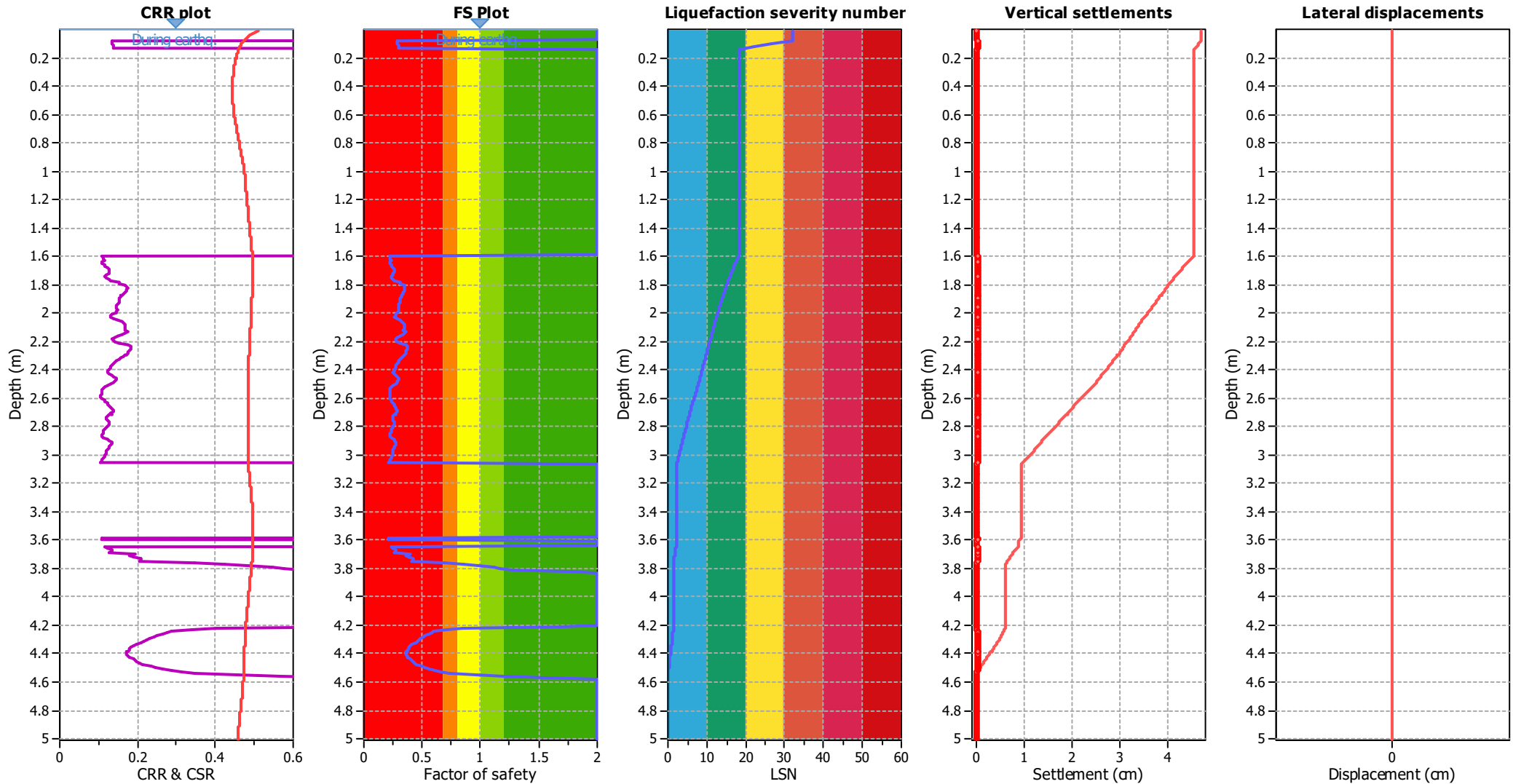
**F.S. color scheme**

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- Major expression of liquefaction
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- Moderate expression of liquefaction
- Minor expression of liquefaction
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### Liquefaction analysis overall plots



#### Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	0.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_f$ applied:	Yes
Earthquake magnitude $M_w$ :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	0.00 m	Fill height:	N/A	Limit depth:	10.00 m

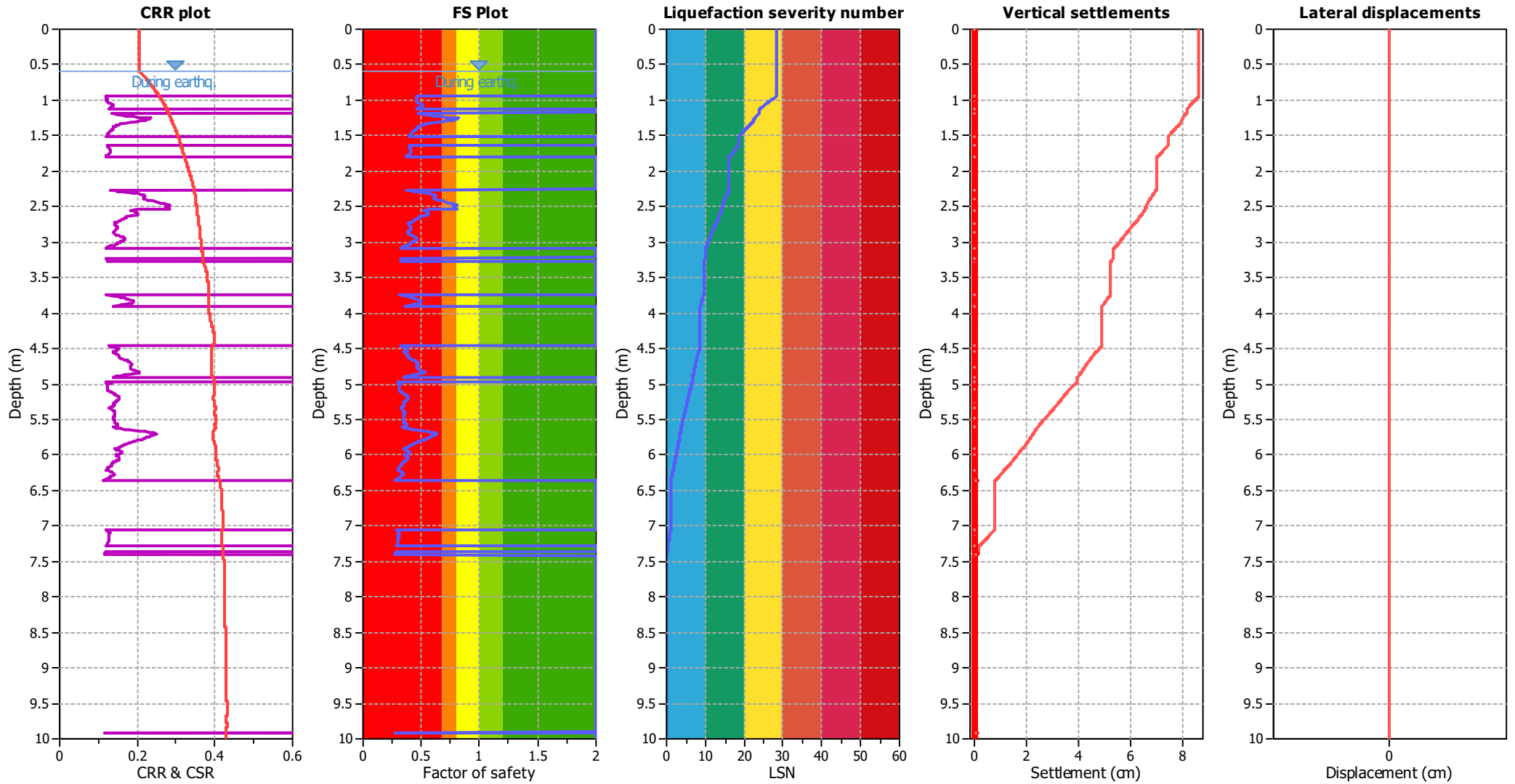
#### F.S. color scheme

- Almost certain it will liquefy
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- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

#### LSN color scheme

- Severe damage
- Major expression of liquefaction
- Moderate to severe exp. of liquefaction
- Moderate expression of liquefaction
- Minor expression of liquefaction
- Little to no expression of liquefaction

### Liquefaction analysis overall plots



#### Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	0.60 m
Fines correction method:	B&I (2014)	Average results interval:	3
Points to test:	Based on Ic value	Ic cut-off value:	2.60
Earthquake magnitude $M_w$ :	7.50	Unit weight calculation:	Based on SBT
Peak ground acceleration:	0.35	Use fill:	No
Depth to water table (insitu):	0.60 m	Fill height:	N/A

Fill weight:	N/A
Transition detect. applied:	No
$K_\sigma$ applied:	Yes
Clay like behavior applied:	Sands only
Limit depth applied:	Yes
Limit depth:	10.00 m

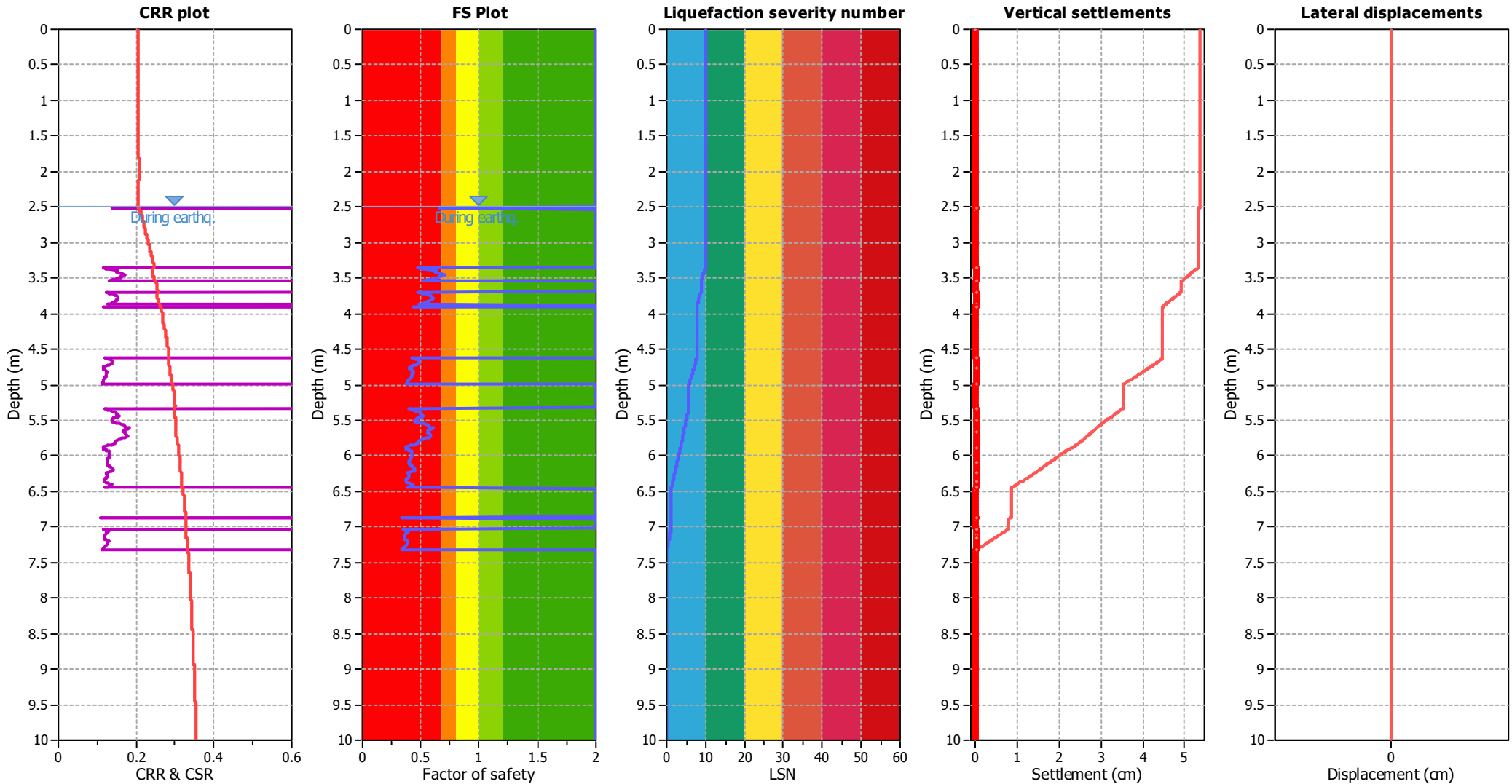
#### F.S. color scheme

<span style="color: red;">■</span>	Almost certain it will liquefy
<span style="color: orange;">■</span>	Very likely to liquefy
<span style="color: yellow;">■</span>	Liquefaction and no liq. are equally likely
<span style="color: lightgreen;">■</span>	Unlike to liquefy
<span style="color: green;">■</span>	Almost certain it will not liquefy

#### LSN color scheme

<span style="color: red;">■</span>	Severe damage
<span style="color: darkred;">■</span>	Major expression of liquefaction
<span style="color: orange;">■</span>	Moderate to severe exp. of liquefaction
<span style="color: yellow;">■</span>	Moderate expression of liquefaction
<span style="color: lightgreen;">■</span>	Minor expression of liquefaction
<span style="color: blue;">■</span>	Little to no expression of liquefaction

### Liquefaction analysis overall plots



**Input parameters and analysis data**

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.50 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_d$ applied:	Yes
Earthquake magnitude $M_w$ :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.50 m	Fill height:	N/A	Limit depth:	10.00 m

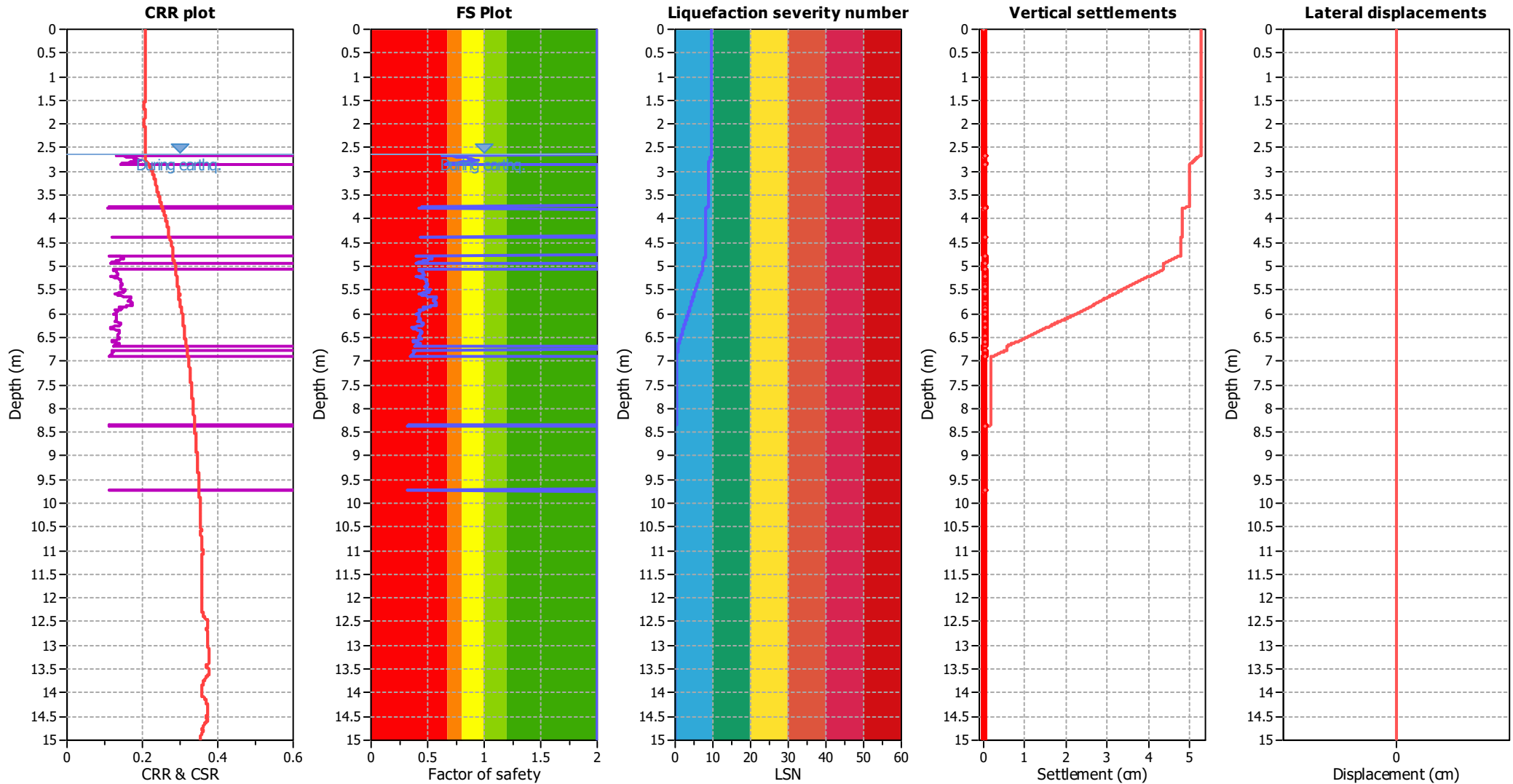
**F.S. color scheme**

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

**LSN color scheme**

- Severe damage
- Major expression of liquefaction
- Moderate to severe exp. of liquefaction
- Moderate expression of liquefaction
- Minor expression of liquefaction
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### Liquefaction analysis overall plots



#### Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.65 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_f$ applied:	Yes
Earthquake magnitude $M_w$ :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.65 m	Fill height:	N/A	Limit depth:	10.00 m

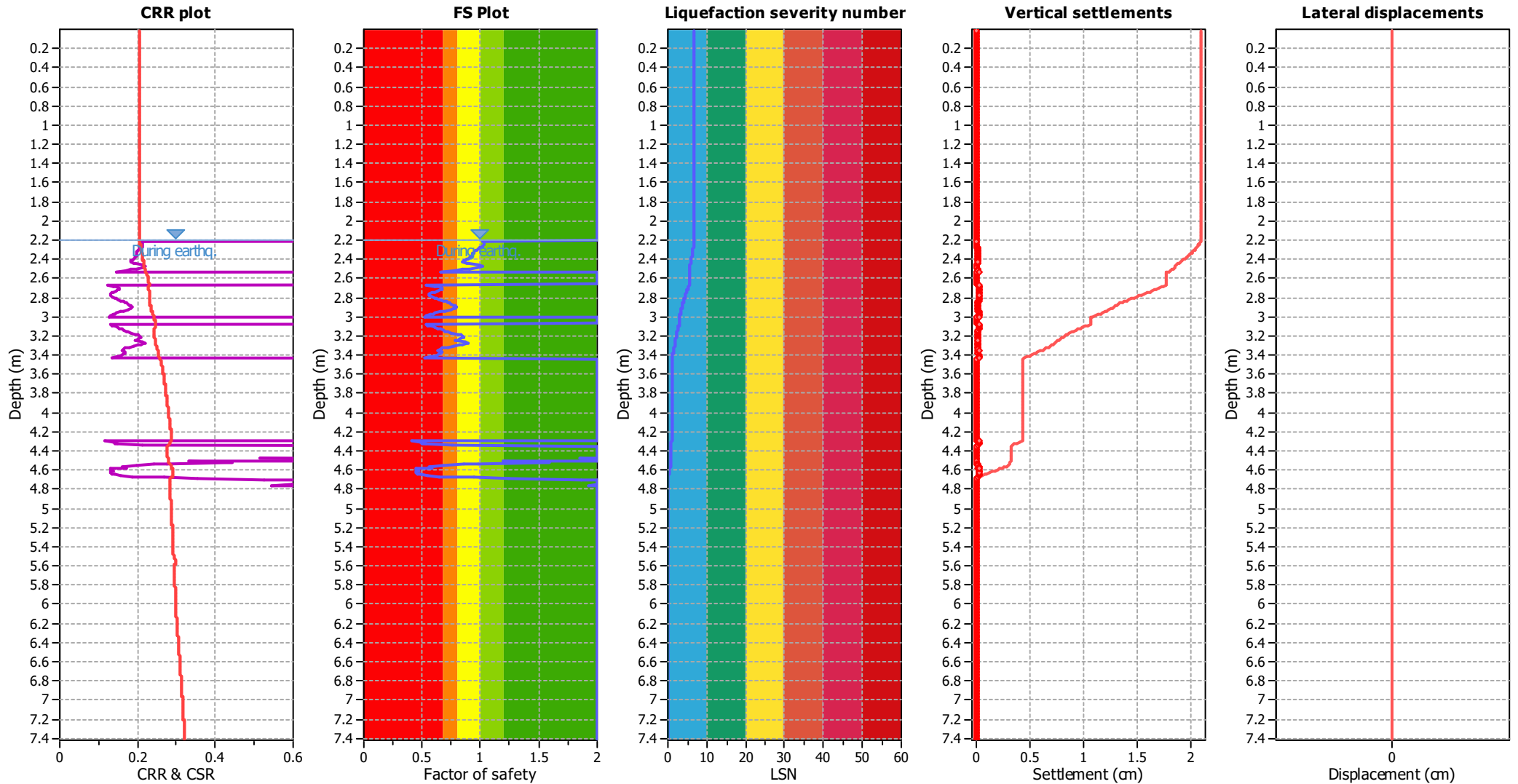
#### F.S. color scheme

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

#### LSN color scheme

- Severe damage
- Major expression of liquefaction
- Moderate to severe exp. of liquefaction
- Moderate expression of liquefaction
- Minor expression of liquefaction
- Little to no expression of liquefaction

### Liquefaction analysis overall plots



**Input parameters and analysis data**

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.20 m
Fines correction method:	B&I (2014)	Average results interval:	3
Points to test:	Based on Ic value	Ic cut-off value:	2.60
Earthquake magnitude $M_w$ :	7.50	Unit weight calculation:	Based on SBT
Peak ground acceleration:	0.35	Use fill:	No
Depth to water table (insitu):	2.20 m	Fill height:	N/A

Fill weight:	N/A
Transition detect. applied:	No
$K_v$ applied:	Yes
Clay like behavior applied:	Sands only
Limit depth applied:	Yes
Limit depth:	10.00 m

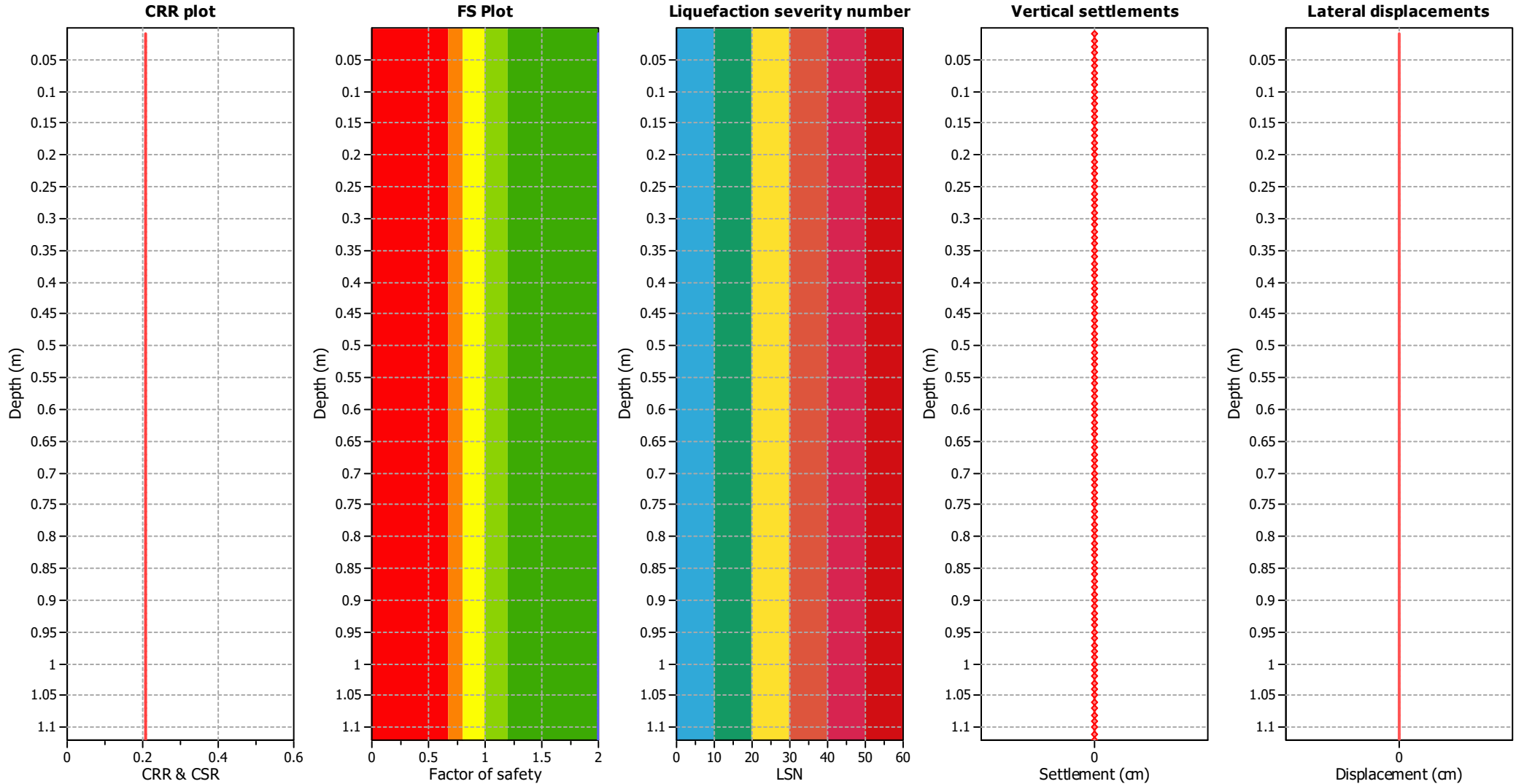
**F.S. color scheme**

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

**LSN color scheme**

- Severe damage
- Major expression of liquefaction
- Moderate to severe exp. of liquefaction
- Moderate expression of liquefaction
- Minor expression of liquefaction
- Little to no expression of liquefaction

### Liquefaction analysis overall plots



#### Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_f$ applied:	Yes
Earthquake magnitude $M_w$ :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.00 m	Fill height:	N/A	Limit depth:	10.00 m

#### F.S. color scheme

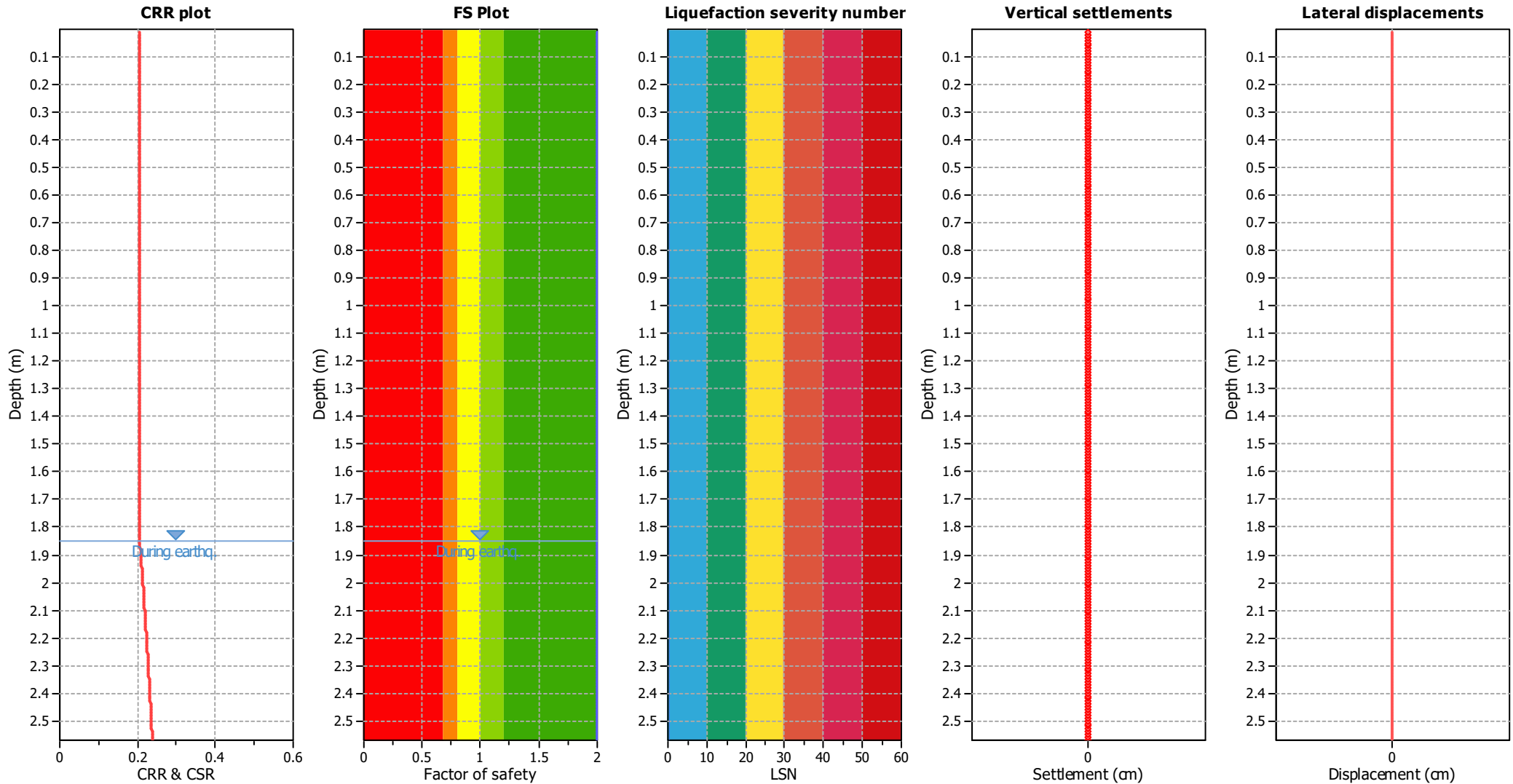
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

#### LSN color scheme

- Severe damage
- Major expression of liquefaction
- Moderate to severe exp. of liquefaction
- Moderate expression of liquefaction
- Minor expression of liquefaction
- Little to no expression of liquefaction



### Liquefaction analysis overall plots



**Input parameters and analysis data**

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.85 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_f$ applied:	Yes
Earthquake magnitude $M_w$ :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.85 m	Fill height:	N/A	Limit depth:	10.00 m

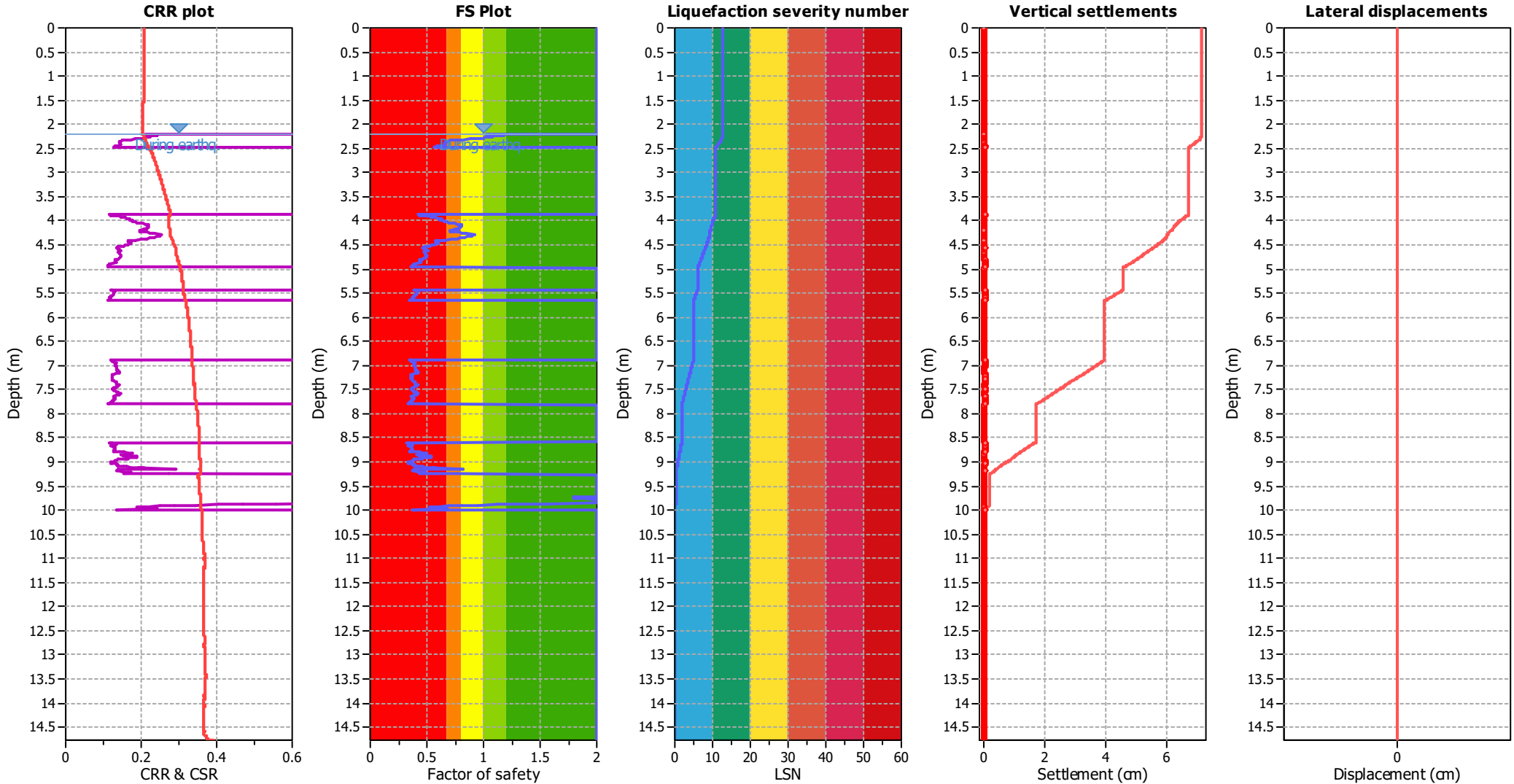
**F.S. color scheme**

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

**LSN color scheme**

- Severe damage
- Major expression of liquefaction
- Moderate to severe exp. of liquefaction
- Moderate expression of liquefaction
- Minor expression of liquefaction
- Little to no expression of liquefaction

### Liquefaction analysis overall plots



**Input parameters and analysis data**

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.20 m
Fines correction method:	B&I (2014)	Average results interval:	3
Points to test:	Based on Ic value	Ic cut-off value:	2.60
Earthquake magnitude $M_w$ :	7.50	Unit weight calculation:	Based on SBT
Peak ground acceleration:	0.35	Use fill:	No
Depth to water table (insitu):	2.20 m	Fill height:	N/A

Fill weight:	N/A
Transition detect. applied:	No
$K_v$ applied:	Yes
Clay like behavior applied:	Sands only
Limit depth applied:	Yes
Limit depth:	10.00 m

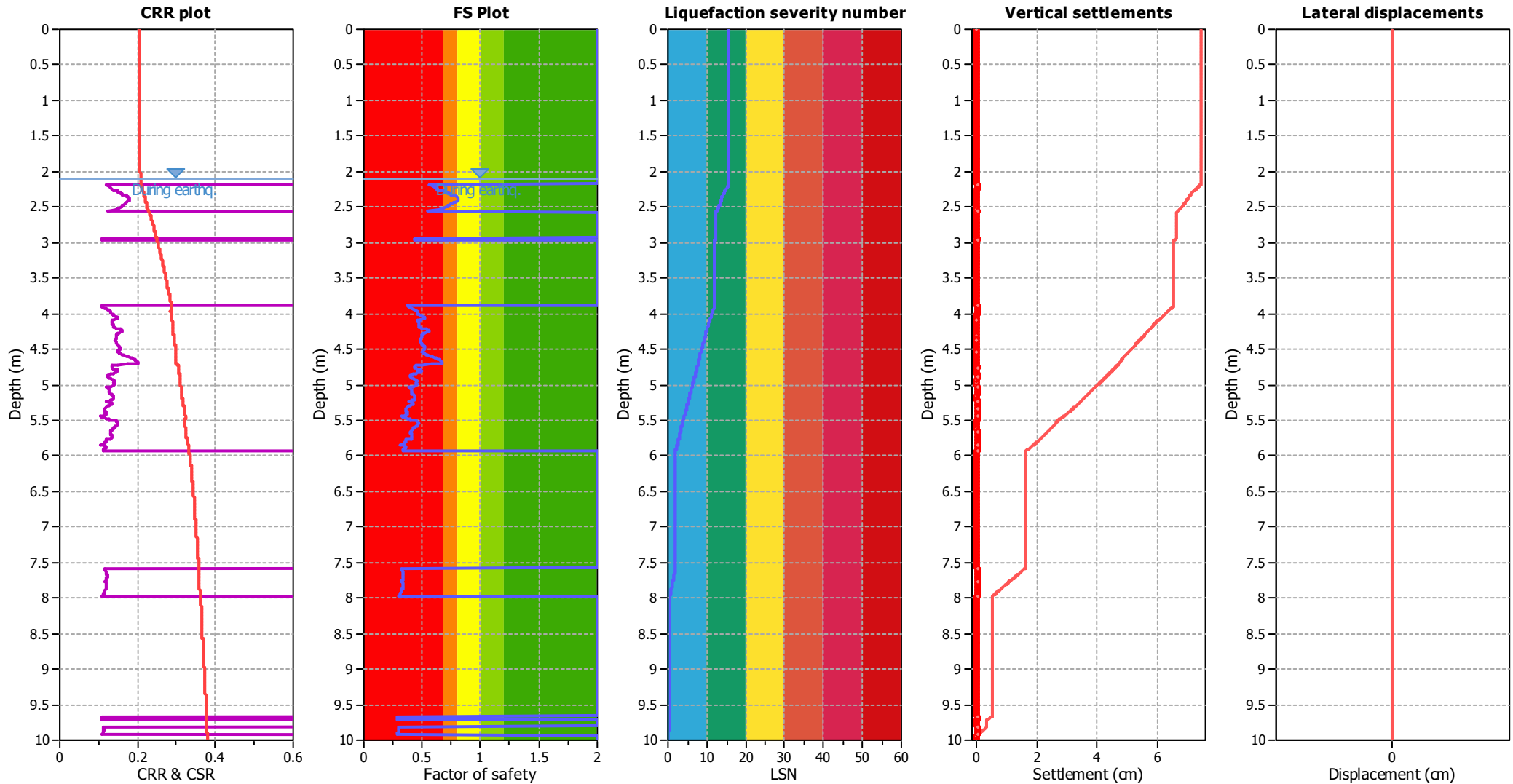
**F.S. color scheme**

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

**LSN color scheme**

- Severe damage
- Major expression of liquefaction
- Moderate to severe exp. of liquefaction
- Moderate expression of liquefaction
- Minor expression of liquefaction
- Little to no expression of liquefaction

### Liquefaction analysis overall plots



**Input parameters and analysis data**

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.10 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_{\sigma}$ applied:	Yes
Earthquake magnitude $M_w$ :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.10 m	Fill height:	N/A	Limit depth:	10.00 m

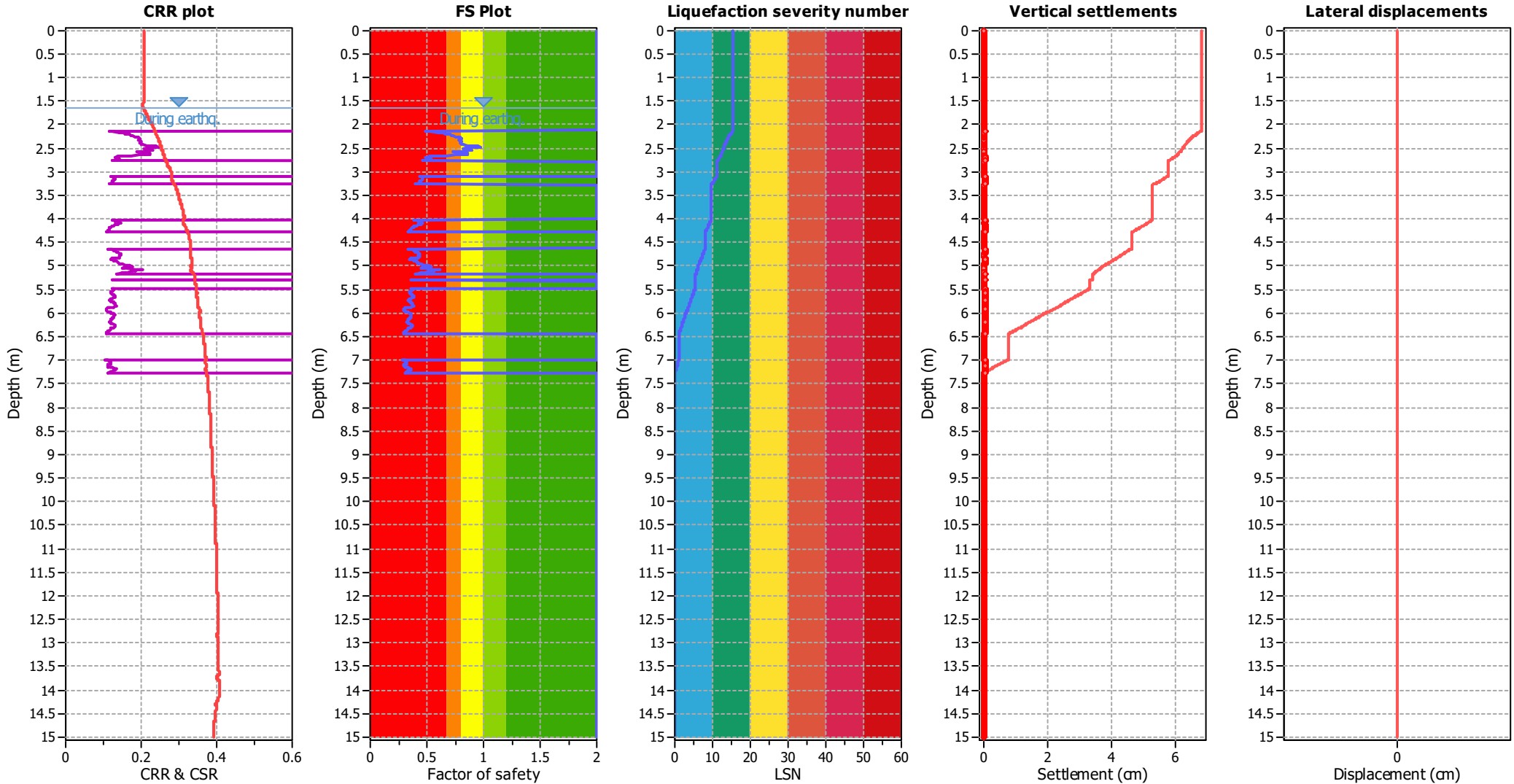
**F.S. color scheme**

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

**LSN color scheme**

- Severe damage
- Major expression of liquefaction
- Moderate to severe exp. of liquefaction
- Moderate expression of liquefaction
- Minor expression of liquefaction
- Little to no expression of liquefaction

### Liquefaction analysis overall plots



**Input parameters and analysis data**

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.65 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_f$ applied:	Yes
Earthquake magnitude $M_w$ :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.65 m	Fill height:	N/A	Limit depth:	10.00 m

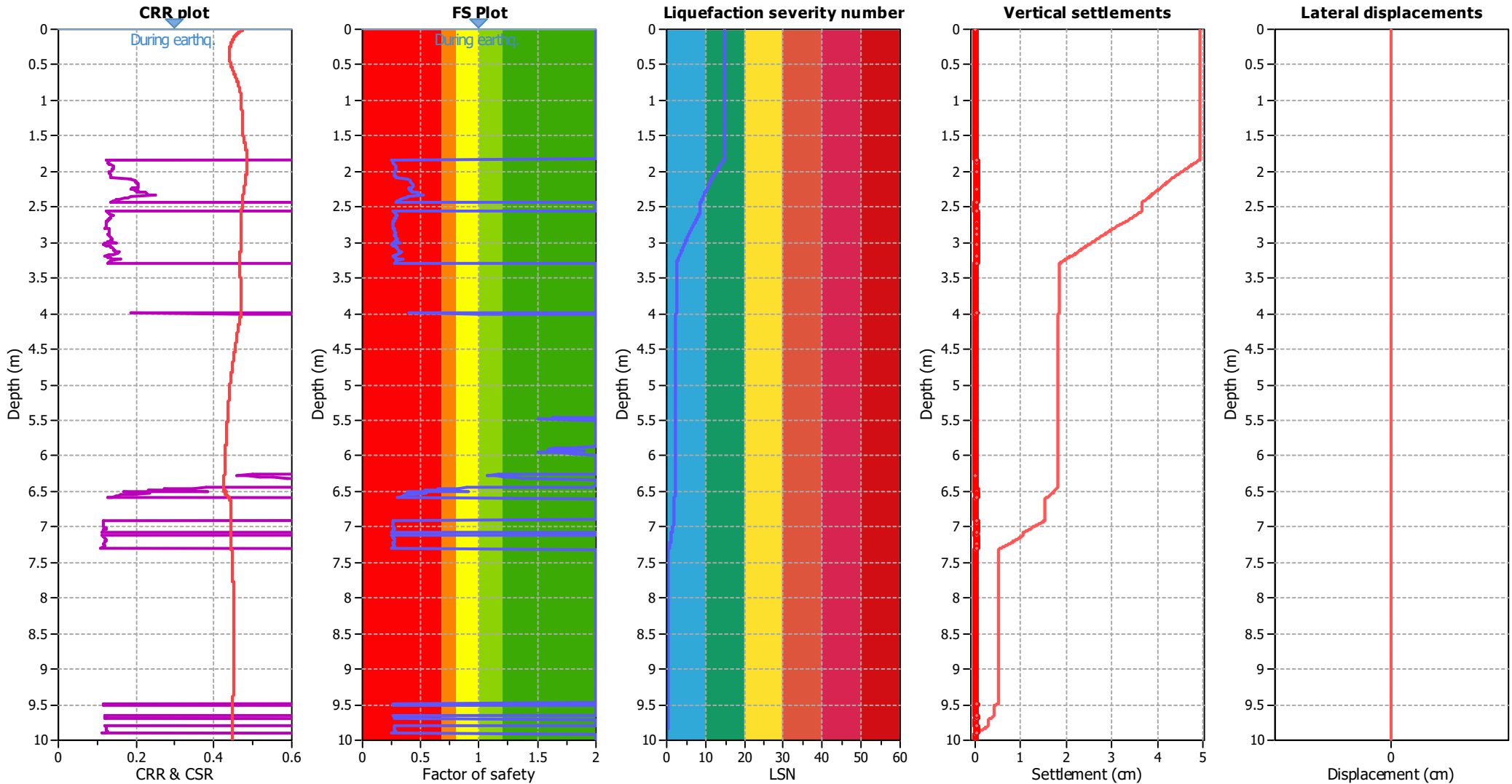
**F.S. color scheme**

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

**LSN color scheme**

- Severe damage
- Major expression of liquefaction
- Moderate to severe exp. of liquefaction
- Moderate expression of liquefaction
- Minor expression of liquefaction
- Little to no expression of liquefaction

### Liquefaction analysis overall plots



#### Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	0.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_d$ applied:	Yes
Earthquake magnitude $M_w$ :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	0.00 m	Fill height:	N/A	Limit depth:	10.00 m

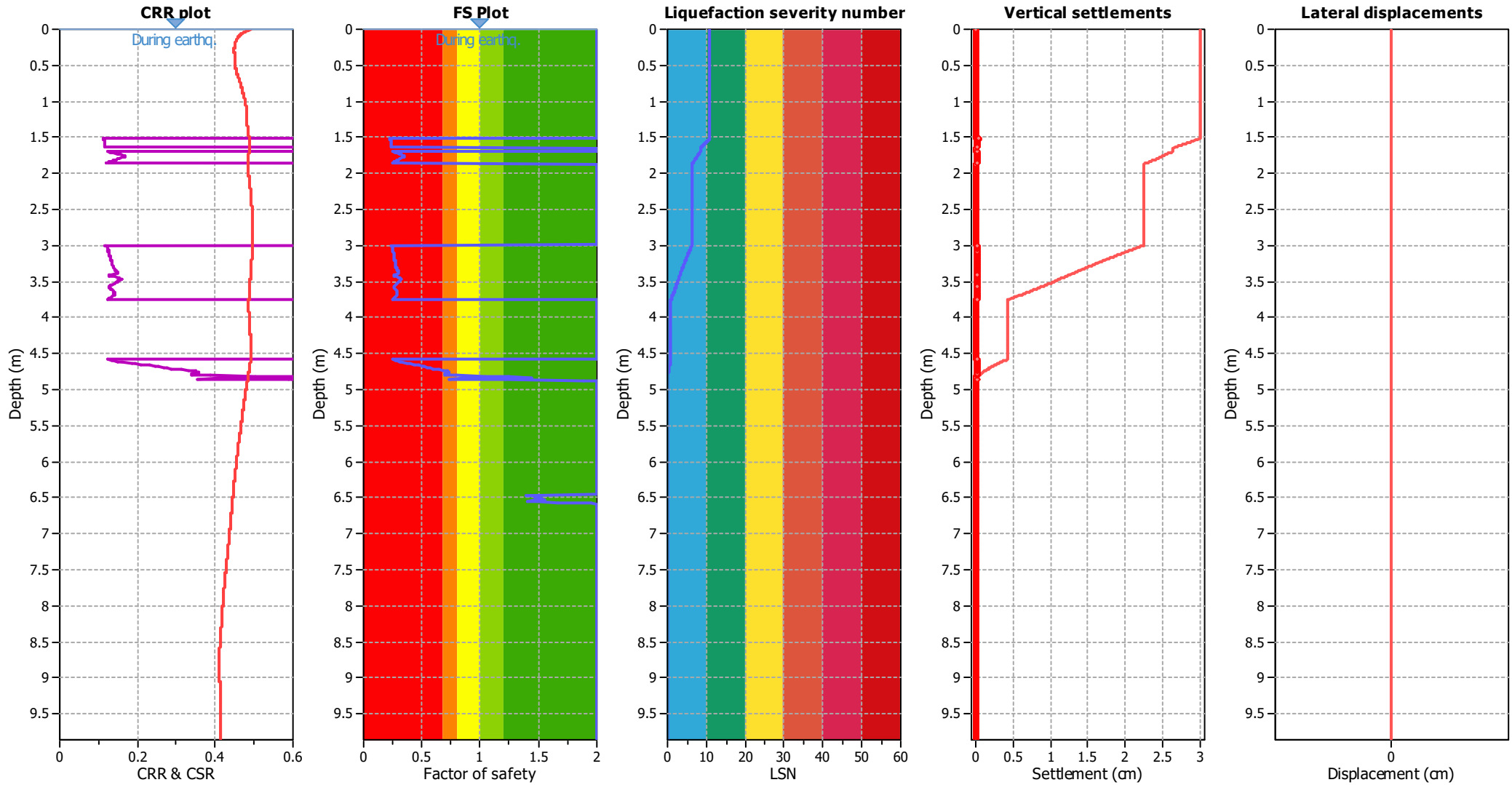
#### F.S. color scheme

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

#### LSN color scheme

- Severe damage
- Major expression of liquefaction
- Moderate to severe exp. of liquefaction
- Moderate expression of liquefaction
- Minor expression of liquefaction
- Little to no expression of liquefaction

### Liquefaction analysis overall plots



#### Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	0.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_f$ applied:	Yes
Earthquake magnitude $M_w$ :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	0.00 m	Fill height:	N/A	Limit depth:	10.00 m

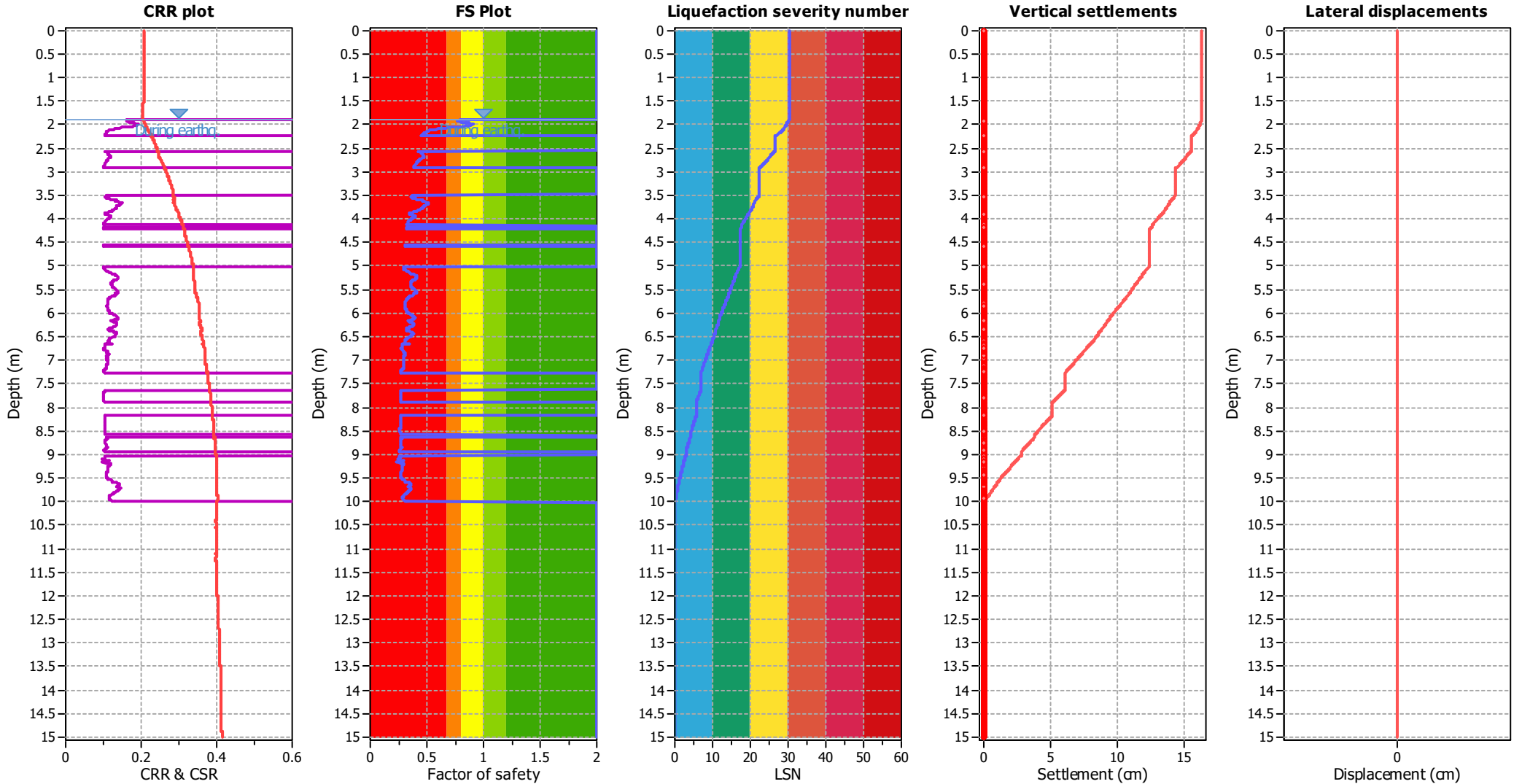
#### F.S. color scheme

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

#### LSN color scheme

- Severe damage
- Major expression of liquefaction
- Moderate to severe exp. of liquefaction
- Moderate expression of liquefaction
- Minor expression of liquefaction
- Little to no expression of liquefaction

### Liquefaction analysis overall plots



#### Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.90 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_f$ applied:	Yes
Earthquake magnitude $M_w$ :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.90 m	Fill height:	N/A	Limit depth:	10.00 m

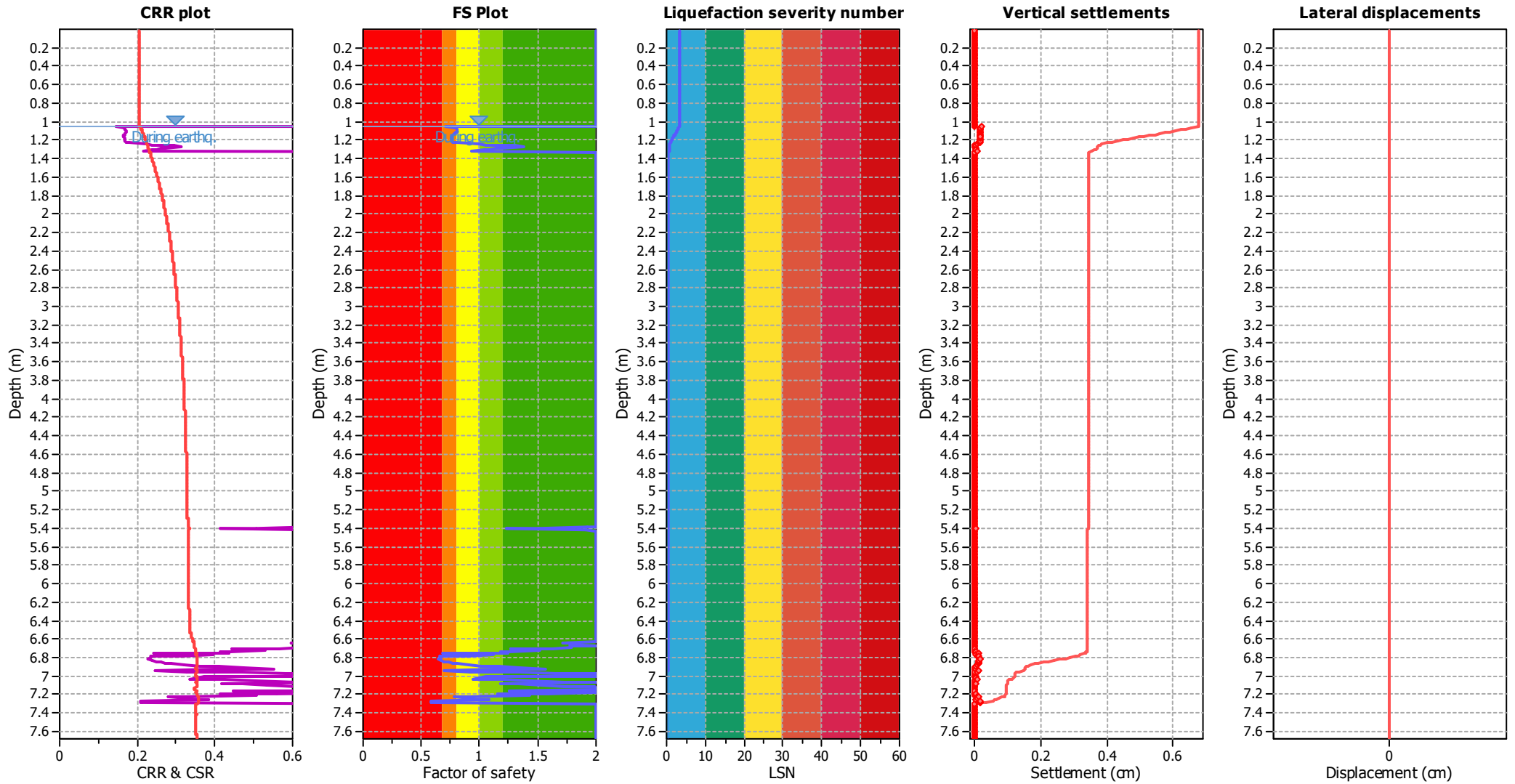
#### F.S. color scheme

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

#### LSN color scheme

- Severe damage
- Major expression of liquefaction
- Moderate to severe exp. of liquefaction
- Moderate expression of liquefaction
- Minor expression of liquefaction
- Little to no expression of liquefaction

### Liquefaction analysis overall plots



#### Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.05 m
Fines correction method:	B&I (2014)	Average results interval:	3
Points to test:	Based on Ic value	Ic cut-off value:	2.60
Earthquake magnitude $M_w$ :	7.50	Unit weight calculation:	Based on SBT
Peak ground acceleration:	0.35	Use fill:	No
Depth to water table (insitu):	1.05 m	Fill height:	N/A

Fill weight:	N/A
Transition detect. applied:	No
$K_v$ applied:	Yes
Clay like behavior applied:	Sands only
Limit depth applied:	Yes
Limit depth:	10.00 m

#### F.S. color scheme

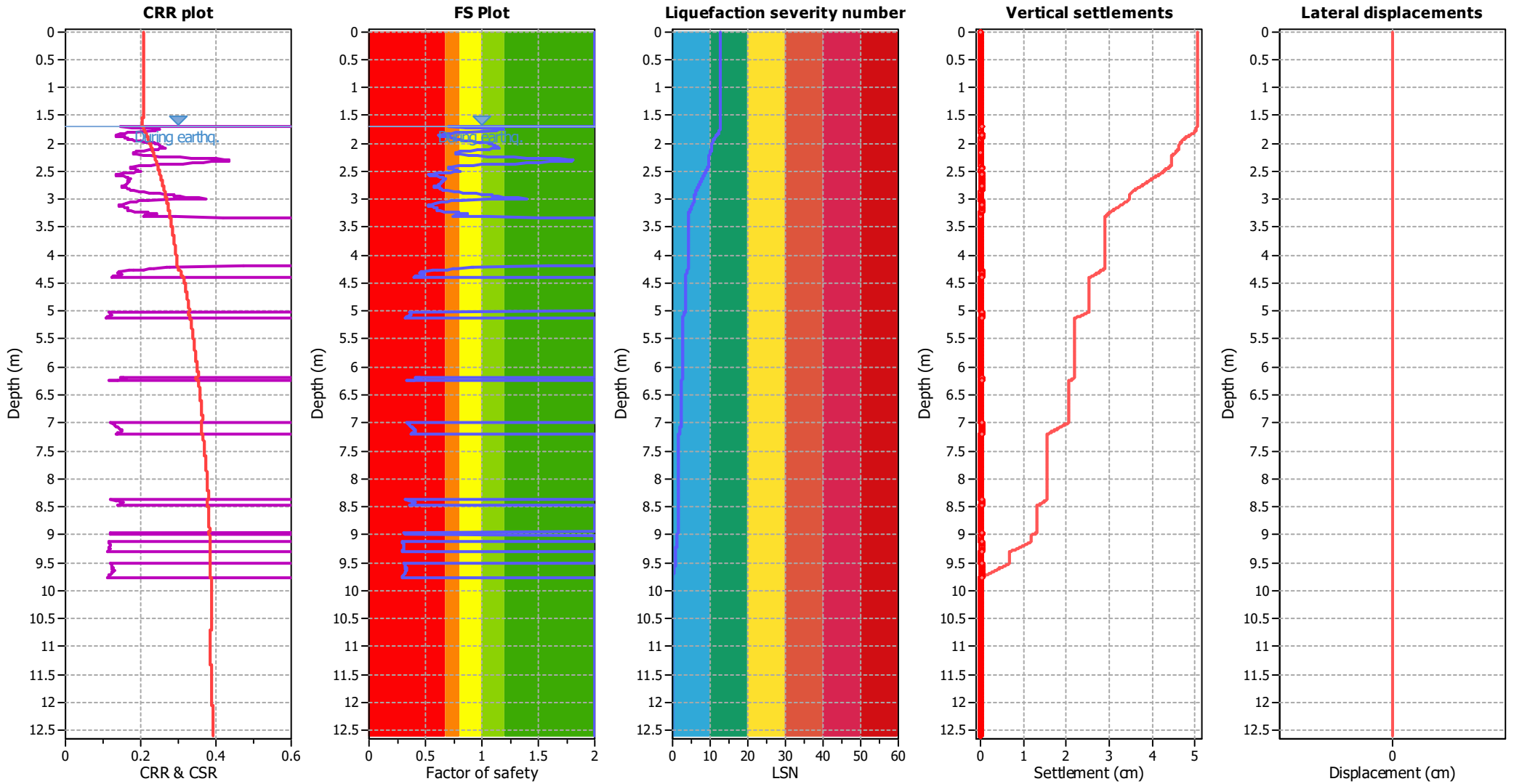
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

#### LSN color scheme

- Severe damage
- Major expression of liquefaction
- Moderate to severe exp. of liquefaction
- Moderate expression of liquefaction
- Minor expression of liquefaction
- Little to no expression of liquefaction



### Liquefaction analysis overall plots



**Input parameters and analysis data**

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_v$ applied:	Yes
Earthquake magnitude $M_w$ :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	10.00 m

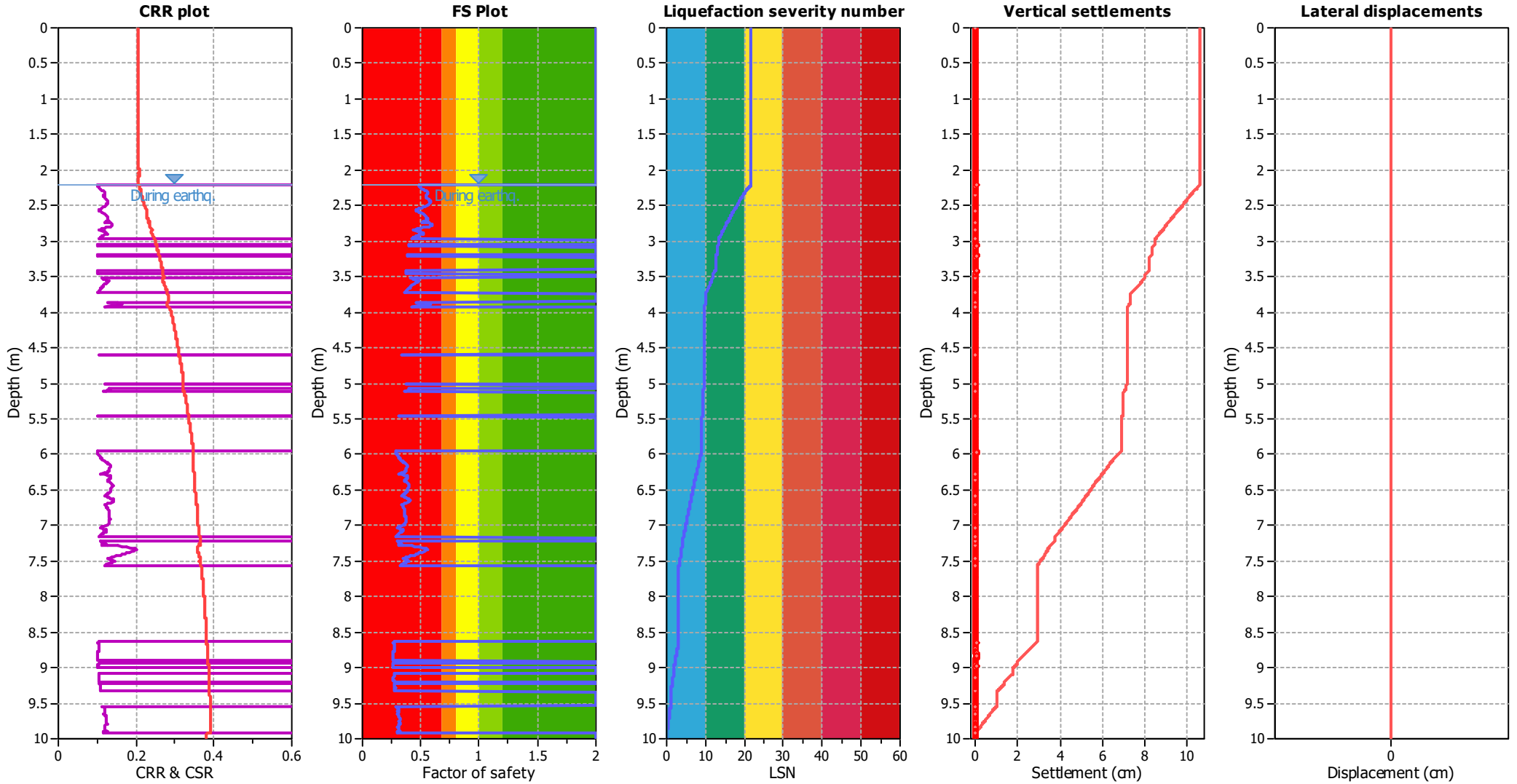
**F.S. color scheme**

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

**LSN color scheme**

- Severe damage
- Major expression of liquefaction
- Moderate to severe exp. of liquefaction
- Moderate expression of liquefaction
- Minor expression of liquefaction
- Little to no expression of liquefaction

### Liquefaction analysis overall plots



**Input parameters and analysis data**

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.20 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_d$ applied:	Yes
Earthquake magnitude $M_w$ :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.20 m	Fill height:	N/A	Limit depth:	10.00 m

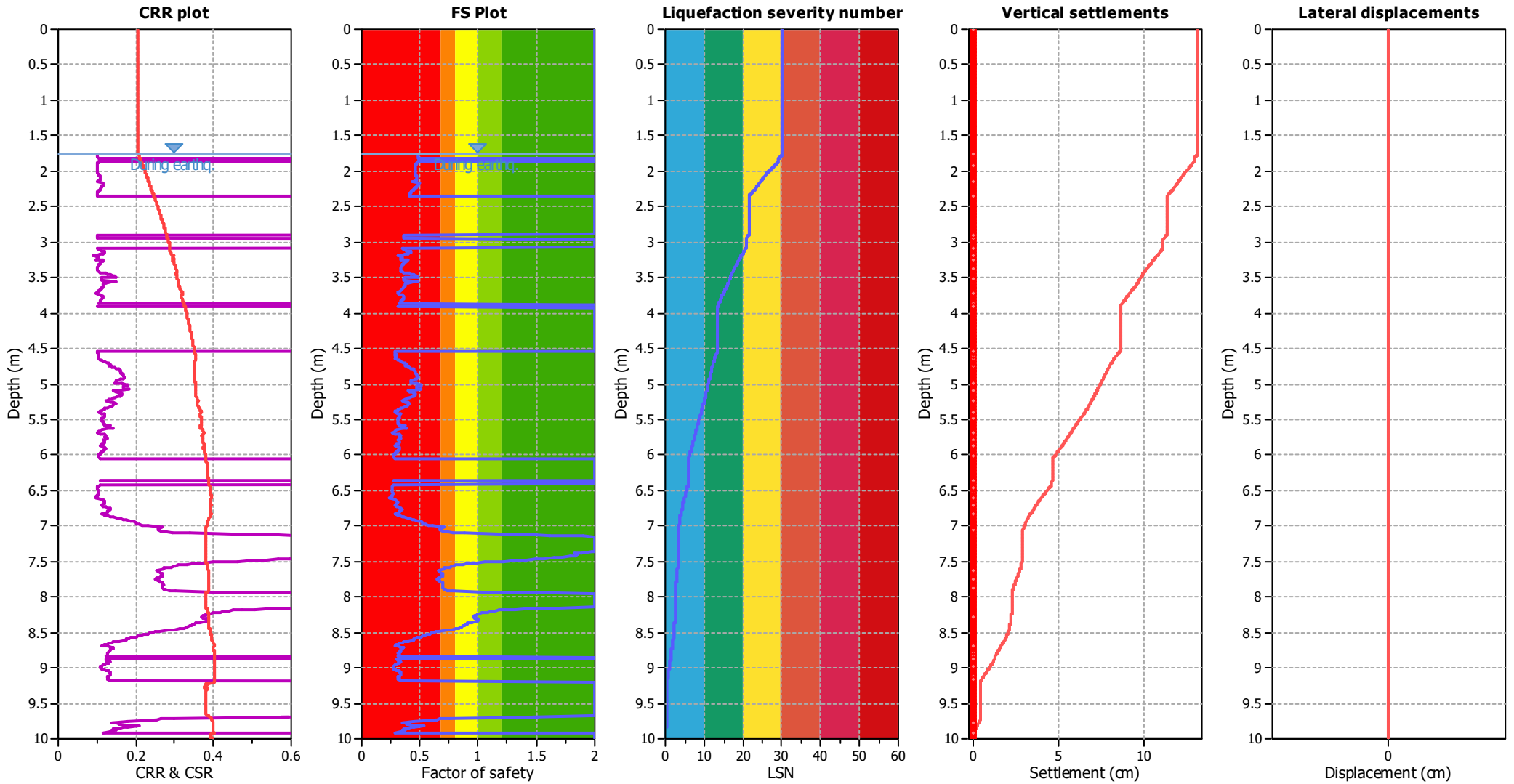
**F.S. color scheme**

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

**LSN color scheme**

- Severe damage
- Major expression of liquefaction
- Moderate to severe exp. of liquefaction
- Moderate expression of liquefaction
- Minor expression of liquefaction
- Little to no expression of liquefaction

### Liquefaction analysis overall plots



**Input parameters and analysis data**

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.75 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_d$ applied:	Yes
Earthquake magnitude $M_w$ :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.75 m	Fill height:	N/A	Limit depth:	10.00 m

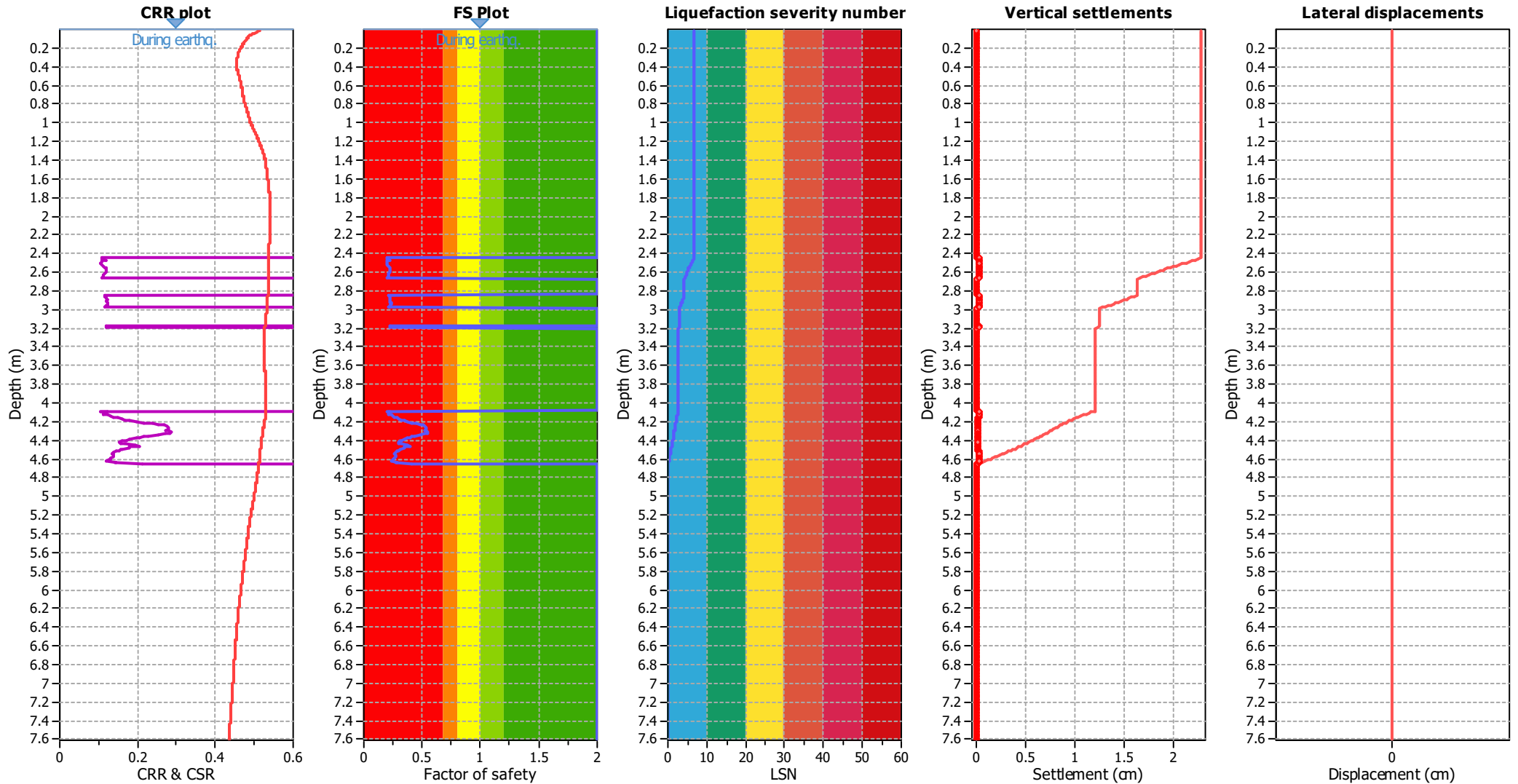
**F.S. color scheme**

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

**LSN color scheme**

- Severe damage
- Major expression of liquefaction
- Moderate to severe exp. of liquefaction
- Moderate expression of liquefaction
- Minor expression of liquefaction
- Little to no expression of liquefaction

### Liquefaction analysis overall plots



#### Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	0.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_v$ applied:	Yes
Earthquake magnitude $M_w$ :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	0.00 m	Fill height:	N/A	Limit depth:	10.00 m

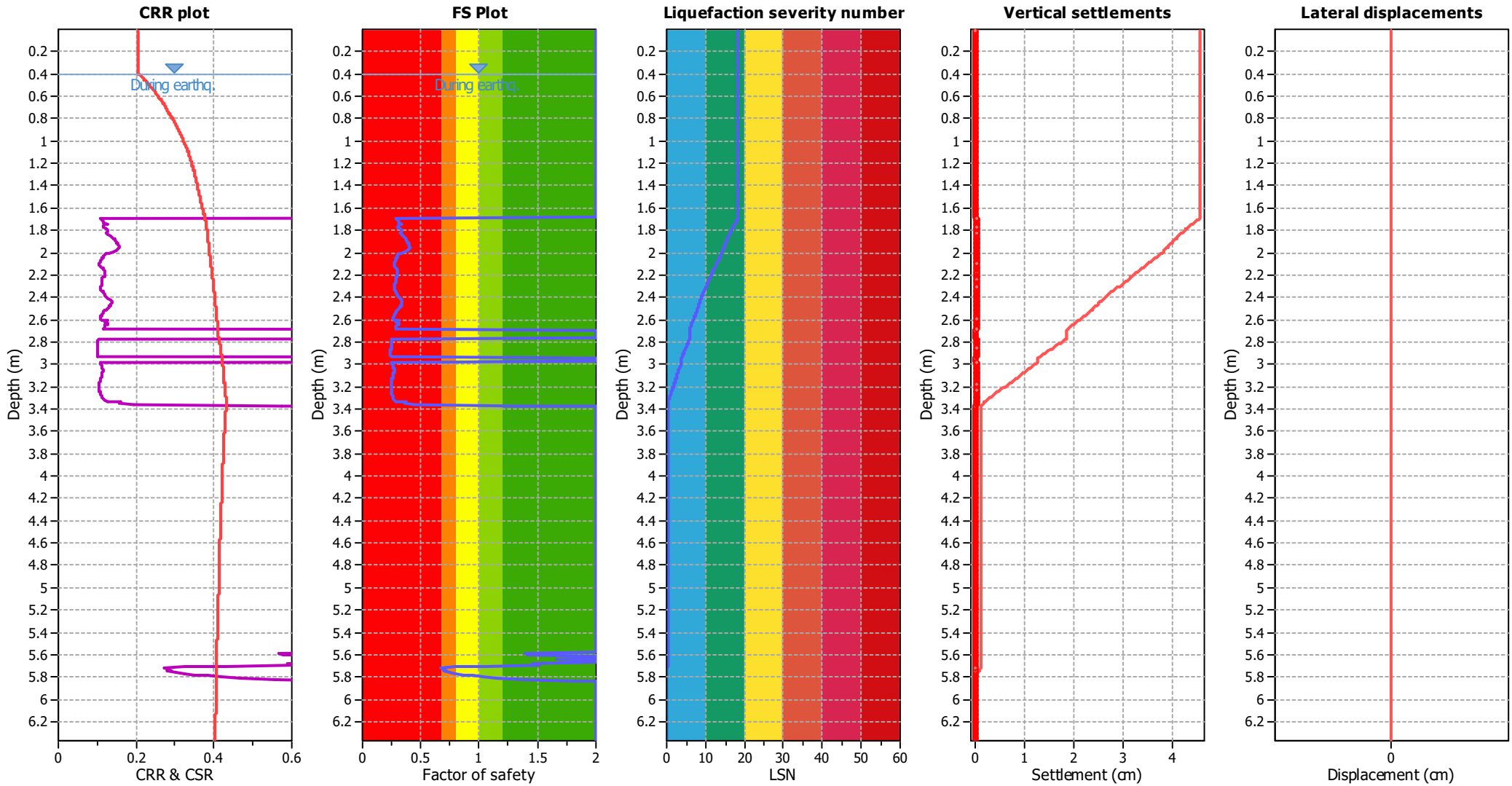
#### F.S. color scheme

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

#### LSN color scheme

- Severe damage
- Major expression of liquefaction
- Moderate to severe exp. of liquefaction
- Moderate expression of liquefaction
- Minor expression of liquefaction
- Little to no expression of liquefaction

### Liquefaction analysis overall plots



**Input parameters and analysis data**

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	0.40 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_f$ applied:	Yes
Earthquake magnitude $M_w$ :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	0.40 m	Fill height:	N/A	Limit depth:	10.00 m

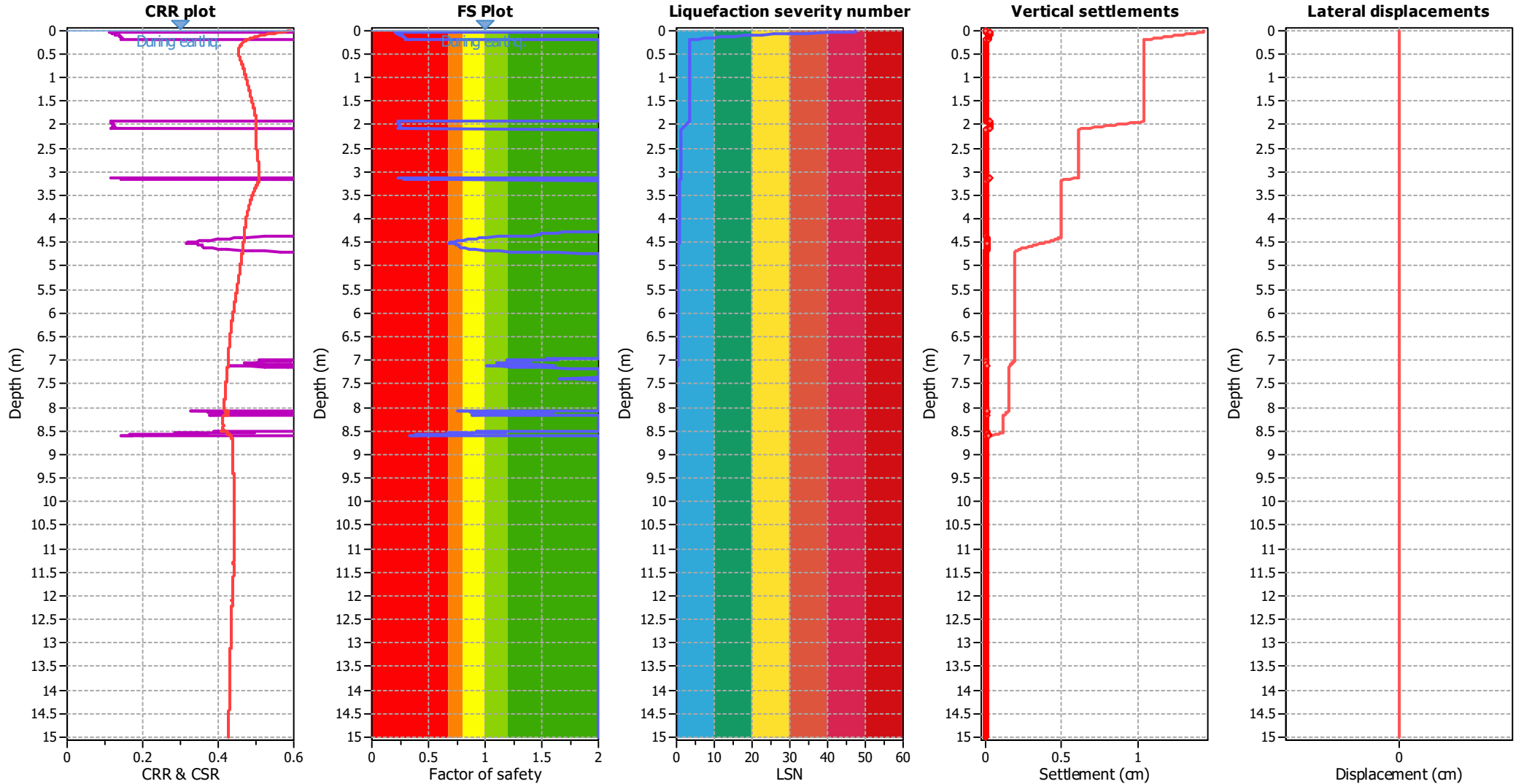
**F.S. color scheme**

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- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

**LSN color scheme**

- Severe damage
- Major expression of liquefaction
- Moderate to severe exp. of liquefaction
- Moderate expression of liquefaction
- Minor expression of liquefaction
- Little to no expression of liquefaction

### Liquefaction analysis overall plots



**Input parameters and analysis data**

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	0.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_f$ applied:	Yes
Earthquake magnitude $M_w$ :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	0.00 m	Fill height:	N/A	Limit depth:	10.00 m

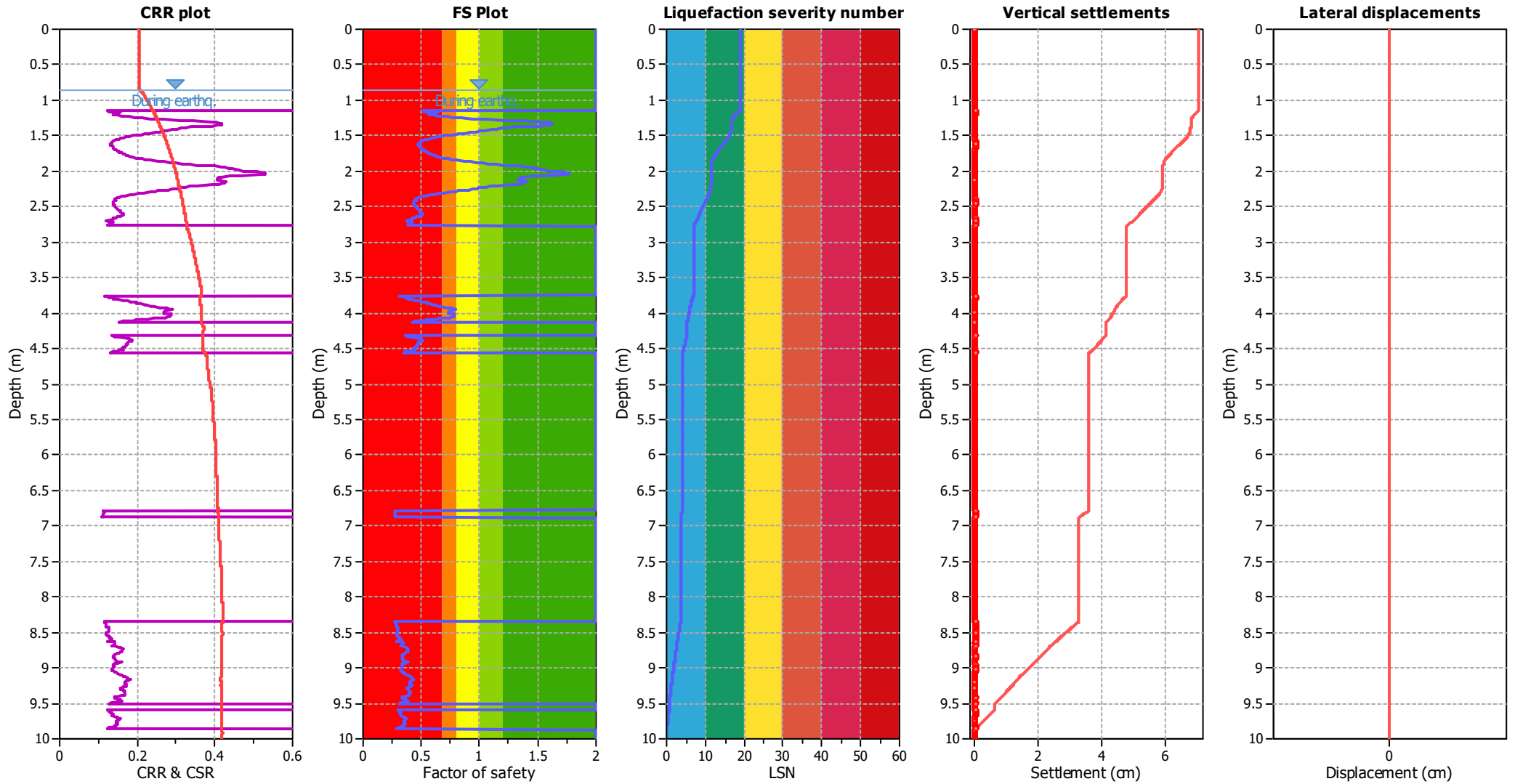
**F.S. color scheme**

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**LSN color scheme**

- Severe damage
- Major expression of liquefaction
- Moderate to severe exp. of liquefaction
- Moderate expression of liquefaction
- Minor expression of liquefaction
- Little to no expression of liquefaction

### Liquefaction analysis overall plots



**Input parameters and analysis data**

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	0.85 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_f$ applied:	Yes
Earthquake magnitude $M_w$ :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	0.85 m	Fill height:	N/A	Limit depth:	10.00 m

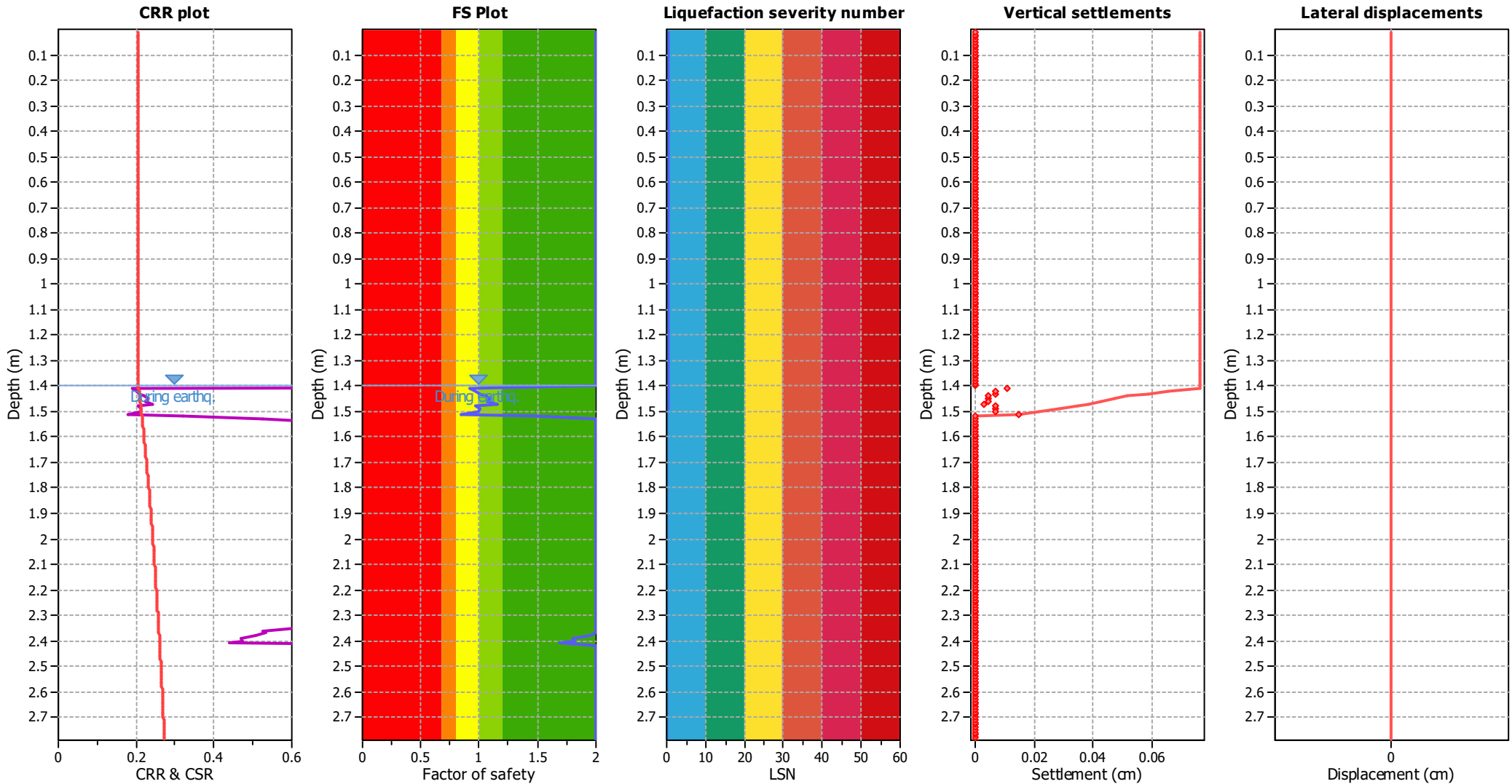
**F.S. color scheme**

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

**LSN color scheme**

- Severe damage
- Major expression of liquefaction
- Moderate to severe exp. of liquefaction
- Moderate expression of liquefaction
- Minor expression of liquefaction
- Little to no expression of liquefaction

### Liquefaction analysis overall plots



**Input parameters and analysis data**

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.40 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_f$ applied:	Yes
Earthquake magnitude $M_w$ :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.40 m	Fill height:	N/A	Limit depth:	10.00 m

**F.S. color scheme**

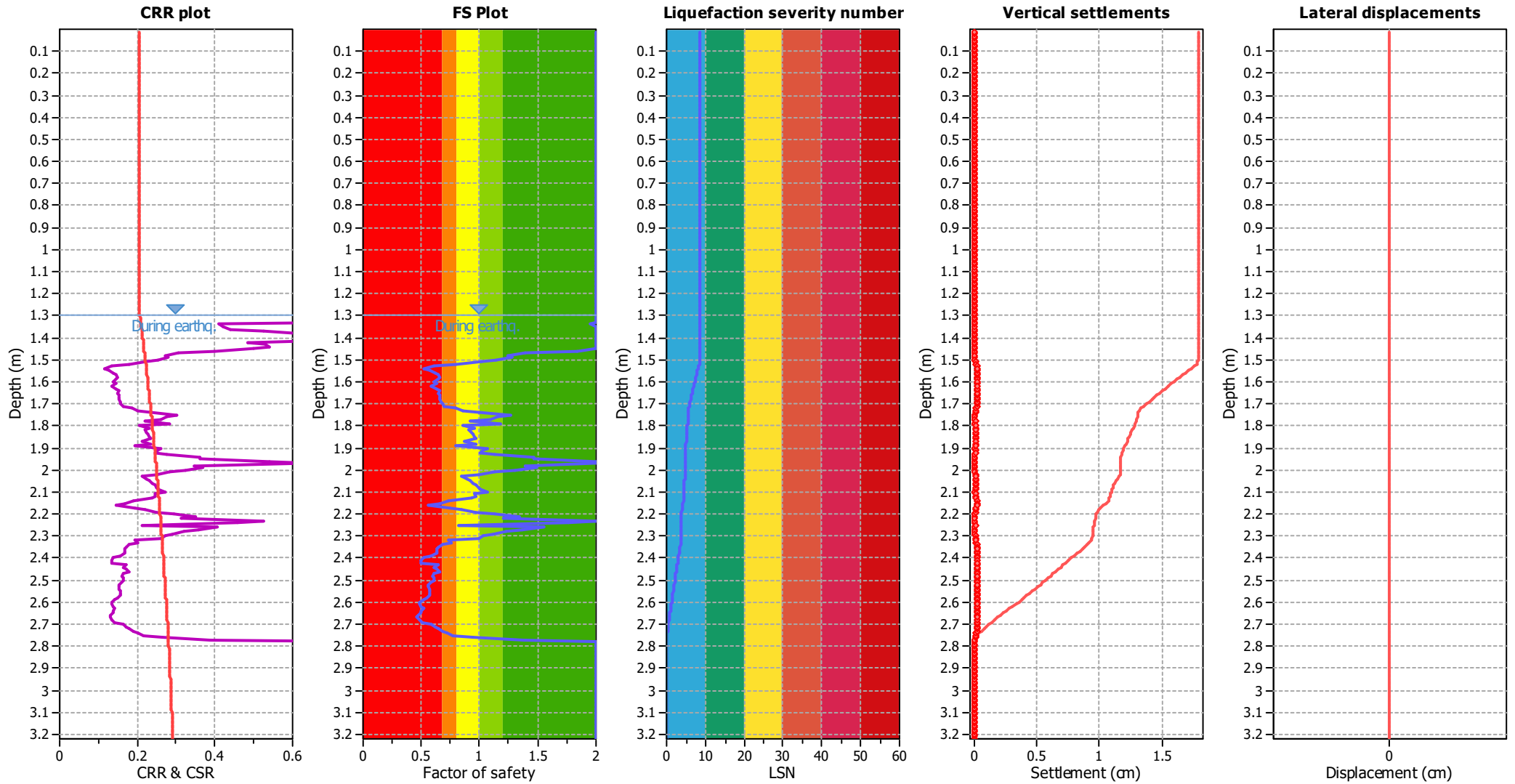
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

**LSN color scheme**

- Severe damage
- Major expression of liquefaction
- Moderate to severe exp. of liquefaction
- Moderate expression of liquefaction
- Minor expression of liquefaction
- Little to no expression of liquefaction



### Liquefaction analysis overall plots



**Input parameters and analysis data**

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.30 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_f$ applied:	Yes
Earthquake magnitude $M_w$ :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.30 m	Fill height:	N/A	Limit depth:	10.00 m

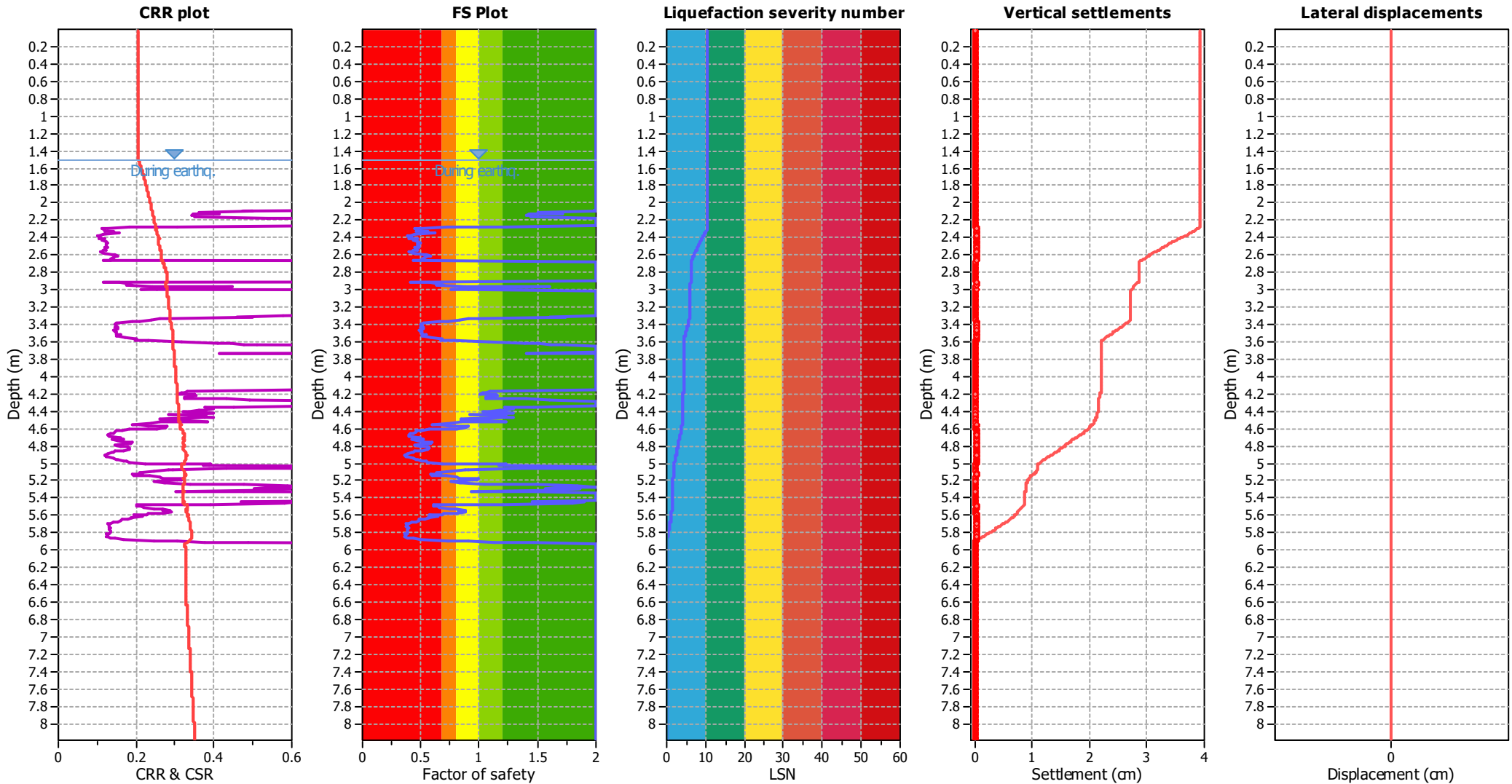
**F.S. color scheme**

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

**LSN color scheme**

- Severe damage
- Major expression of liquefaction
- Moderate to severe exp. of liquefaction
- Moderate expression of liquefaction
- Minor expression of liquefaction
- Little to no expression of liquefaction

### Liquefaction analysis overall plots



**Input parameters and analysis data**

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.50 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K <sub>σ</sub> applied:	Yes
Earthquake magnitude M <sub>w</sub> :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	10.00 m

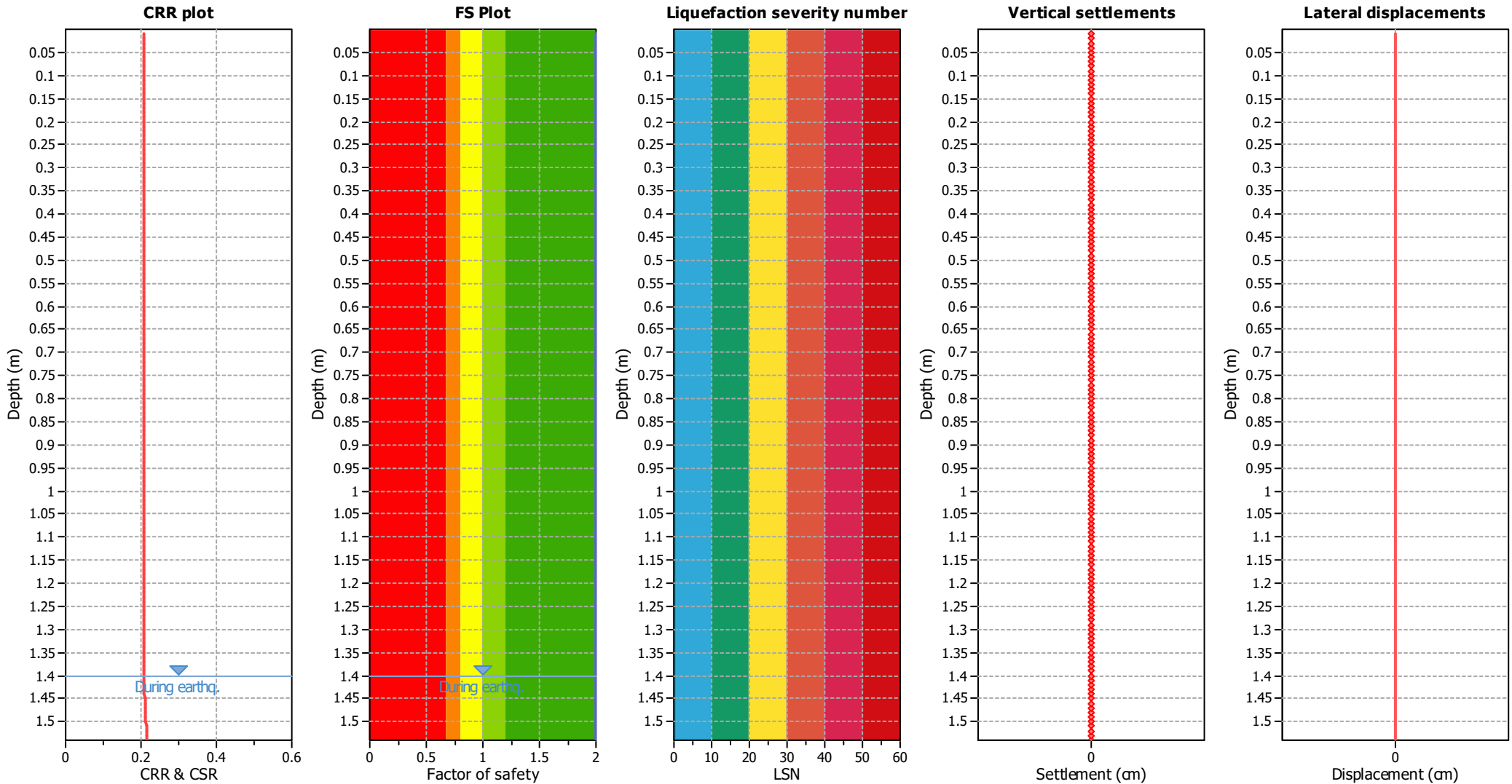
**F.S. color scheme**

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

**LSN color scheme**

- Severe damage
- Major expression of liquefaction
- Moderate to severe exp. of liquefaction
- Moderate expression of liquefaction
- Minor expression of liquefaction
- Little to no expression of liquefaction

### Liquefaction analysis overall plots



**Input parameters and analysis data**

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.40 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_{\sigma}$ applied:	Yes
Earthquake magnitude $M_w$ :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.40 m	Fill height:	N/A	Limit depth:	10.00 m

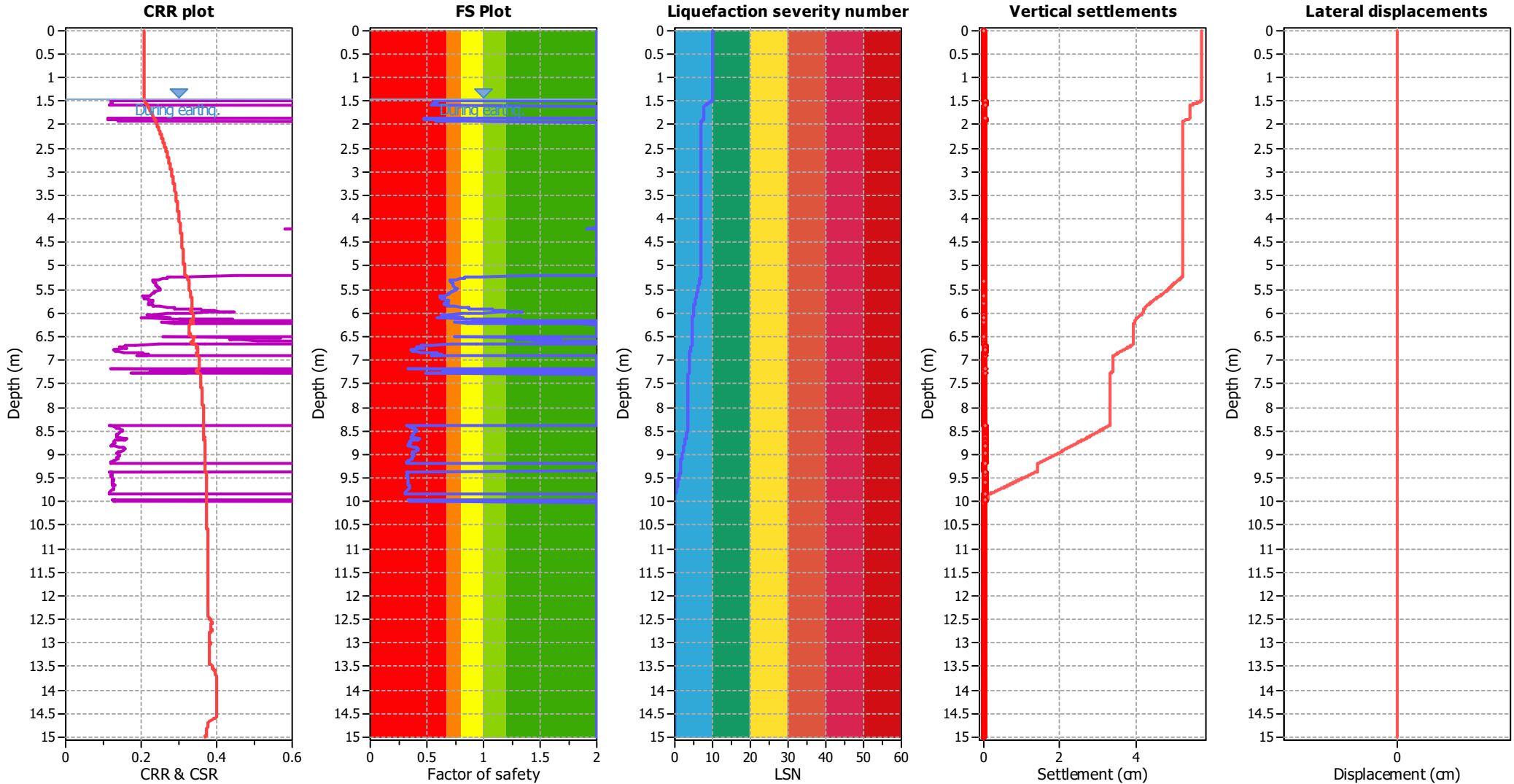
**F.S. color scheme**

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

**LSN color scheme**

- Severe damage
- Major expression of liquefaction
- Moderate to severe exp. of liquefaction
- Moderate expression of liquefaction
- Minor expression of liquefaction
- Little to no expression of liquefaction

### Liquefaction analysis overall plots



**Input parameters and analysis data**

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.45 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_v$ applied:	Yes
Earthquake magnitude $M_w$ :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.45 m	Fill height:	N/A	Limit depth:	10.00 m

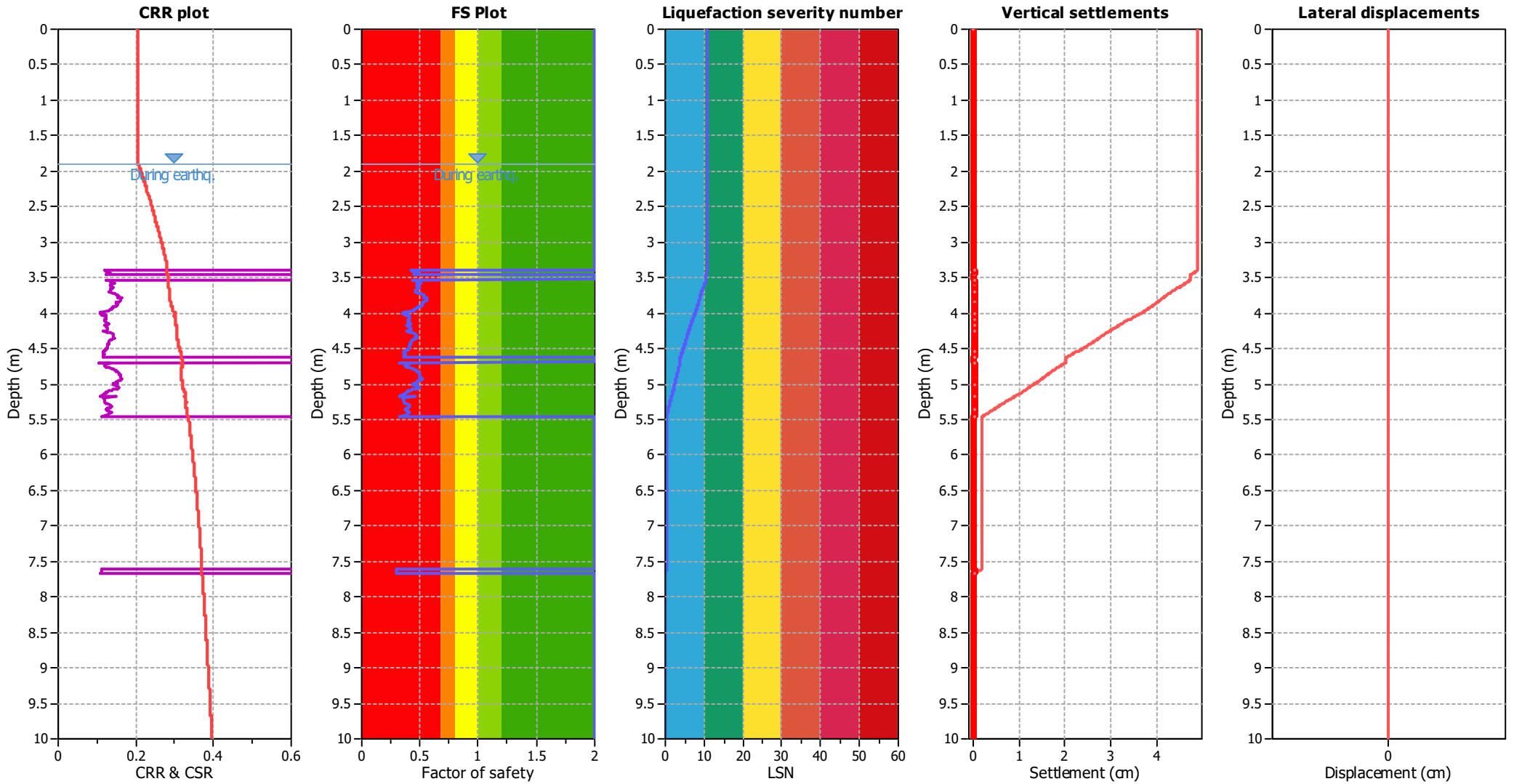
**F.S. color scheme**

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

**LSN color scheme**

- Severe damage
- Major expression of liquefaction
- Moderate to severe exp. of liquefaction
- Moderate expression of liquefaction
- Minor expression of liquefaction
- Little to no expression of liquefaction

### Liquefaction analysis overall plots



**Input parameters and analysis data**

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.90 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_{\sigma}$ applied:	Yes
Earthquake magnitude $M_w$ :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.90 m	Fill height:	N/A	Limit depth:	10.00 m

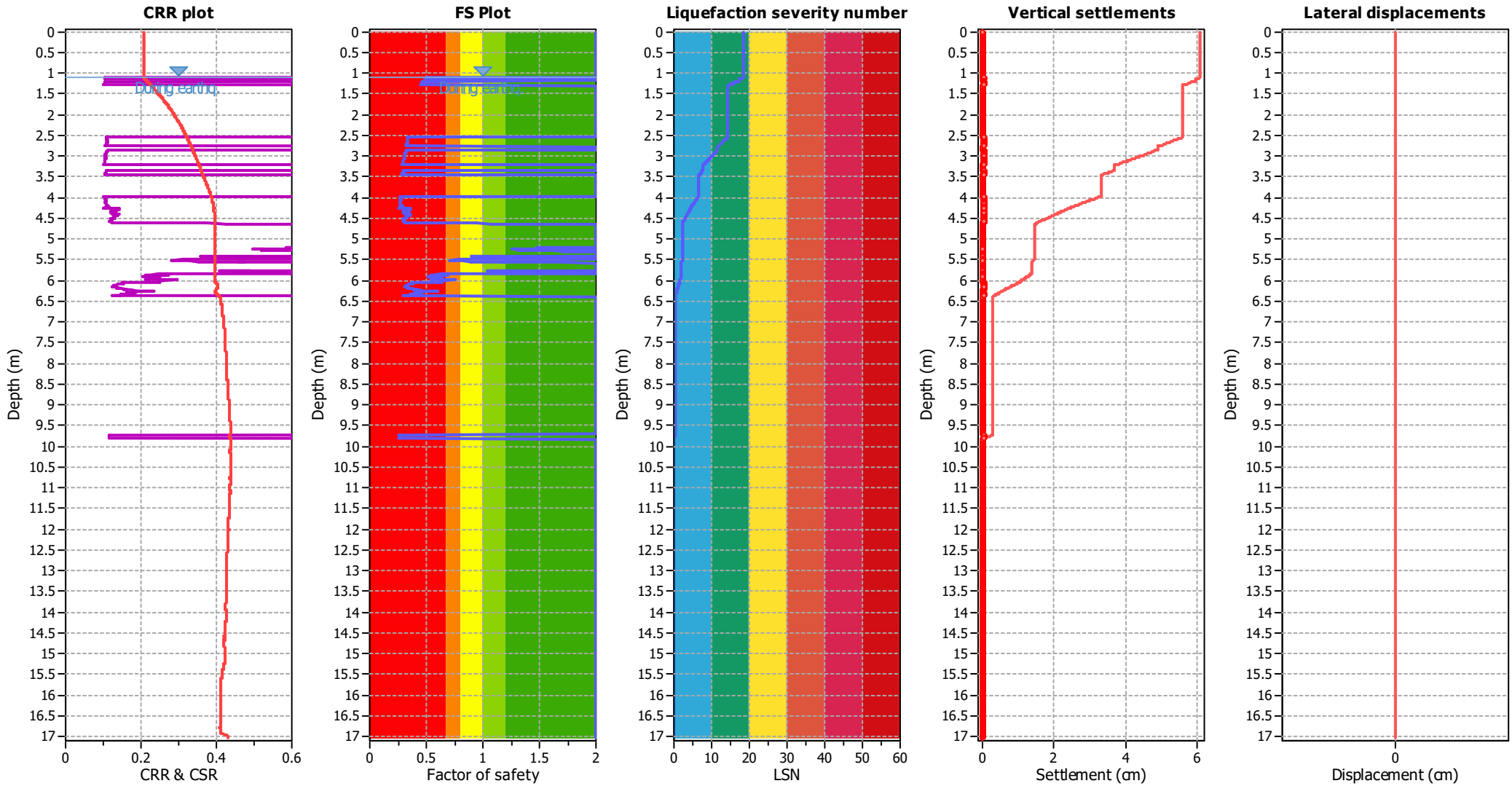
**F.S. color scheme**

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

**LSN color scheme**

- Severe damage
- Major expression of liquefaction
- Moderate to severe exp. of liquefaction
- Moderate expression of liquefaction
- Minor expression of liquefaction
- Little to no expression of liquefaction

### Liquefaction analysis overall plots



**Input parameters and analysis data**

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.10 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_v$ applied:	Yes
Earthquake magnitude $M_w$ :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.10 m	Fill height:	N/A	Limit depth:	10.00 m

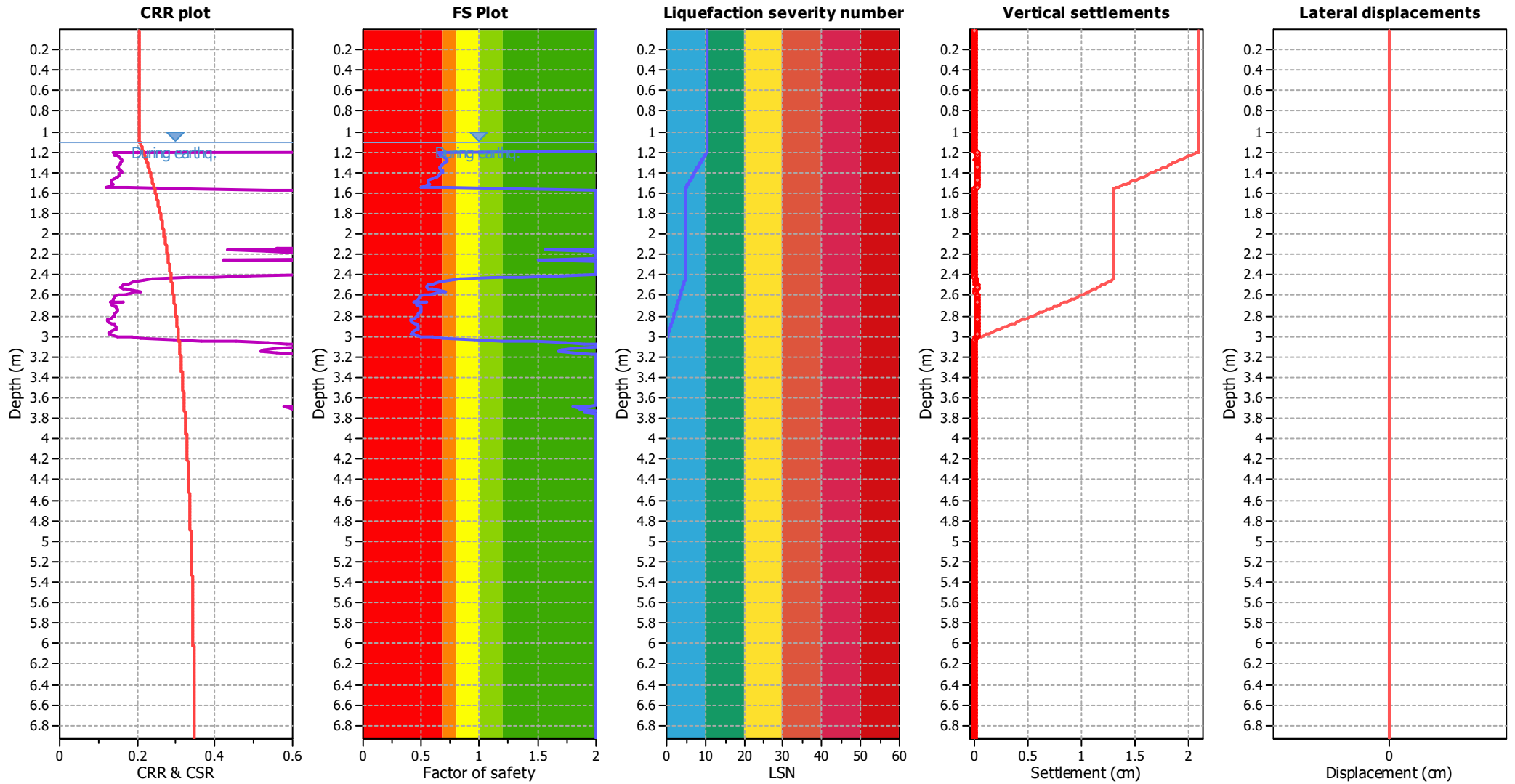
**F.S. color scheme**

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

**LSN color scheme**

- Severe damage
- Major expression of liquefaction
- Moderate to severe exp. of liquefaction
- Moderate expression of liquefaction
- Minor expression of liquefaction
- Little to no expression of liquefaction

### Liquefaction analysis overall plots



#### Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.10 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_D$ applied:	Yes
Earthquake magnitude $M_w$ :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.10 m	Fill height:	N/A	Limit depth:	10.00 m

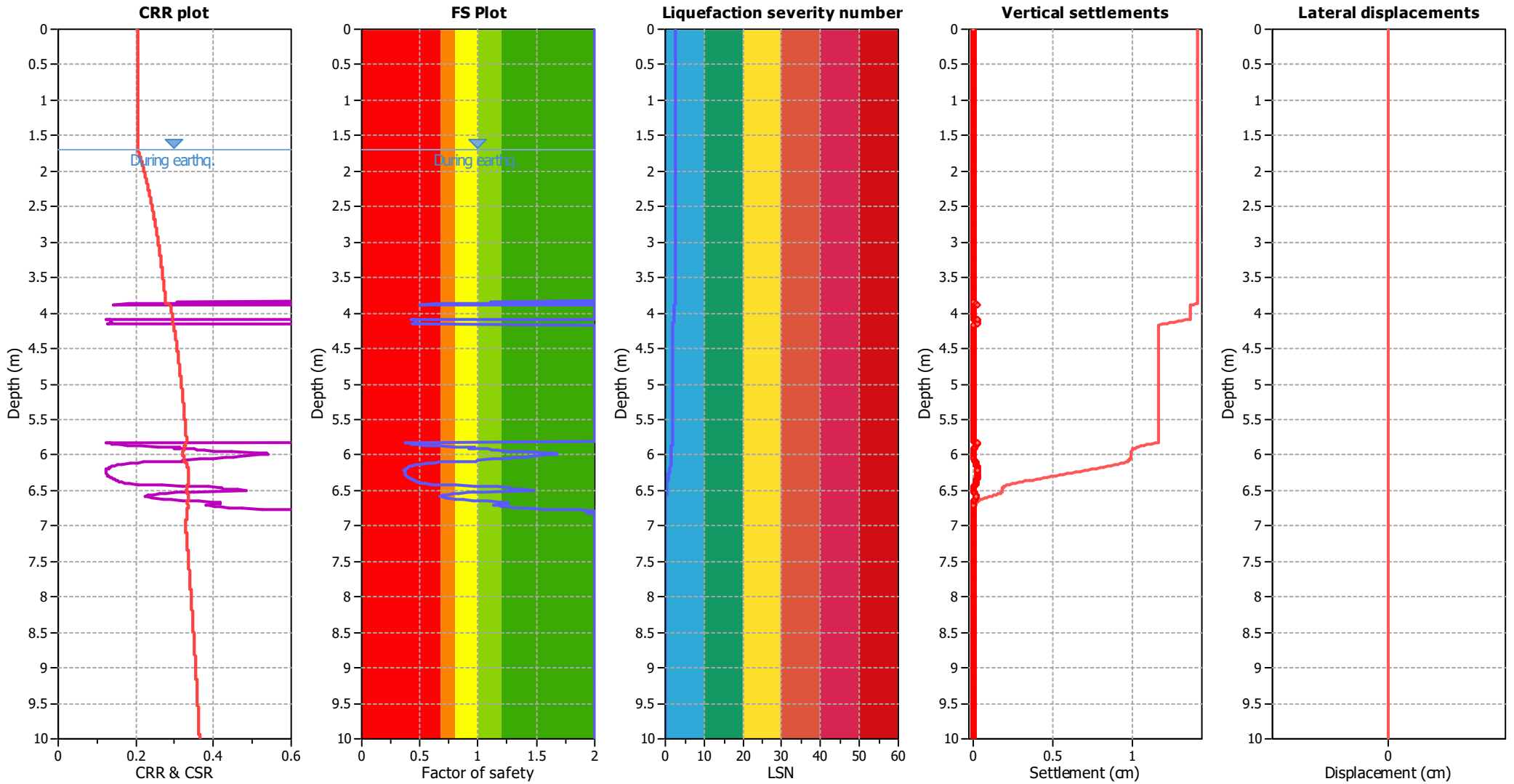
#### F.S. color scheme

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

#### LSN color scheme

- Severe damage
- Major expression of liquefaction
- Moderate to severe exp. of liquefaction
- Moderate expression of liquefaction
- Minor expression of liquefaction
- Little to no expression of liquefaction

### Liquefaction analysis overall plots



**Input parameters and analysis data**

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_d$ applied:	Yes
Earthquake magnitude $M_w$ :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	10.00 m

**F.S. color scheme**

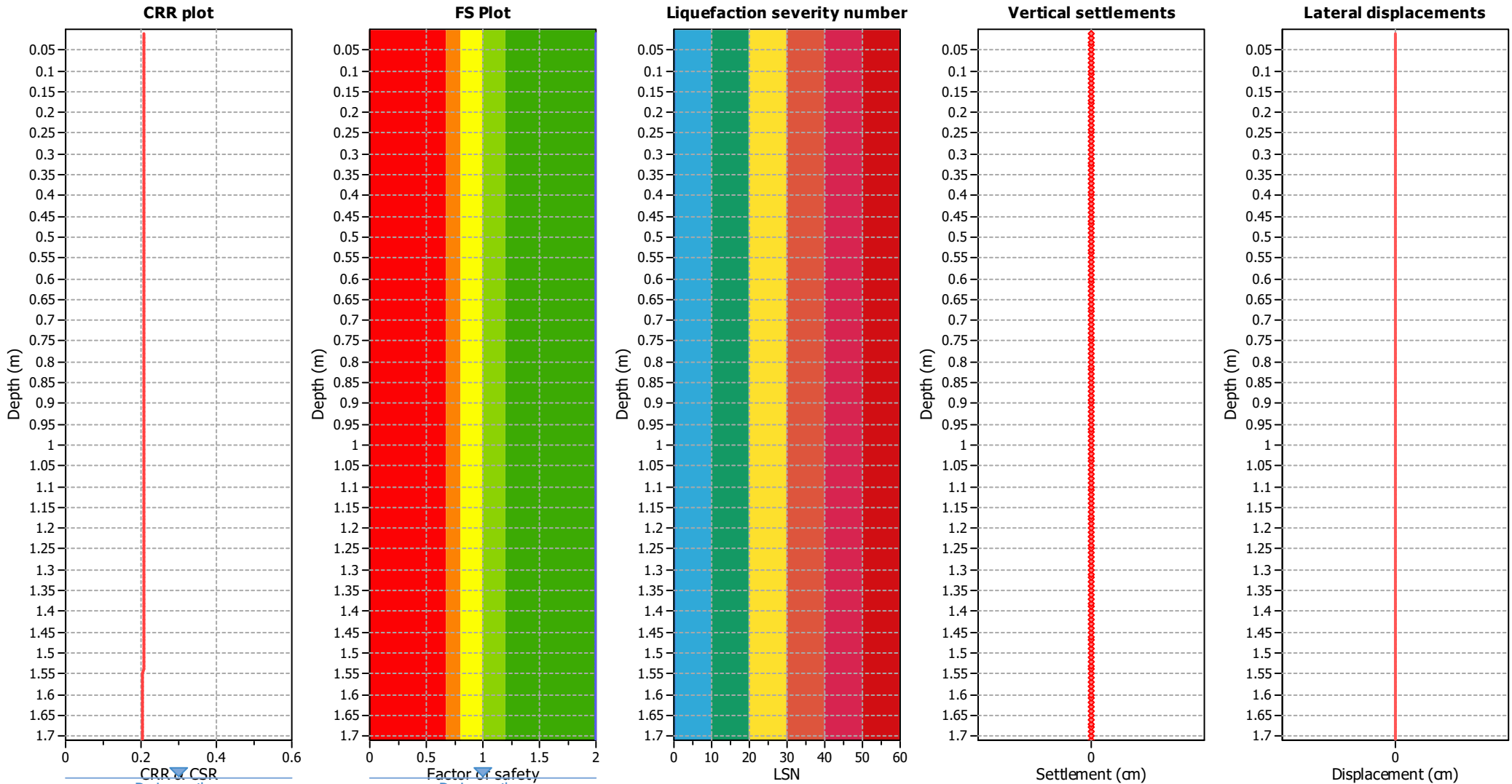
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

**LSN color scheme**

- Severe damage
- Major expression of liquefaction
- Moderate to severe exp. of liquefaction
- Moderate expression of liquefaction
- Minor expression of liquefaction
- Little to no expression of liquefaction



### Liquefaction analysis overall plots



**Input parameters and analysis data**

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.80 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_{\sigma}$ applied:	Yes
Earthquake magnitude $M_w$ :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.80 m	Fill height:	N/A	Limit depth:	10.00 m

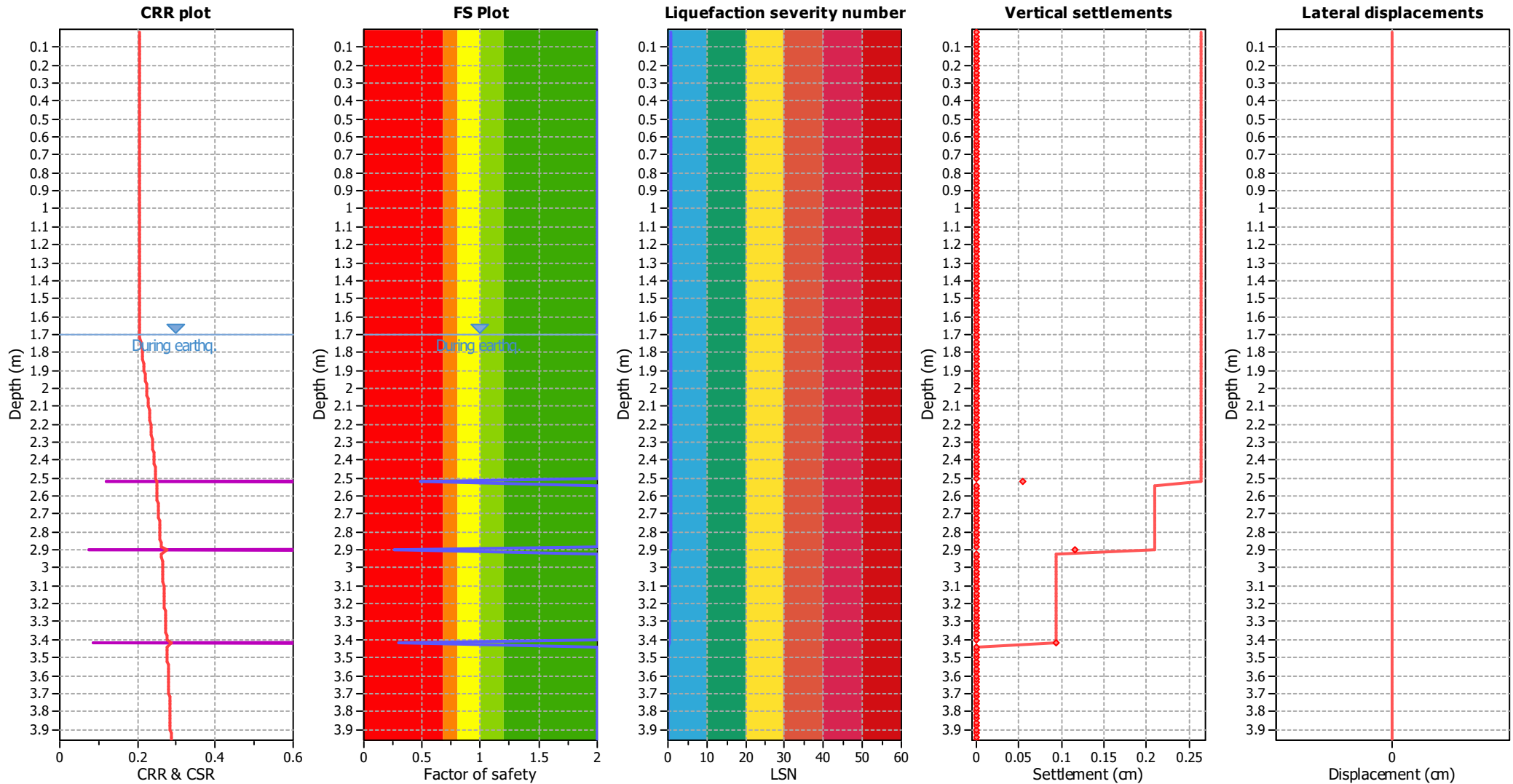
**F.S. color scheme**

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

**LSN color scheme**

- Severe damage
- Major expression of liquefaction
- Moderate to severe exp. of liquefaction
- Moderate expression of liquefaction
- Minor expression of liquefaction
- Little to no expression of liquefaction

### Liquefaction analysis overall plots



**Input parameters and analysis data**

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_f$ applied:	Yes
Earthquake magnitude $M_w$ :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	10.00 m

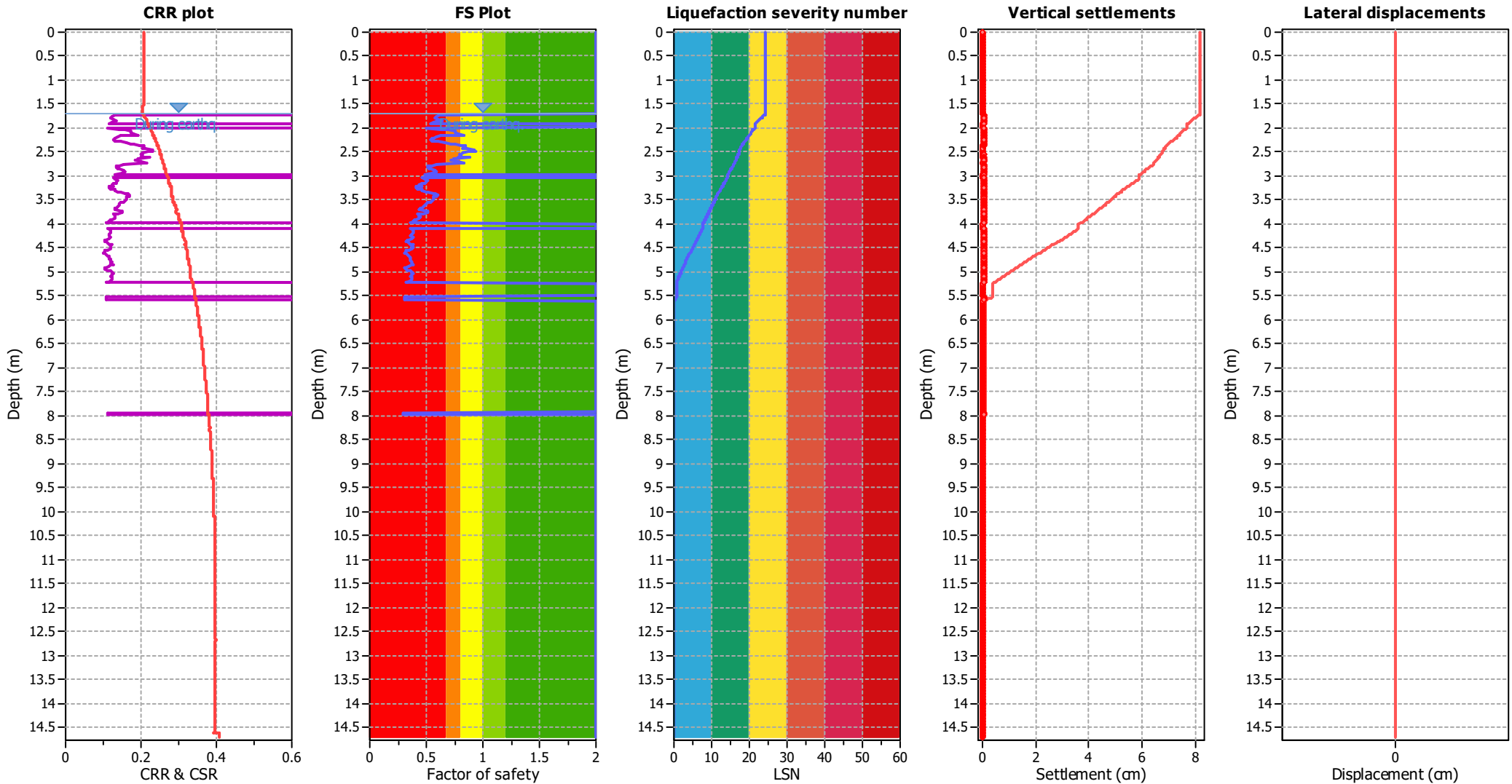
**F.S. color scheme**

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- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

**LSN color scheme**

- Severe damage
- Major expression of liquefaction
- Moderate to severe exp. of liquefaction
- Moderate expression of liquefaction
- Minor expression of liquefaction
- Little to no expression of liquefaction

### Liquefaction analysis overall plots



**Input parameters and analysis data**

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_v$ applied:	Yes
Earthquake magnitude $M_w$ :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	10.00 m

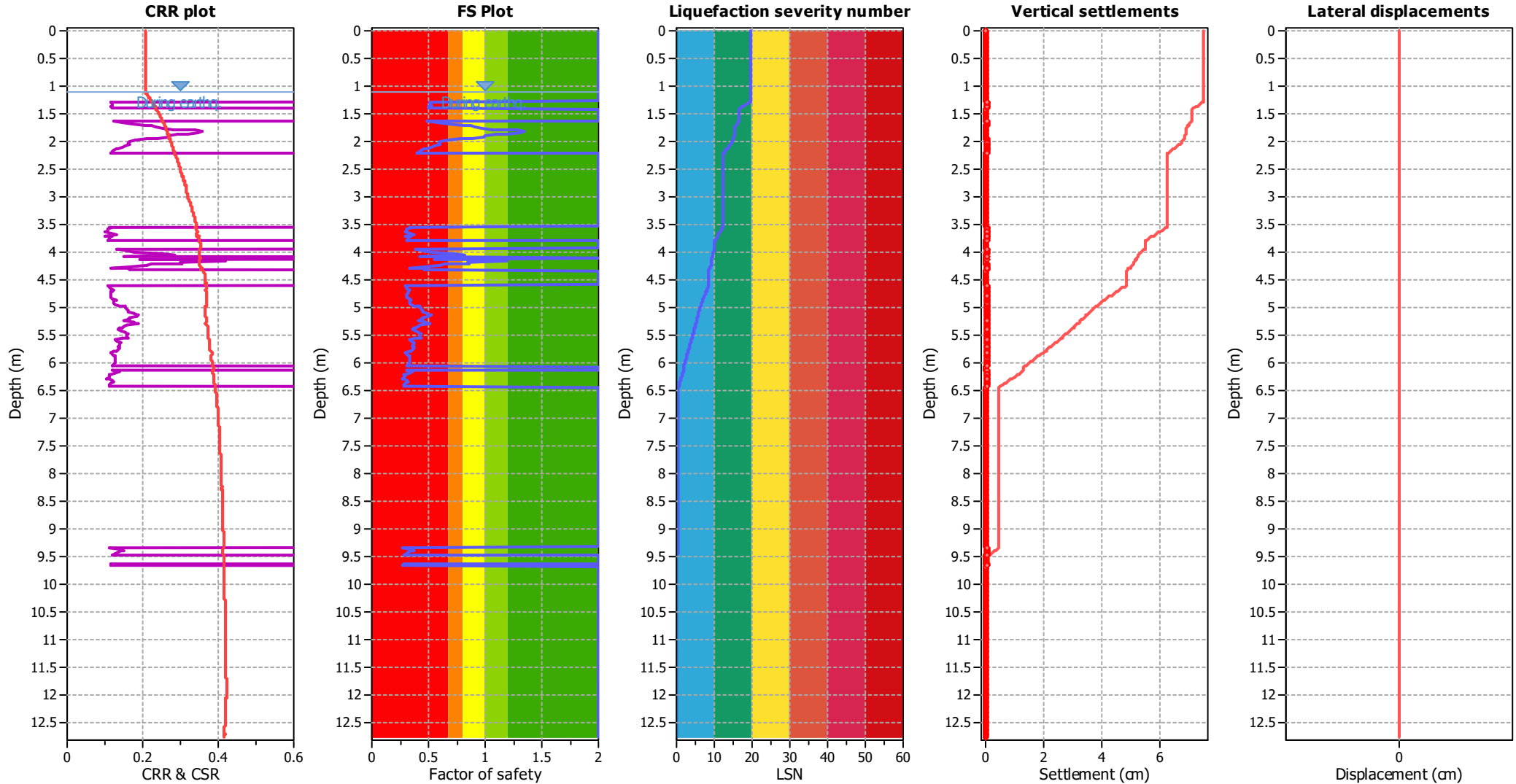
**F.S. color scheme**

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### Liquefaction analysis overall plots



#### Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.10 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_v$ applied:	Yes
Earthquake magnitude $M_w$ :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.10 m	Fill height:	N/A	Limit depth:	10.00 m

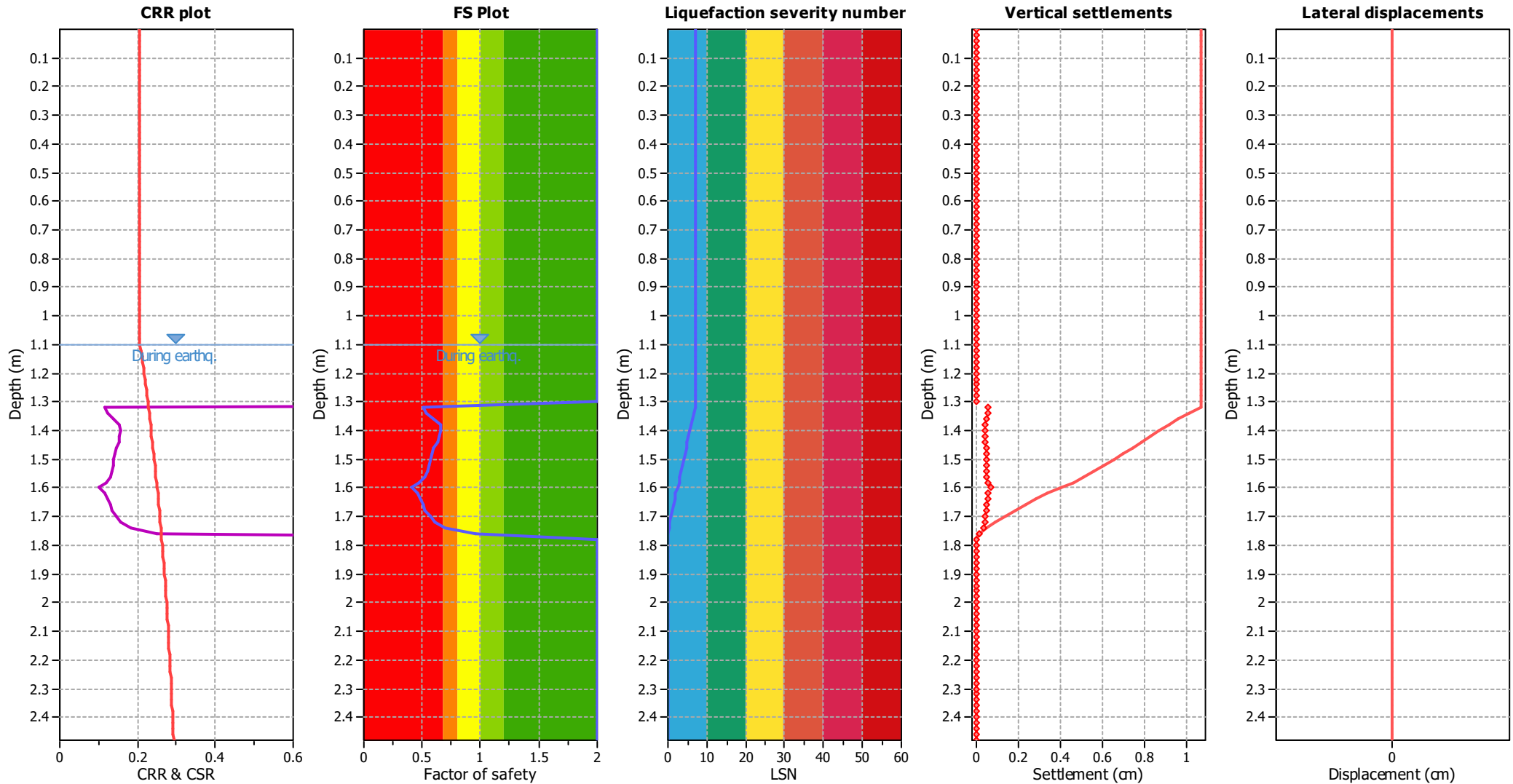
#### F.S. color scheme

- Almost certain it will liquefy
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- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

#### LSN color scheme

- Severe damage
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- Moderate to severe exp. of liquefaction
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- Minor expression of liquefaction
- Little to no expression of liquefaction

### Liquefaction analysis overall plots



**Input parameters and analysis data**

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.10 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_{\phi}$ applied:	Yes
Earthquake magnitude $M_w$ :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.10 m	Fill height:	N/A	Limit depth:	10.00 m

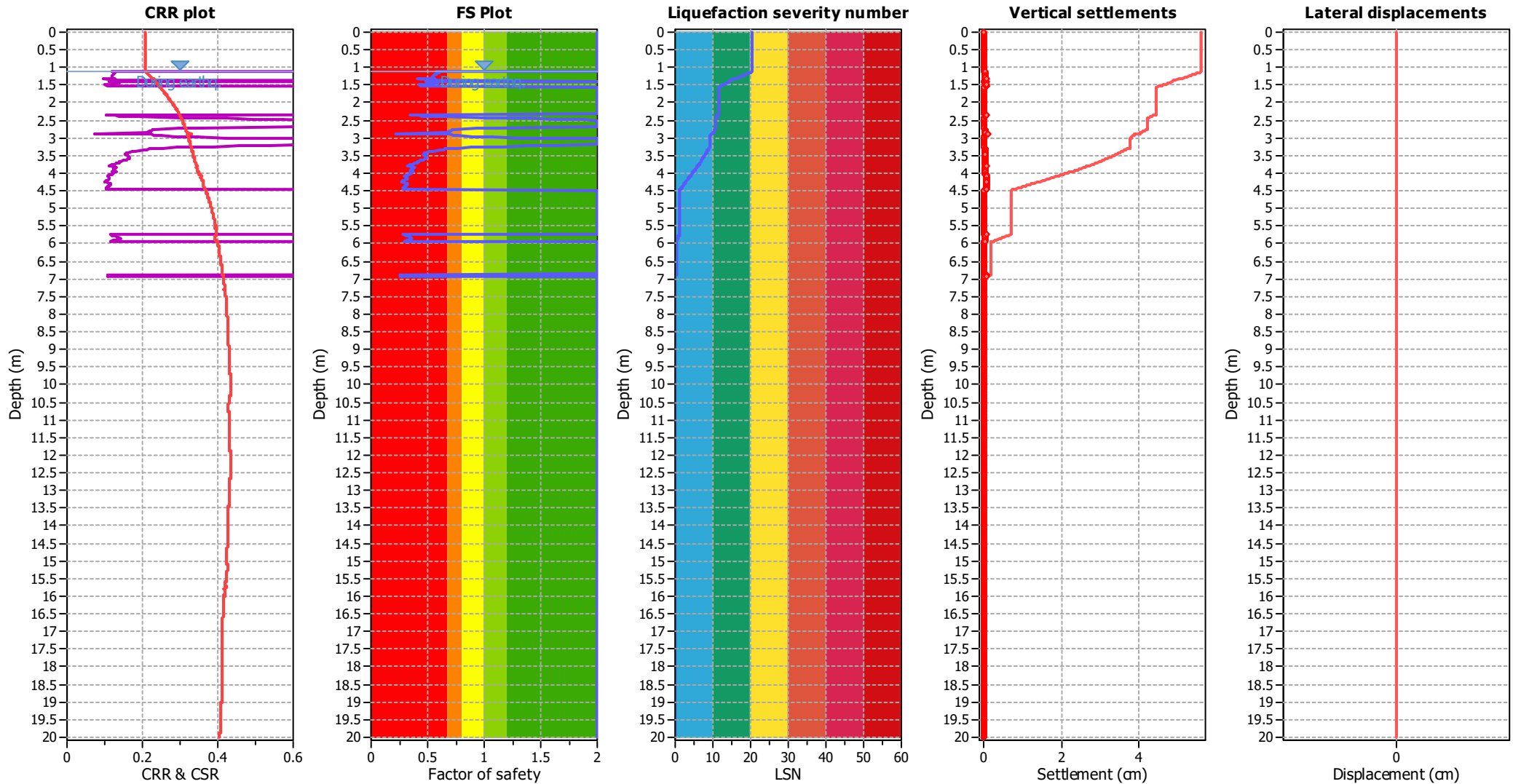
**F.S. color scheme**

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- Moderate to severe exp. of liquefaction
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- Minor expression of liquefaction
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### Liquefaction analysis overall plots



#### Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.10 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K <sub>v</sub> applied:	Yes
Earthquake magnitude M <sub>w</sub> :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.10 m	Fill height:	N/A	Limit depth:	10.00 m

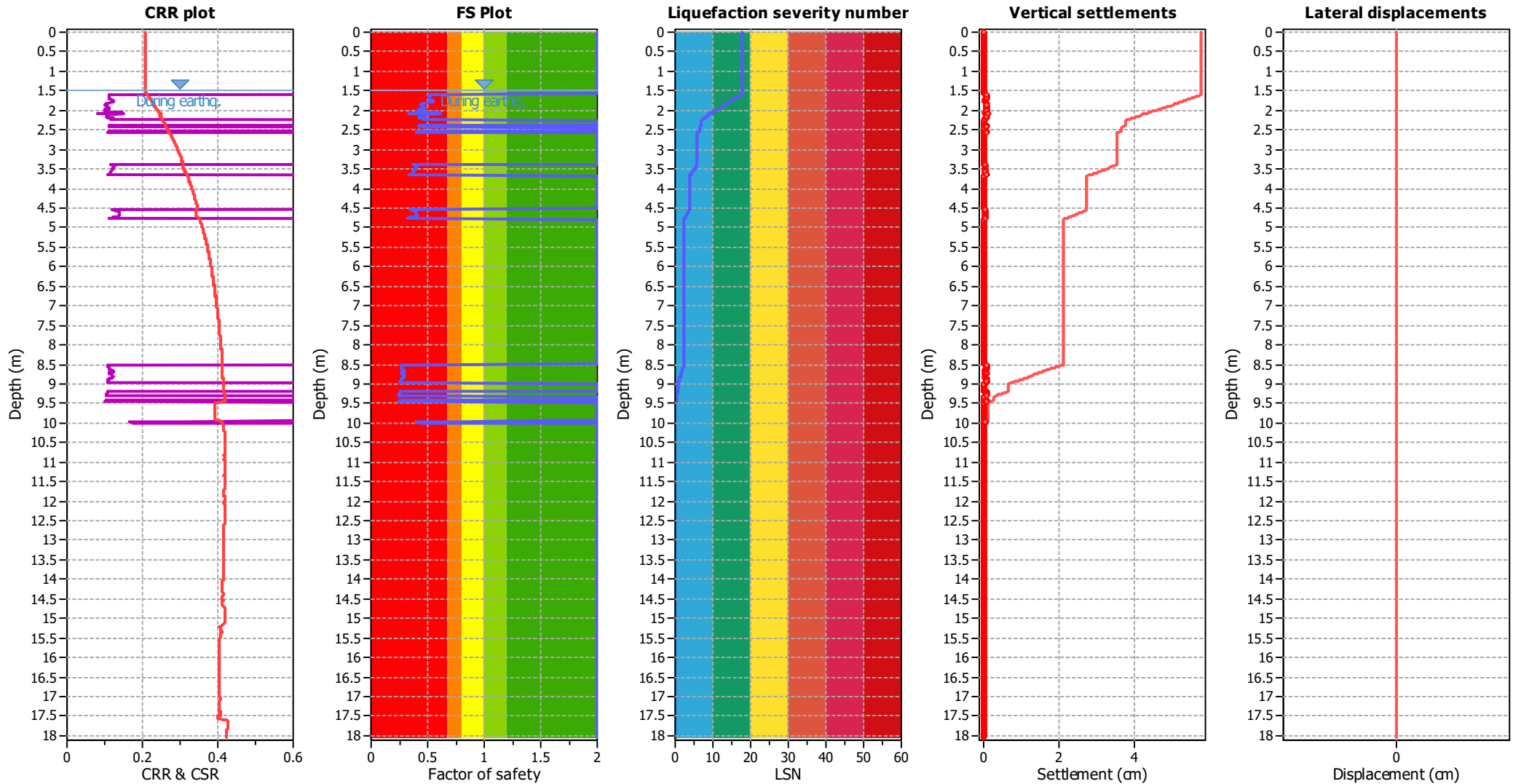
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### Liquefaction analysis overall plots



**Input parameters and analysis data**

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.50 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_v$ applied:	Yes
Earthquake magnitude $M_w$ :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	10.00 m

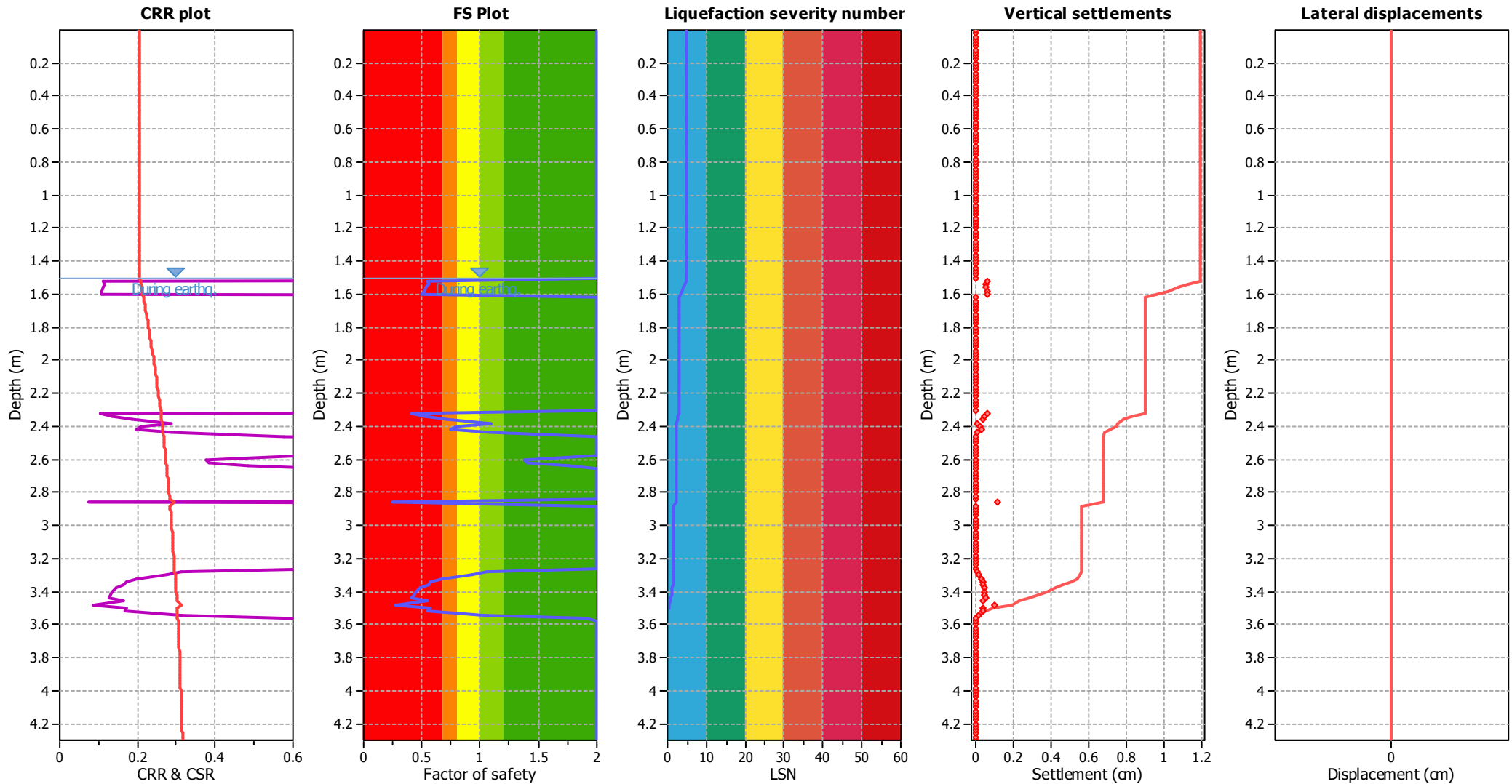
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- Moderate expression of liquefaction
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- Little to no expression of liquefaction

### Liquefaction analysis overall plots



**Input parameters and analysis data**

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.50 m
Fines correction method:	B&I (2014)	Average results interval:	3
Points to test:	Based on Ic value	Ic cut-off value:	2.60
Earthquake magnitude $M_w$ :	7.50	Unit weight calculation:	Based on SBT
Peak ground acceleration:	0.35	Use fill:	No
Depth to water table (insitu):	1.50 m	Fill height:	N/A

Fill weight:	N/A
Transition detect. applied:	No
$K_v$ applied:	Yes
Clay like behavior applied:	Sands only
Limit depth applied:	Yes
Limit depth:	10.00 m

**F.S. color scheme**

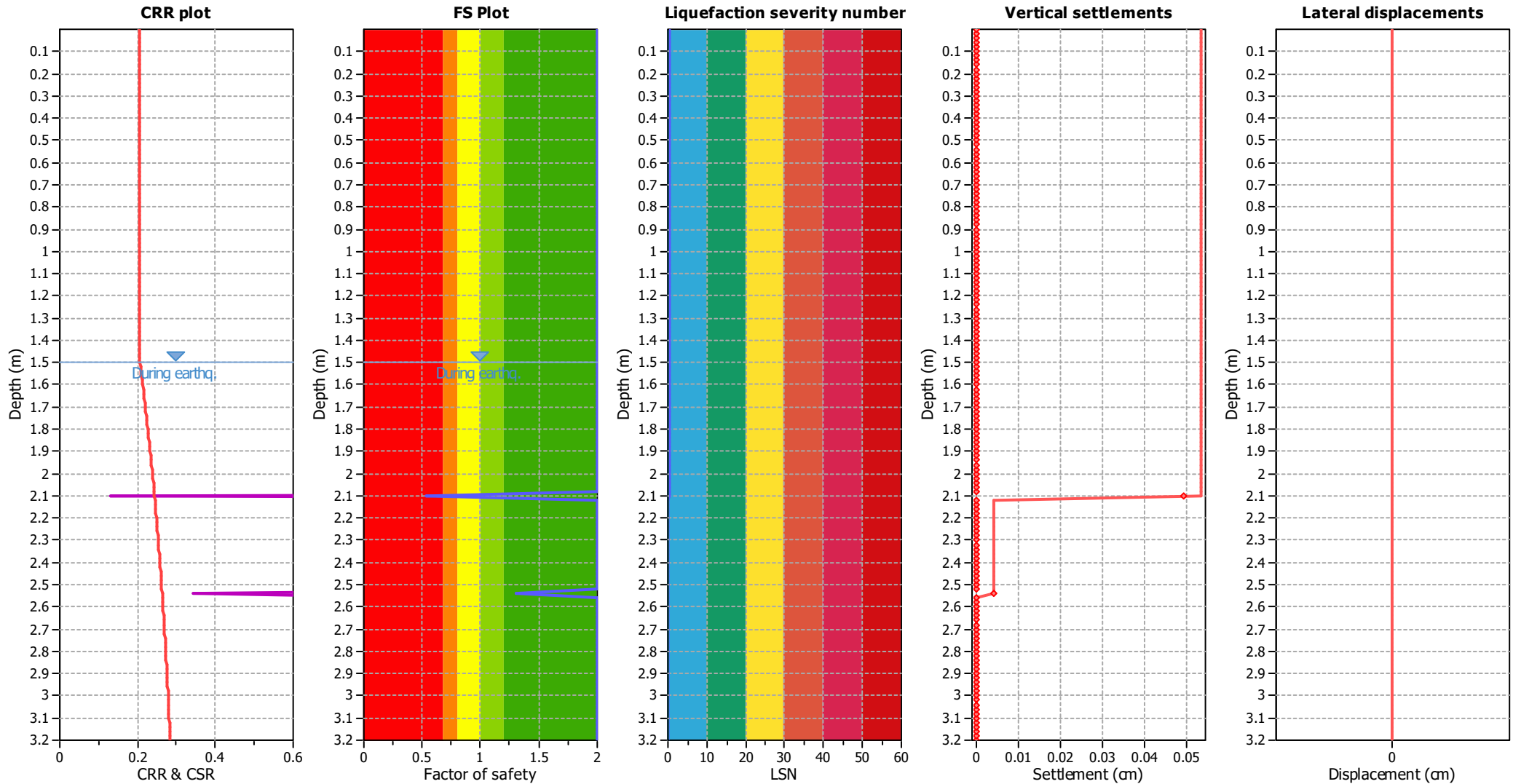
- Almost certain it will liquefy
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- Liquefaction and no liq. are equally likely
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**LSN color scheme**

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### Liquefaction analysis overall plots



**Input parameters and analysis data**

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.50 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_d$ applied:	Yes
Earthquake magnitude $M_w$ :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	10.00 m

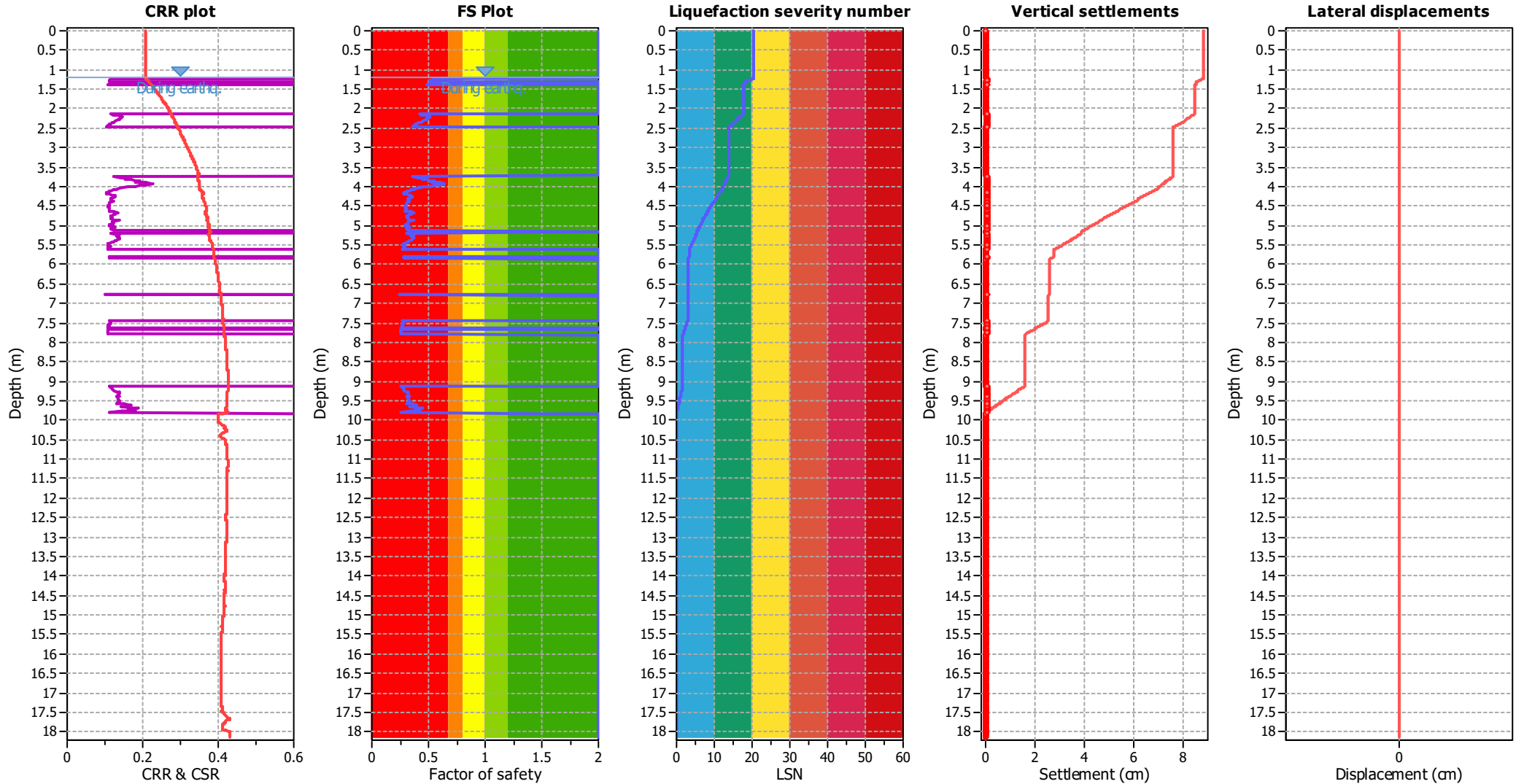
**F.S. color scheme**

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- Moderate to severe exp. of liquefaction
- Moderate expression of liquefaction
- Minor expression of liquefaction
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### Liquefaction analysis overall plots



**Input parameters and analysis data**

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.20 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_{\sigma}$ applied:	Yes
Earthquake magnitude $M_w$ :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.20 m	Fill height:	N/A	Limit depth:	10.00 m

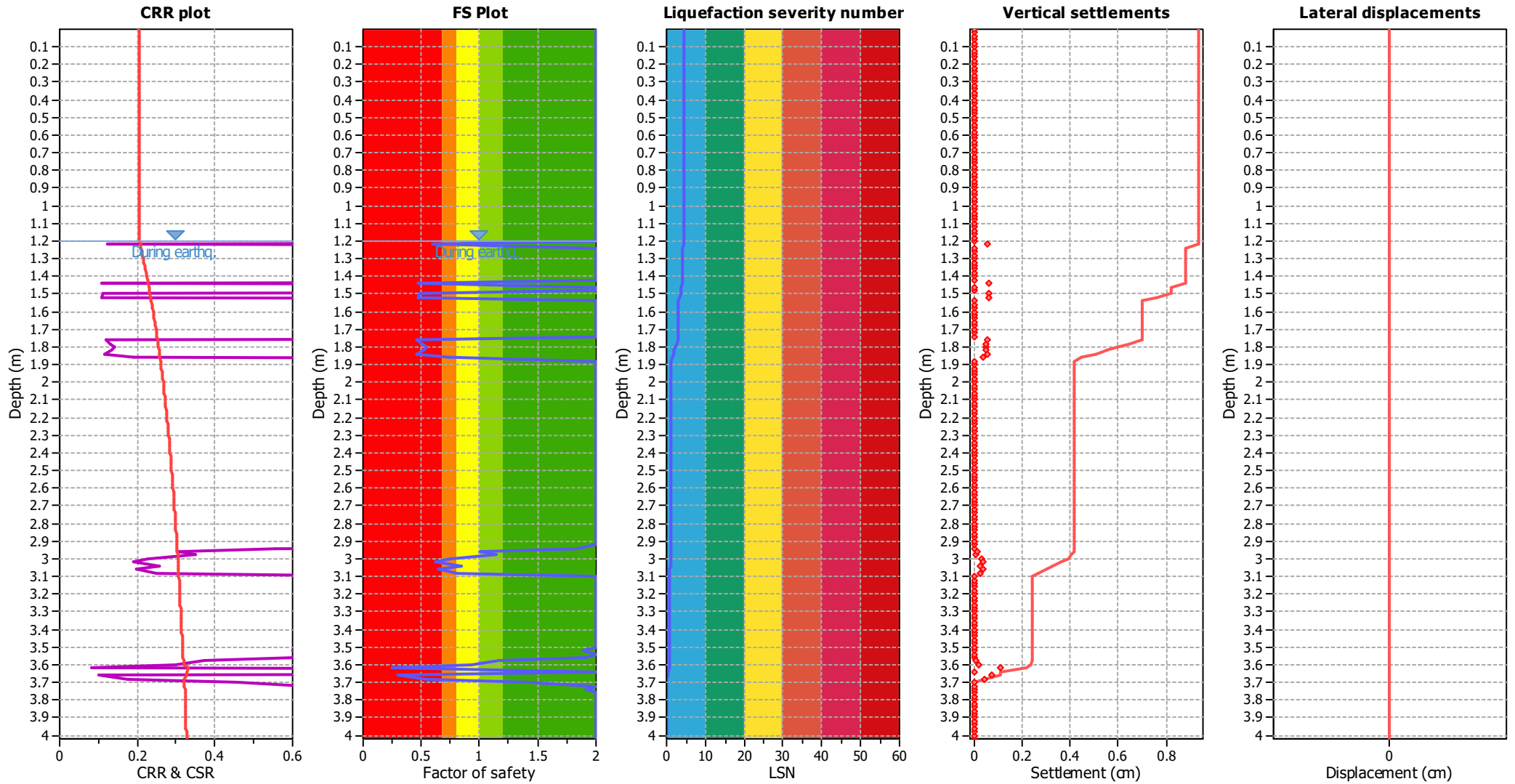
**F.S. color scheme**

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

**LSN color scheme**

- Severe damage
- Major expression of liquefaction
- Moderate to severe exp. of liquefaction
- Moderate expression of liquefaction
- Minor expression of liquefaction
- Little to no expression of liquefaction

### Liquefaction analysis overall plots



**Input parameters and analysis data**

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.20 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_f$ applied:	Yes
Earthquake magnitude $M_w$ :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.20 m	Fill height:	N/A	Limit depth:	10.00 m

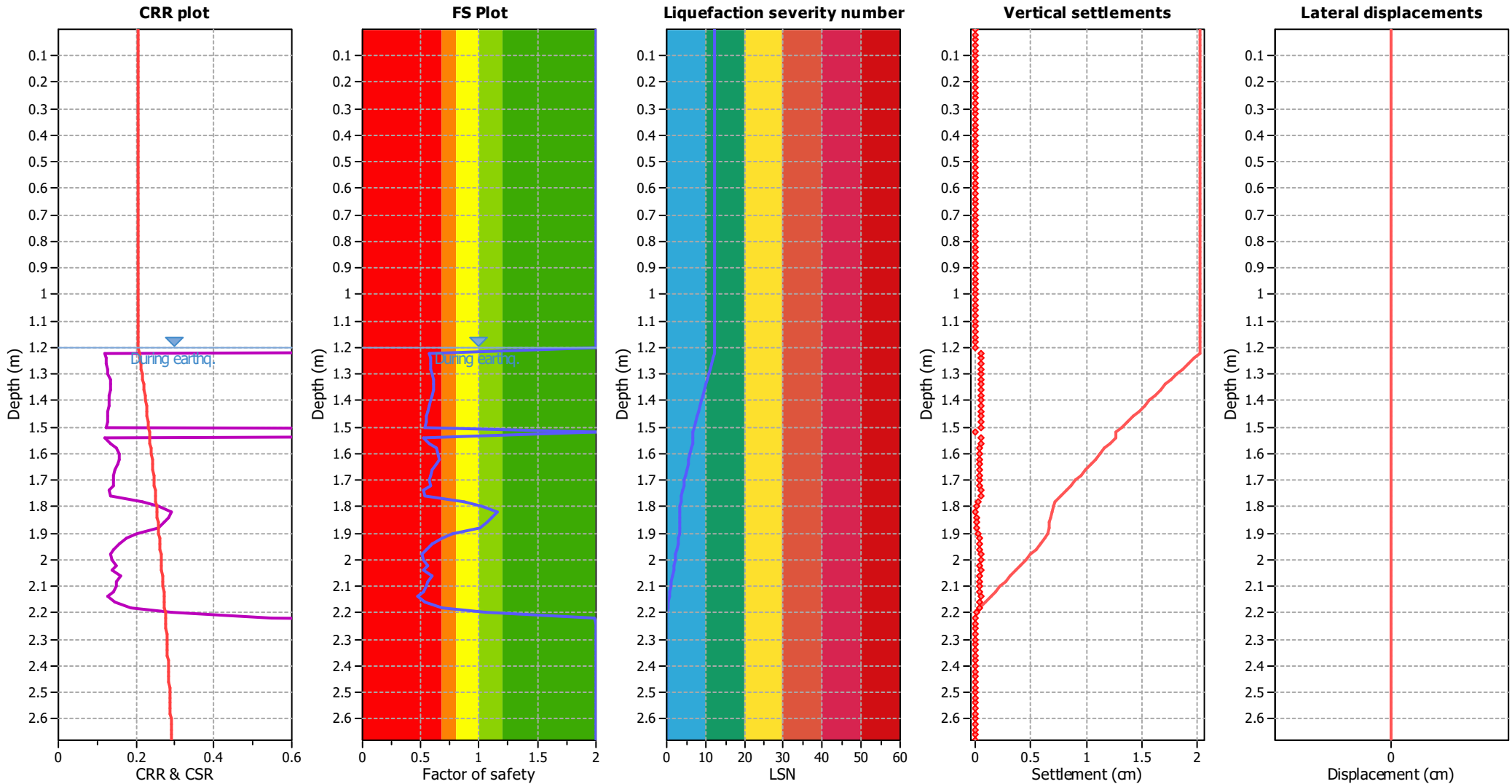
**F.S. color scheme**

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

**LSN color scheme**

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- Moderate to severe exp. of liquefaction
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- Minor expression of liquefaction
- Little to no expression of liquefaction

### Liquefaction analysis overall plots



**Input parameters and analysis data**

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.20 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_f$ applied:	Yes
Earthquake magnitude $M_w$ :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.20 m	Fill height:	N/A	Limit depth:	10.00 m

**F.S. color scheme**

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

**LSN color scheme**

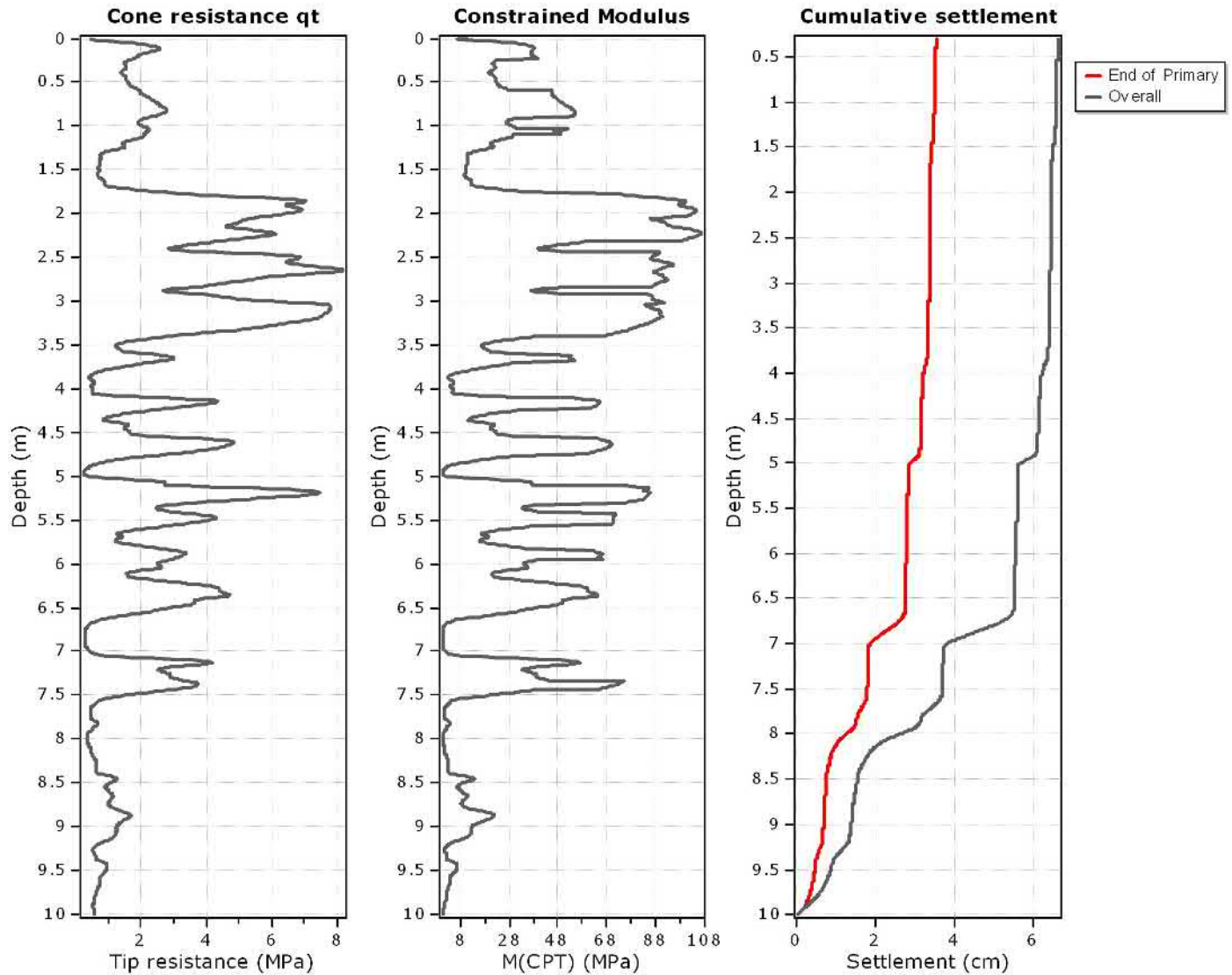
- Severe damage
- Major expression of liquefaction
- Moderate to severe exp. of liquefaction
- Moderate expression of liquefaction
- Minor expression of liquefaction
- Little to no expression of liquefaction

## **APPENDIX 6:** Consolidation Analysis Outputs

**Project:**

**Location:**

**Settlements calculation according to theory of elasticity\***



**Calculation properties**

Footing type: Rectangular  
 Footing width: 20.00 (m)  
 L/B: 1.0  
 Footing pressure: 20.00 (kPa)  
 Embedment depth: 0.30 (m)  
 Footing is rigid: No  
 Remove excavation load: No  
 Apply 20% rule: No  
 Calculate secondary settlements: Yes  
 Time period for primary consolidation: 6 months  
 Time period for second. settlements: 600 months

\* Primary settlements calculation is performed according to the following formula:

$$S = \sum \frac{\Delta\sigma_v}{M_{CPT}} \Delta z$$

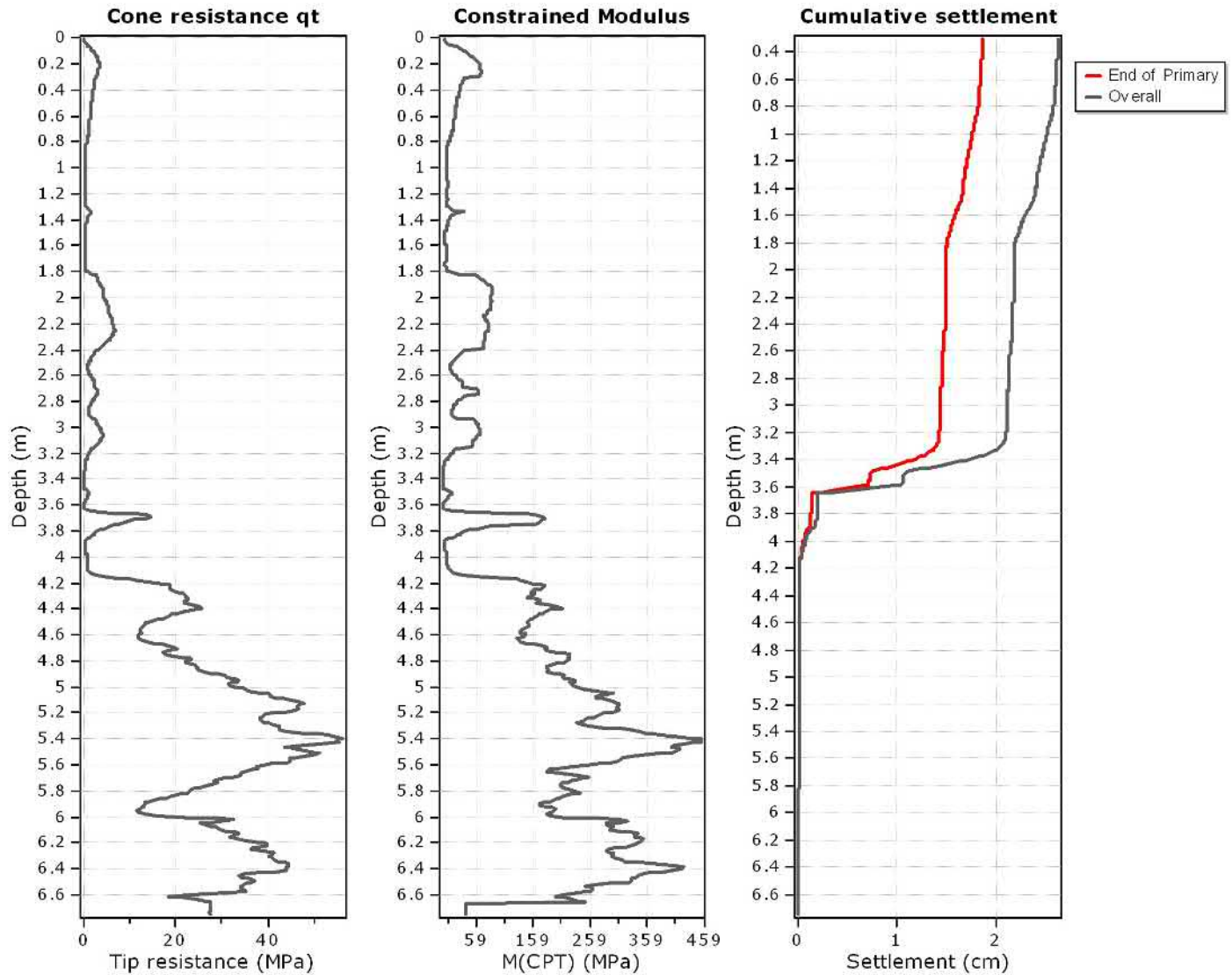
\* Secondary (creep) settlements calculation is performed according to the following formula:

$$S = C_a \cdot \Delta z \cdot \log(t)$$

**Project:**

**Location:**

**Settlements calculation according to theory of elasticity\***



**Calculation properties**

Footing type: Rectangular  
 Footing width: 20.00 (m)  
 L/B: 1.0  
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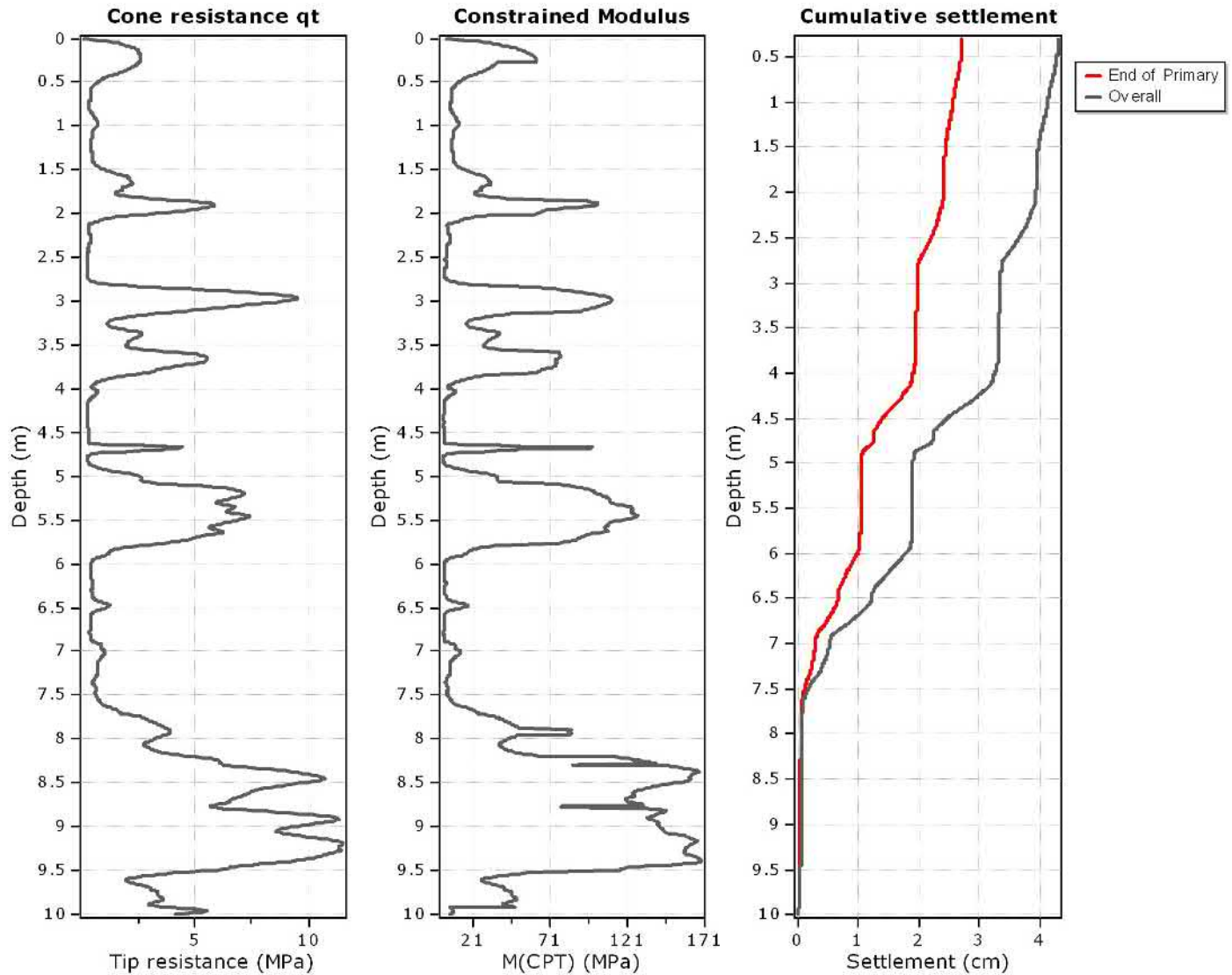
\* Secondary (creep) settlements calculation is performed according to the following formula:

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**Location:**

**Settlements calculation according to theory of elasticity\***



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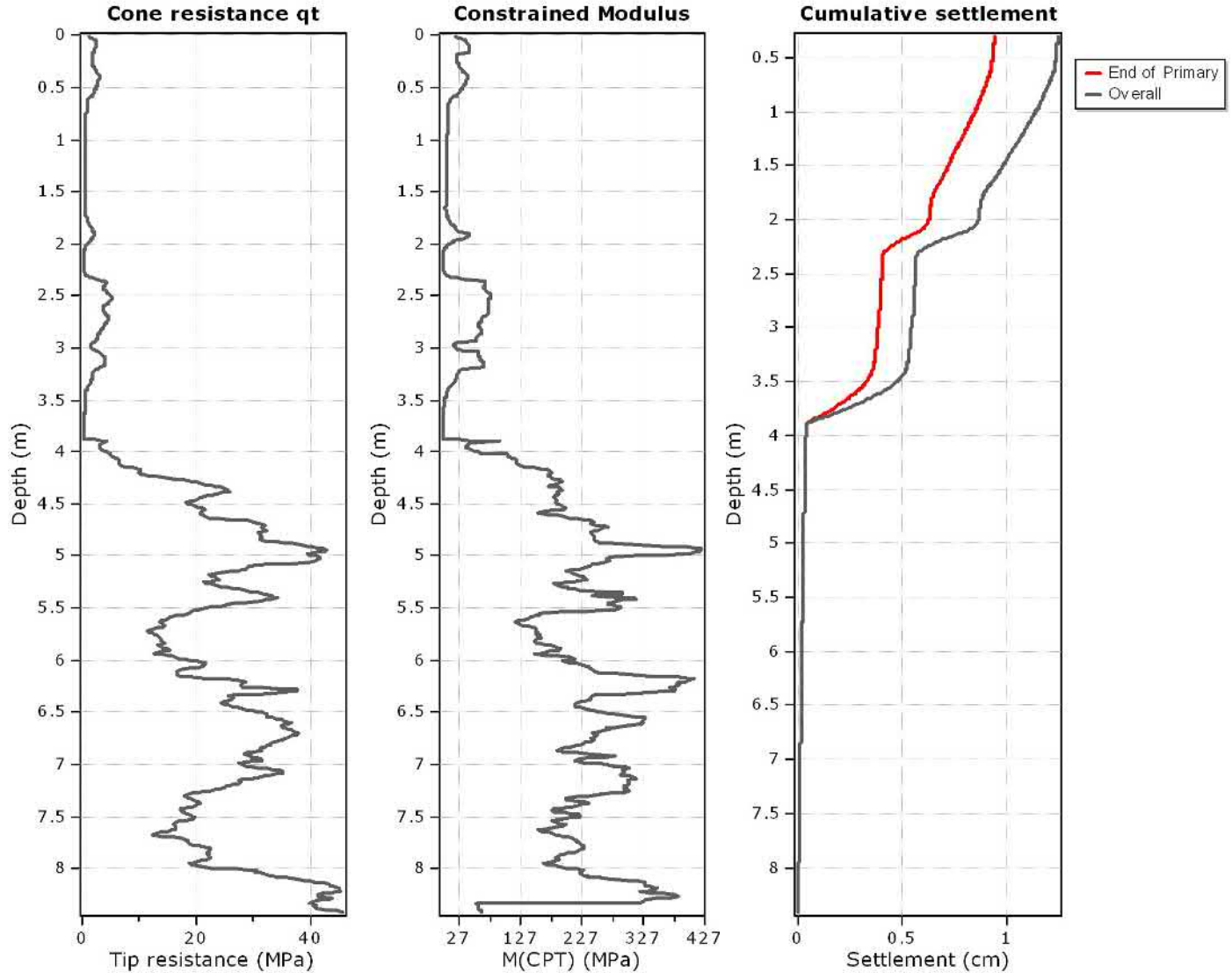
$$S = C_a \cdot \Delta z \cdot \log(t)$$



**Project:**

**Location:**

**Settlements calculation according to theory of elasticity\***



**Calculation properties**

Footing type: Rectangular  
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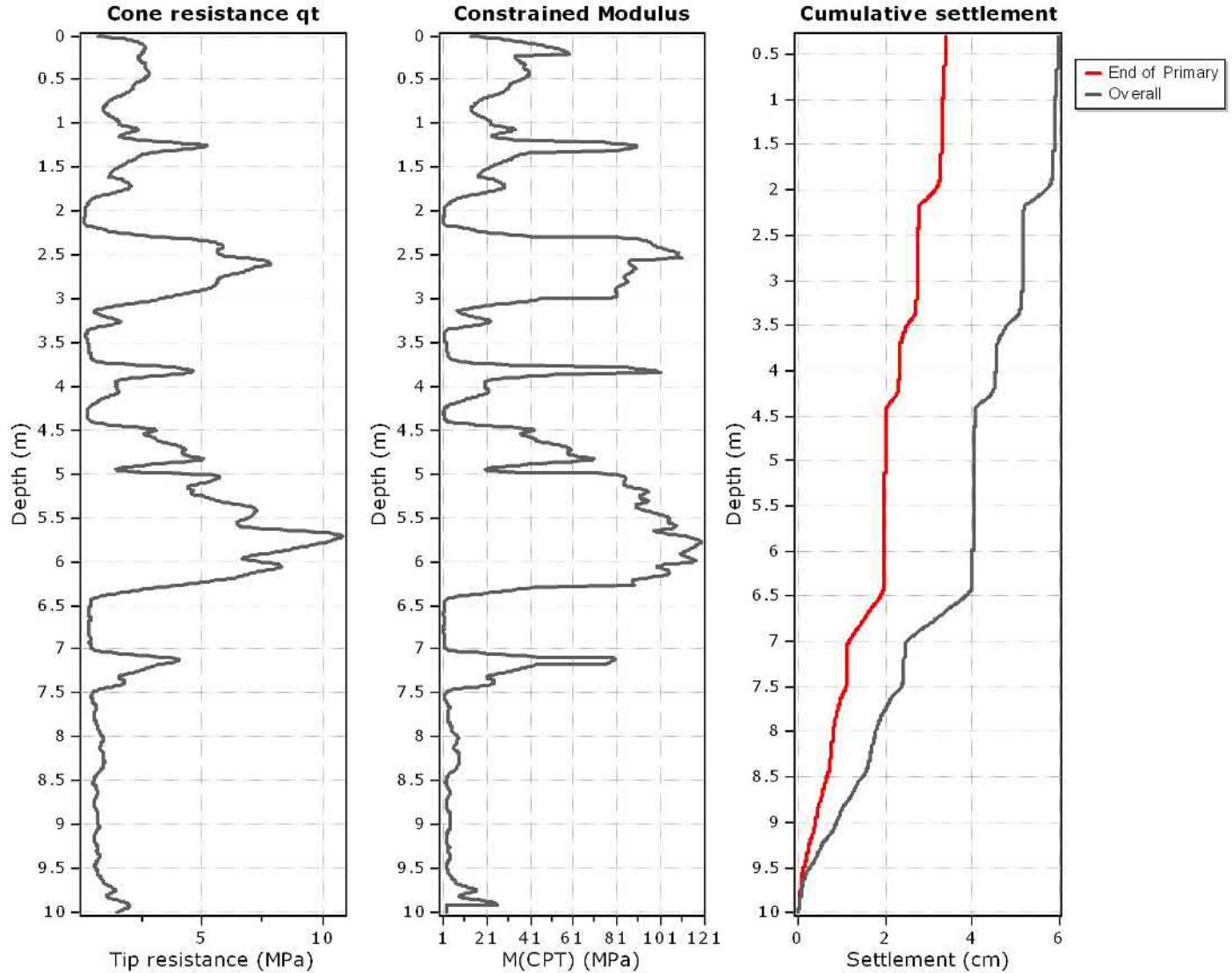
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**Location:**

**Settlements calculation according to theory of elasticity\***



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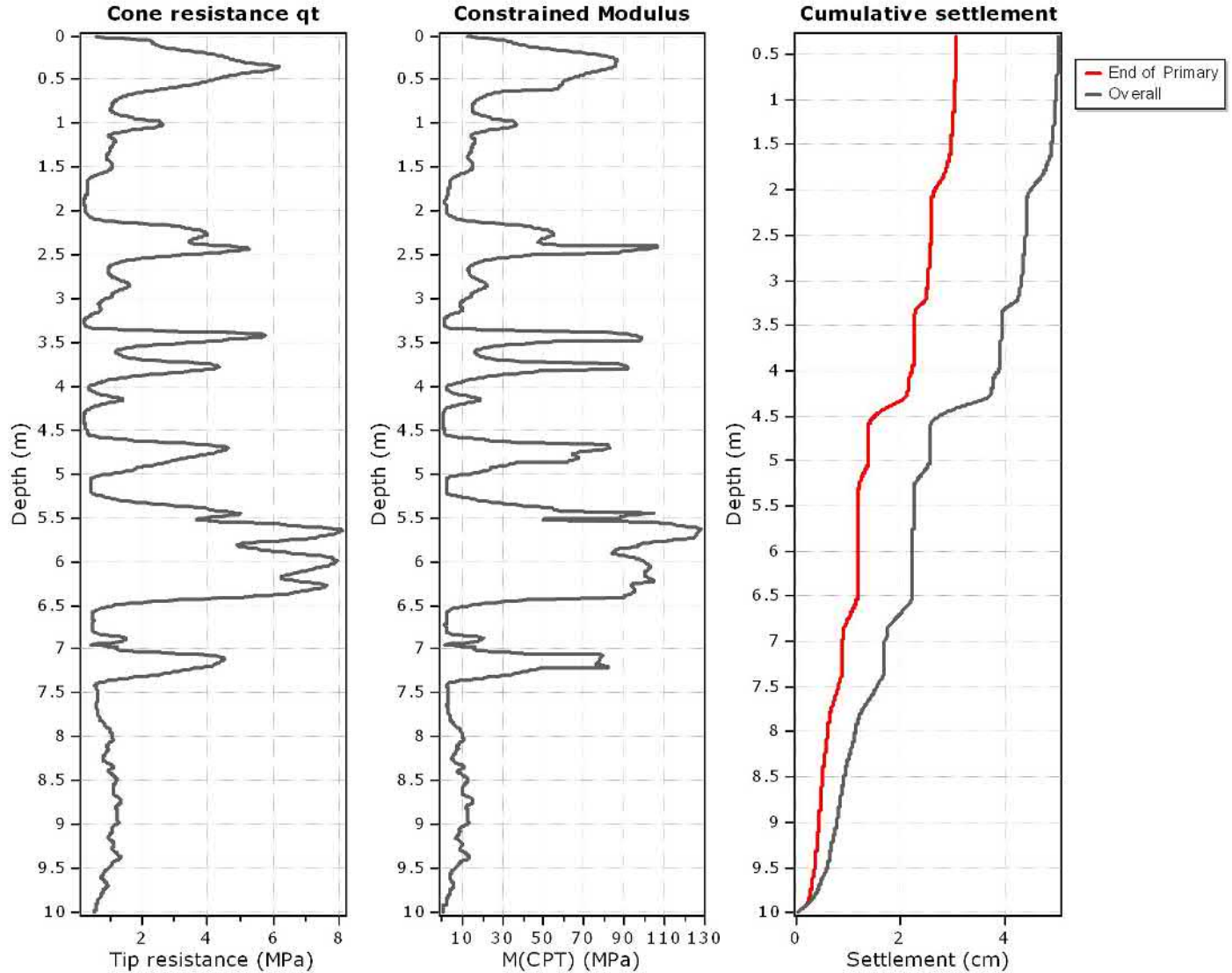
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**Settlements calculation according to theory of elasticity\***



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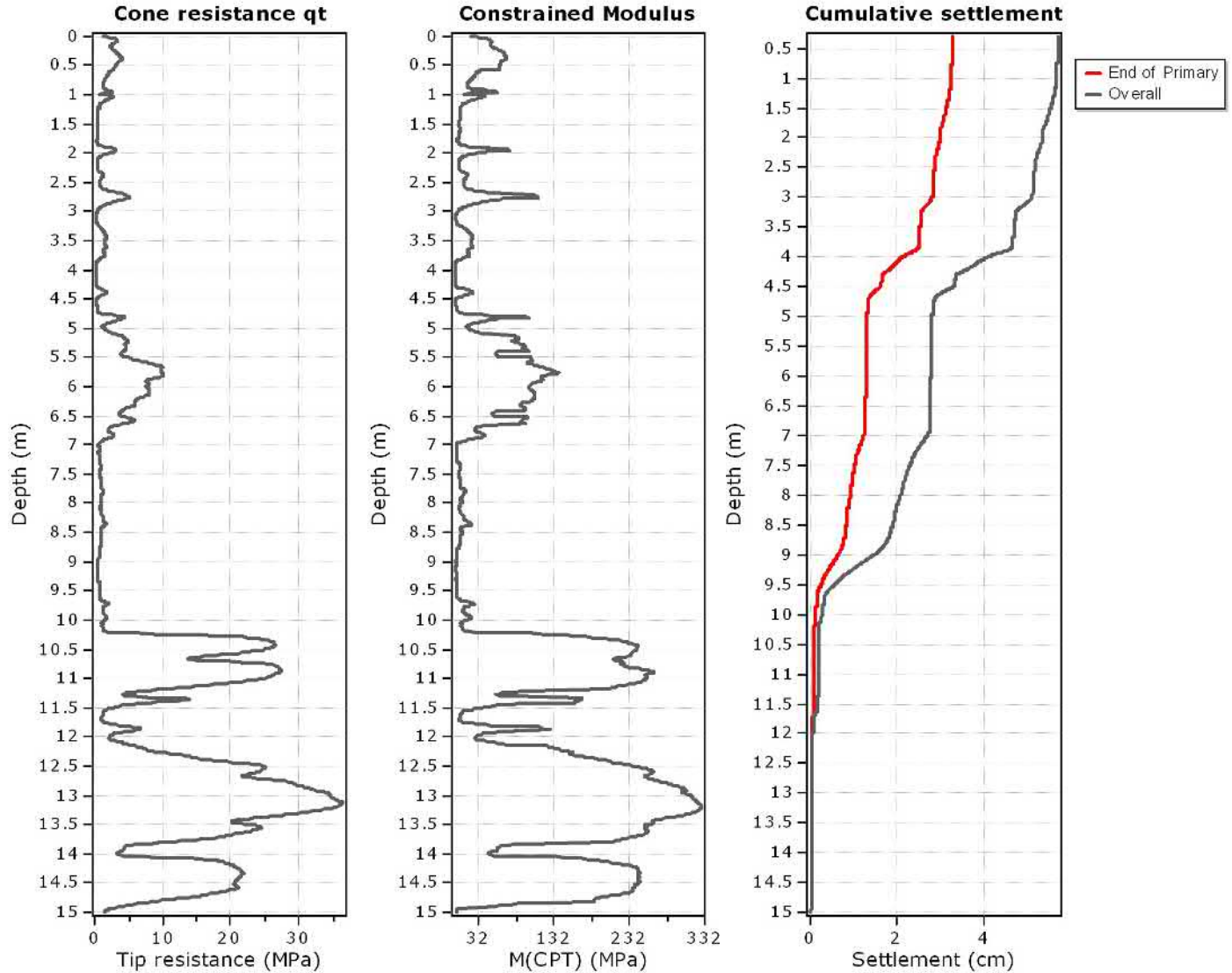
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**Project:**

**Location:**

**Settlements calculation according to theory of elasticity\***



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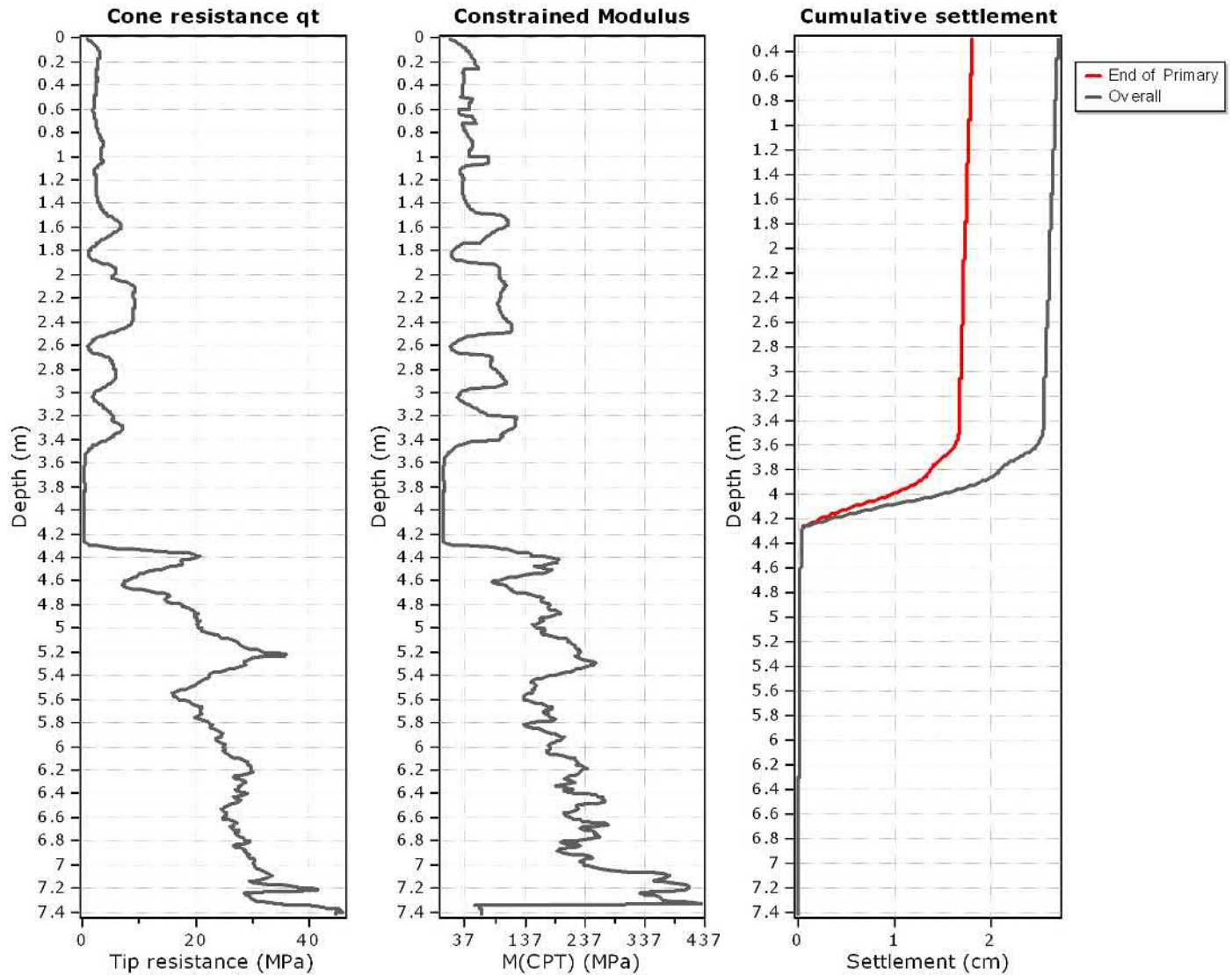
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**Project:**

**Location:**

**Settlements calculation according to theory of elasticity\***



**Calculation properties**

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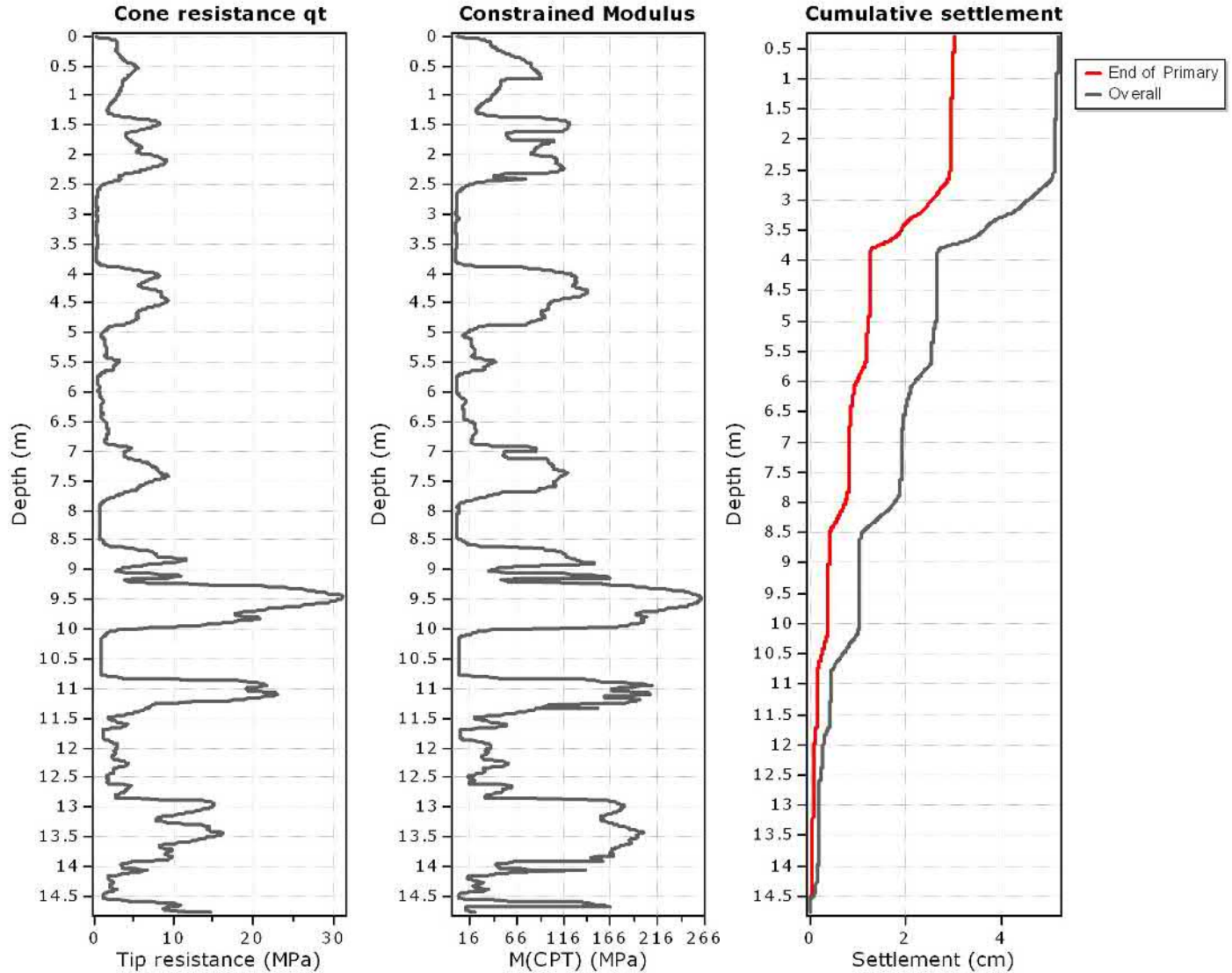
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**Location:**

**Settlements calculation according to theory of elasticity\***



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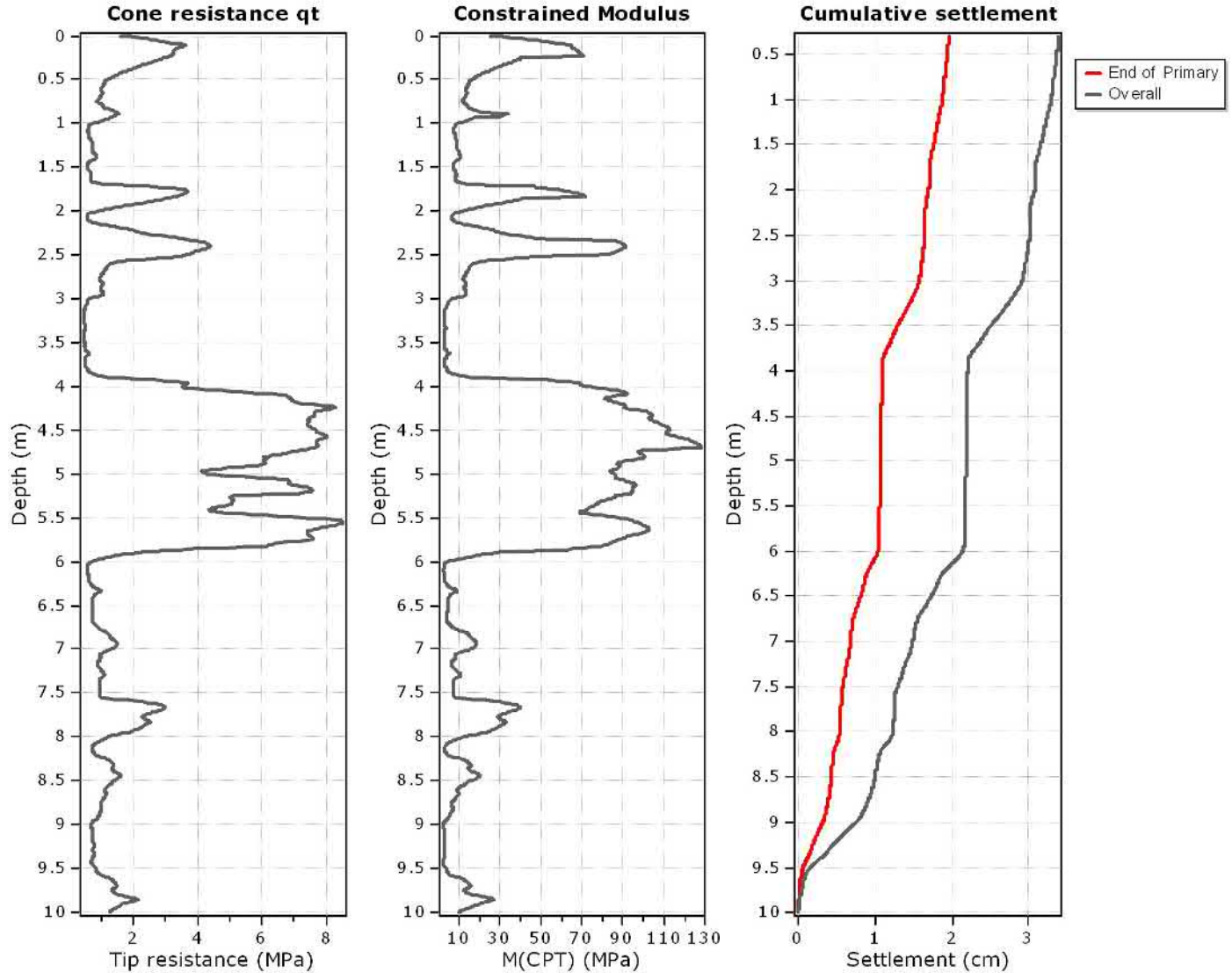
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**Settlements calculation according to theory of elasticity\***



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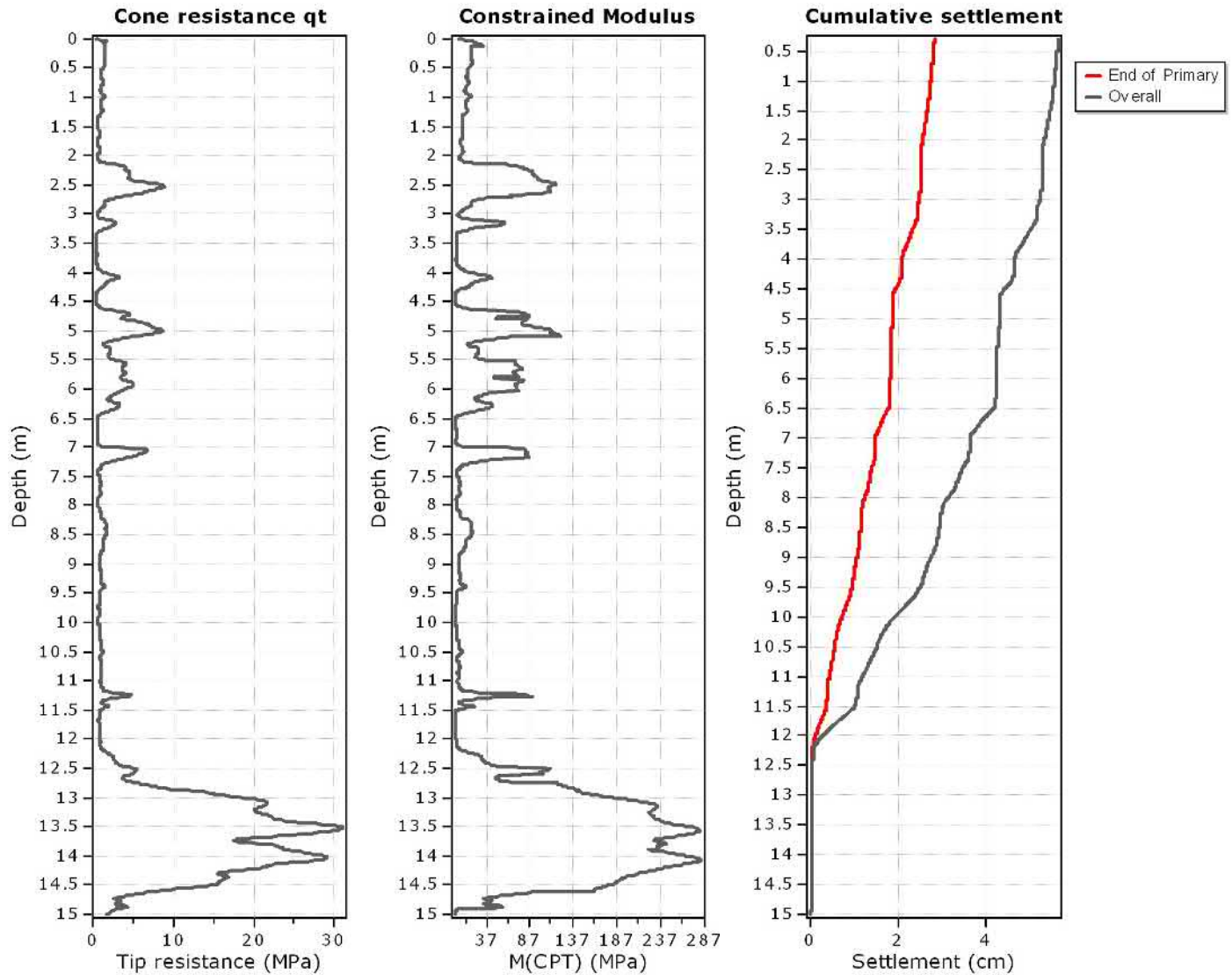
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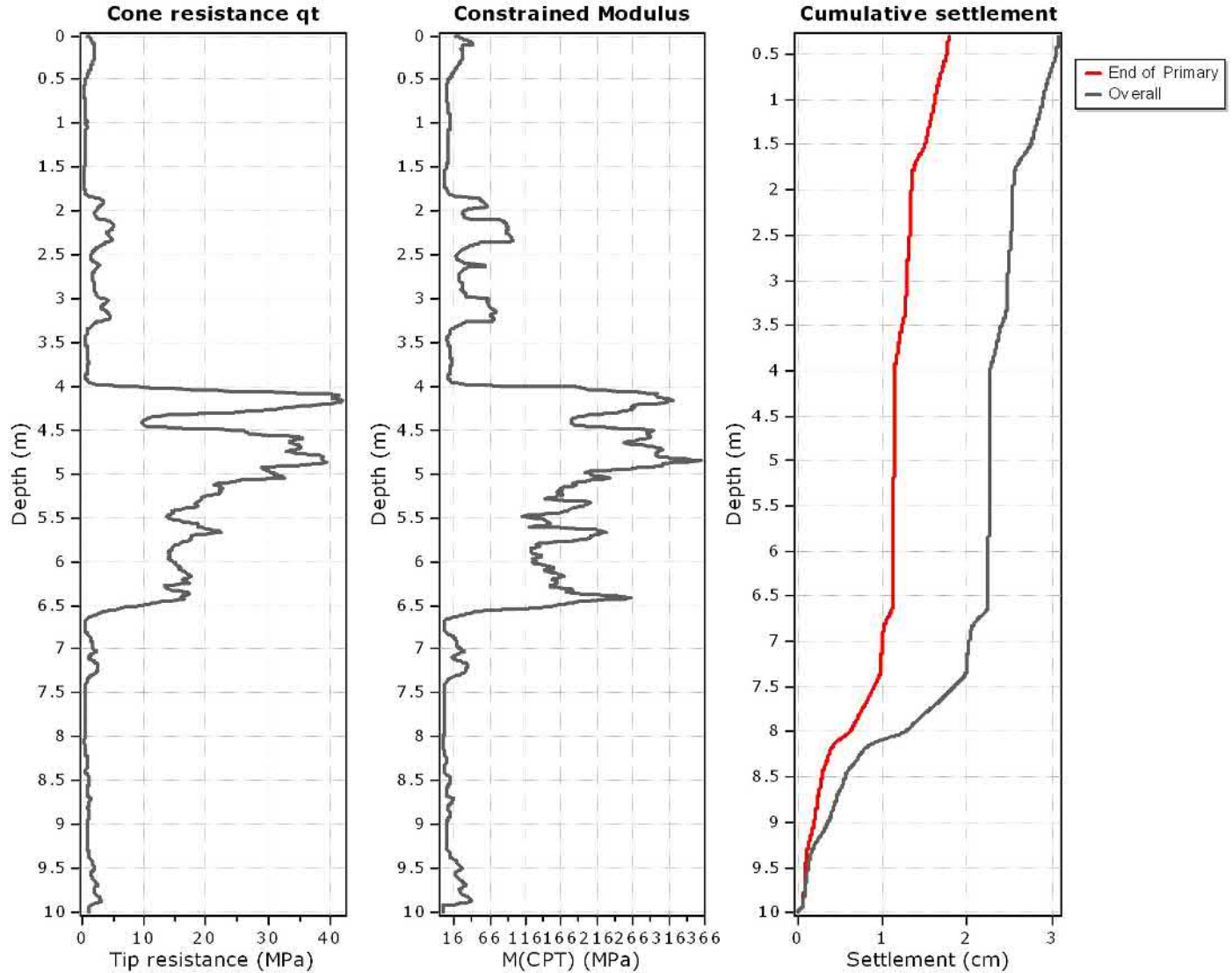
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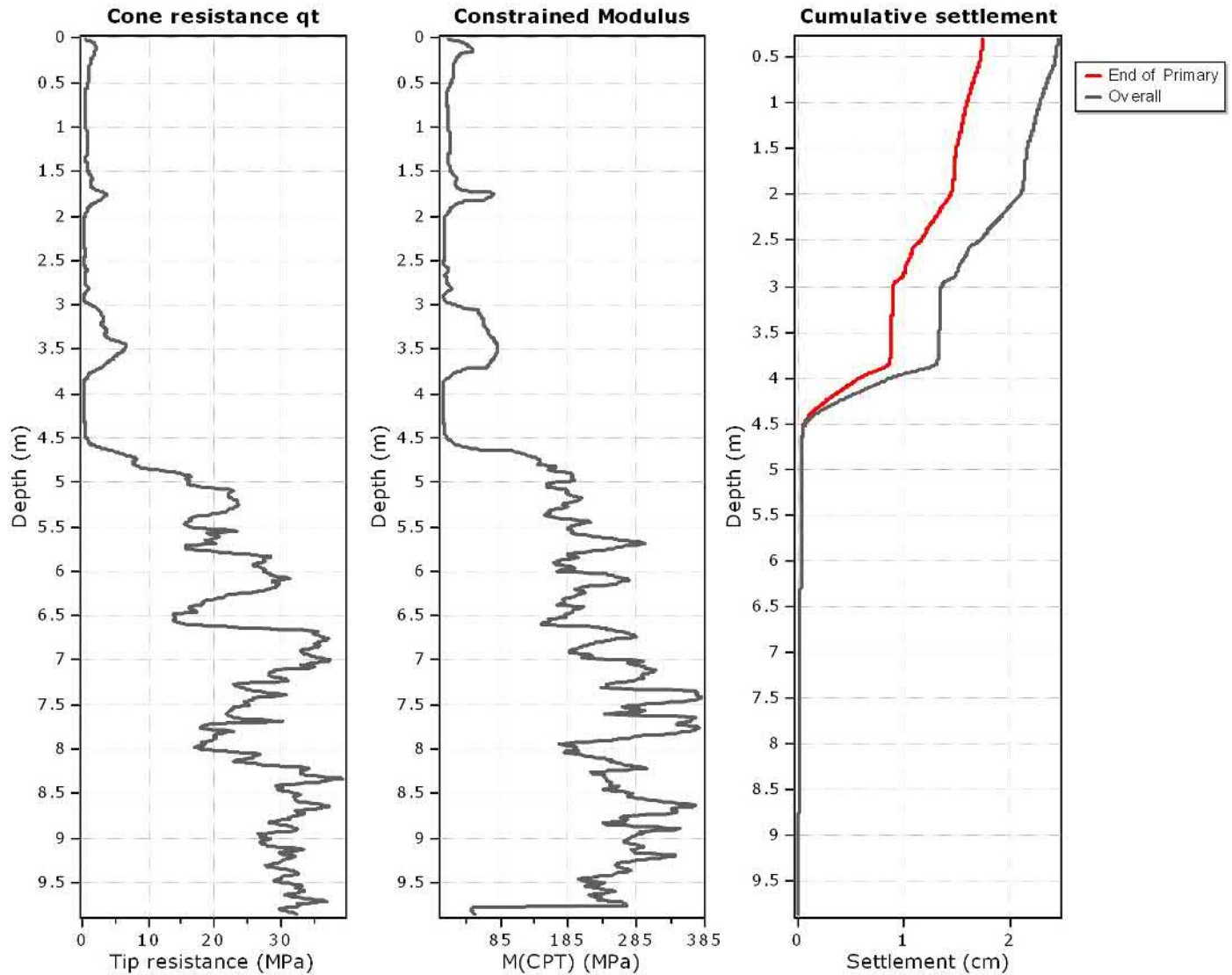
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**Settlements calculation according to theory of elasticity\***



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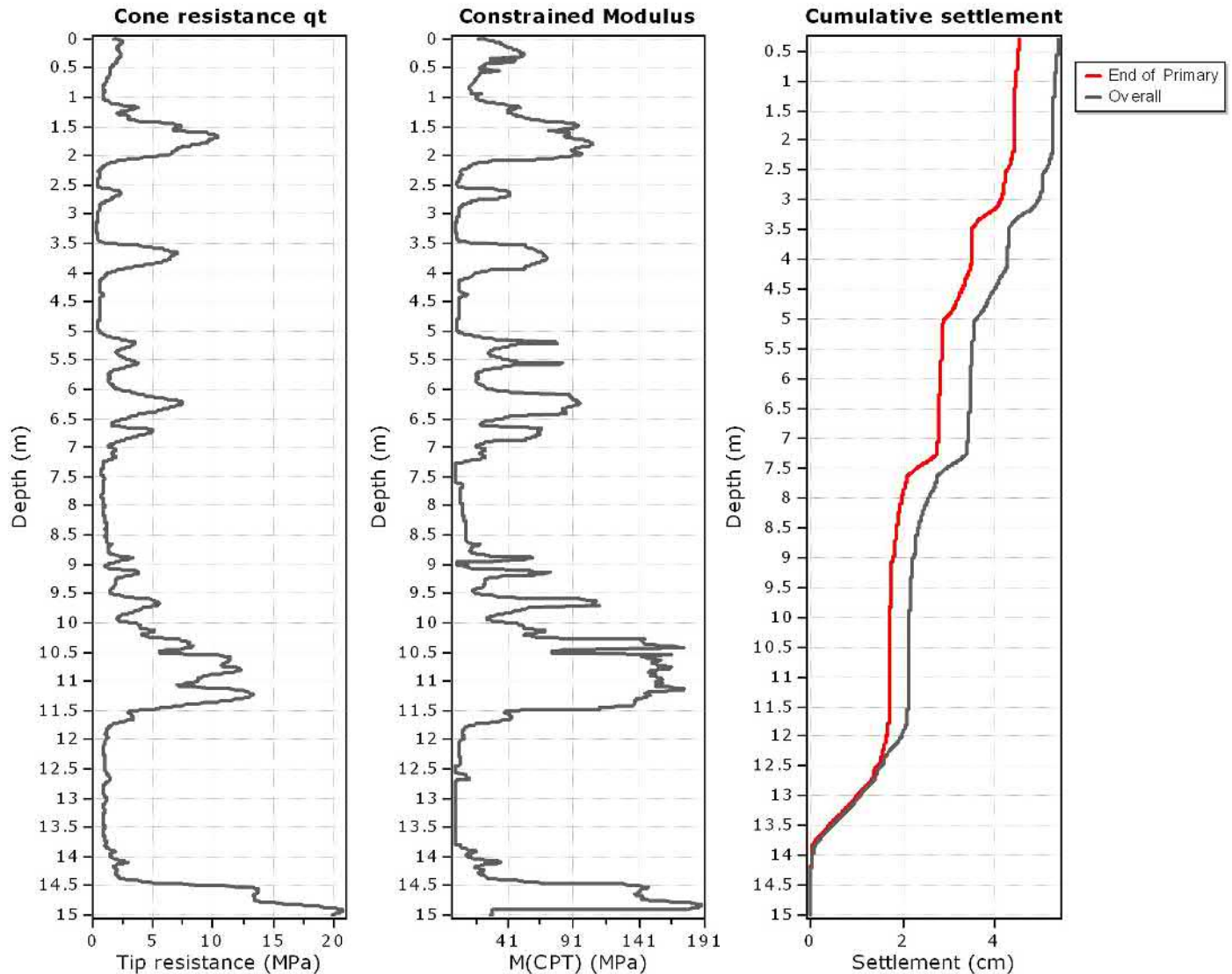
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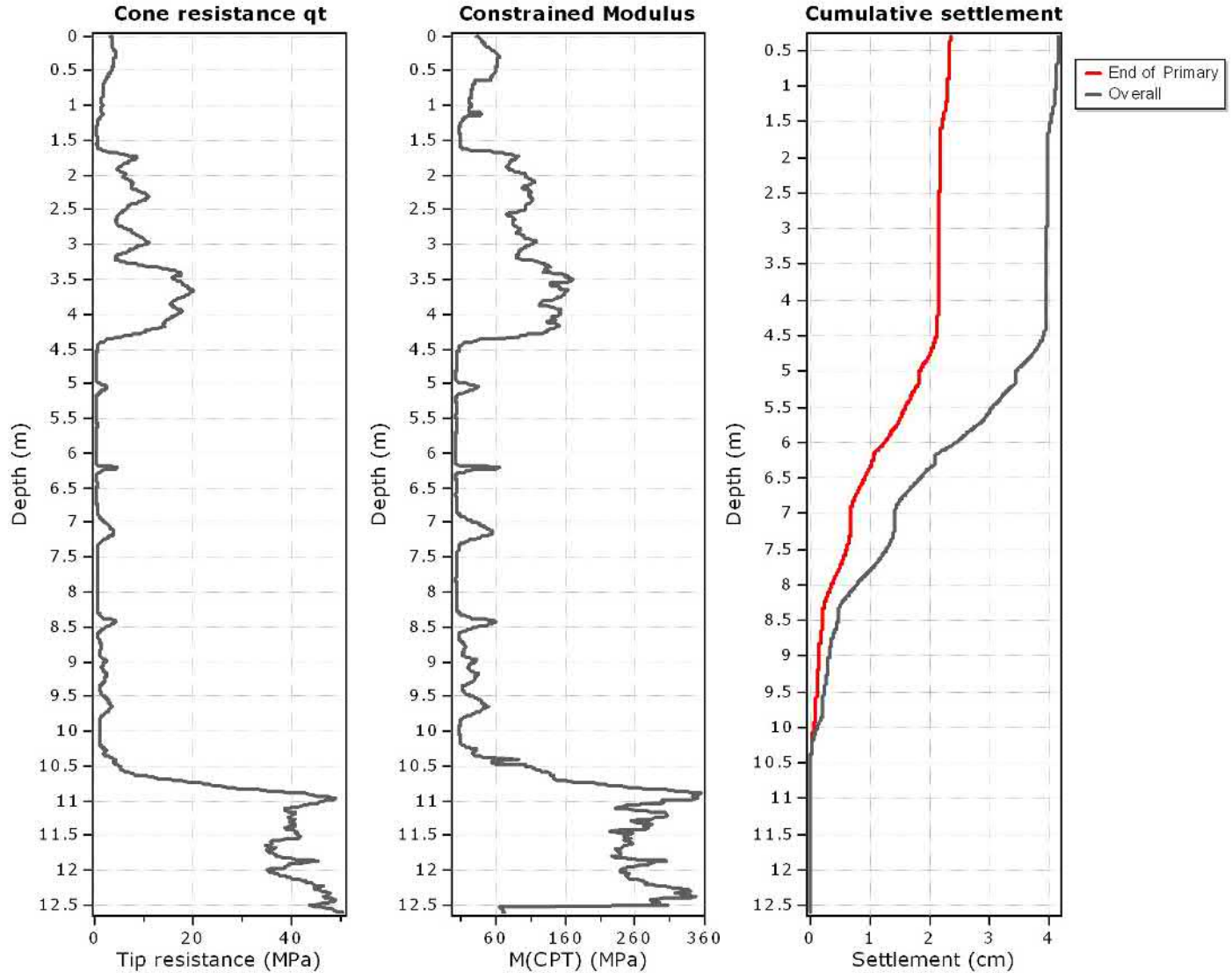
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**Location:**

**Settlements calculation according to theory of elasticity\***



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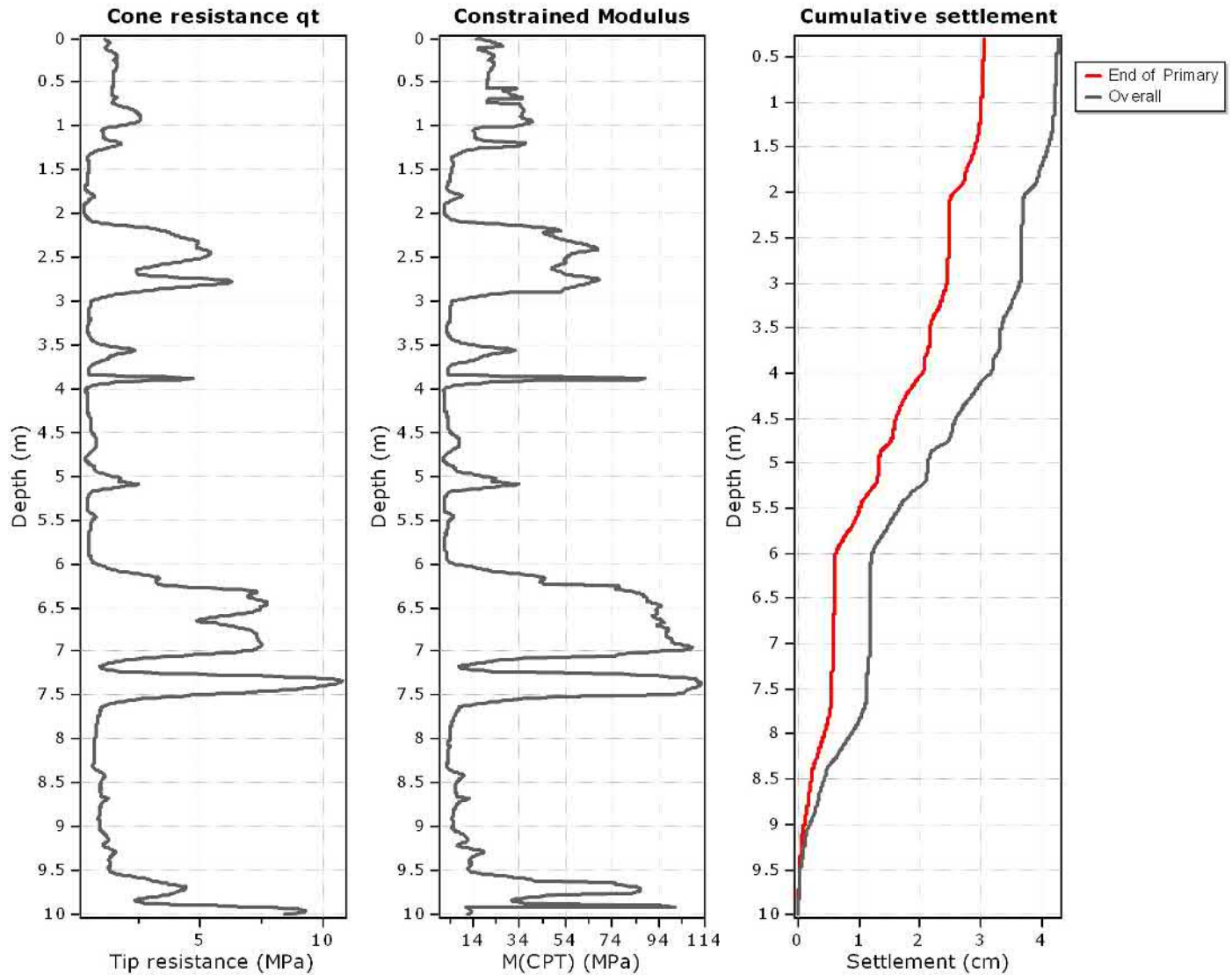
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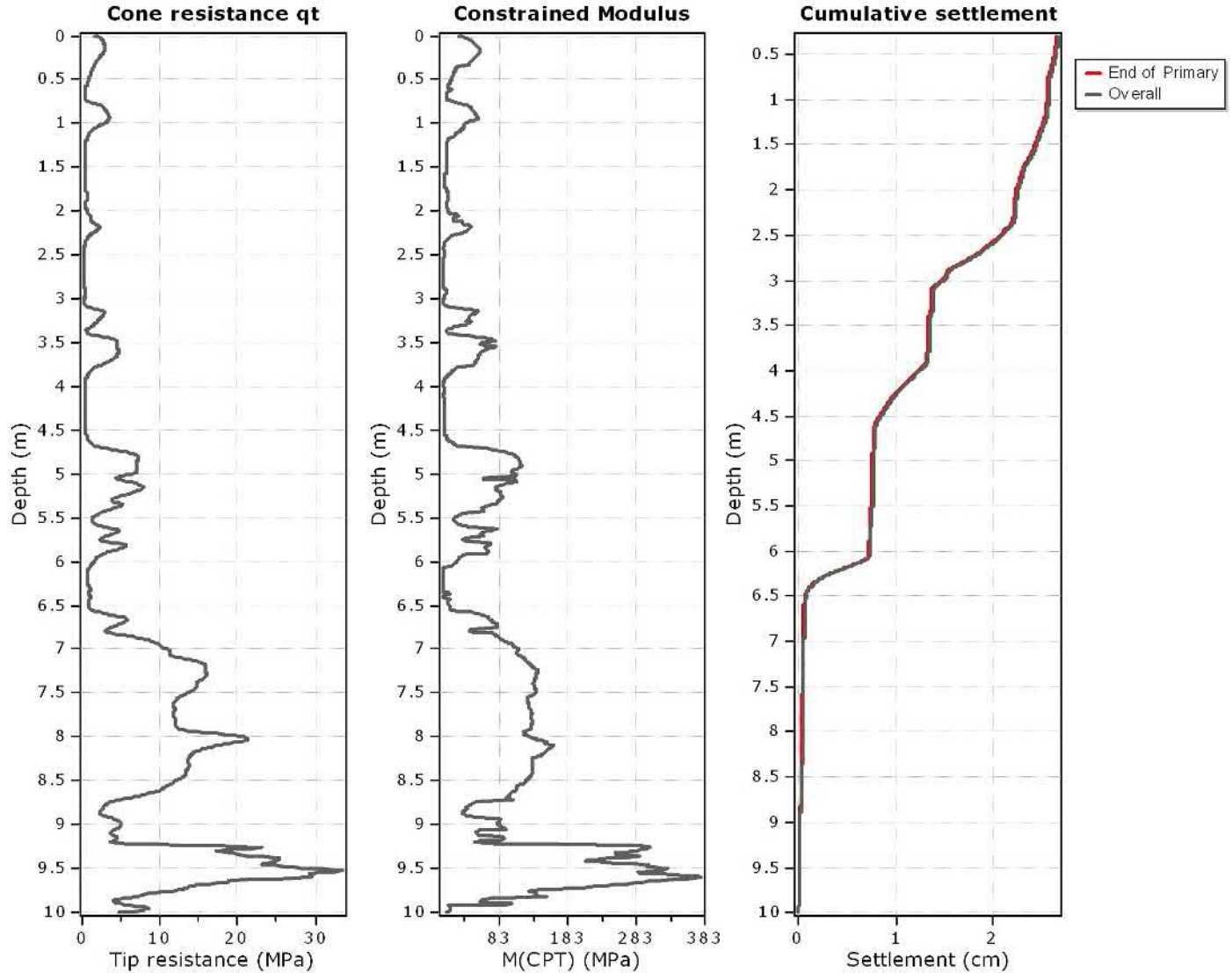
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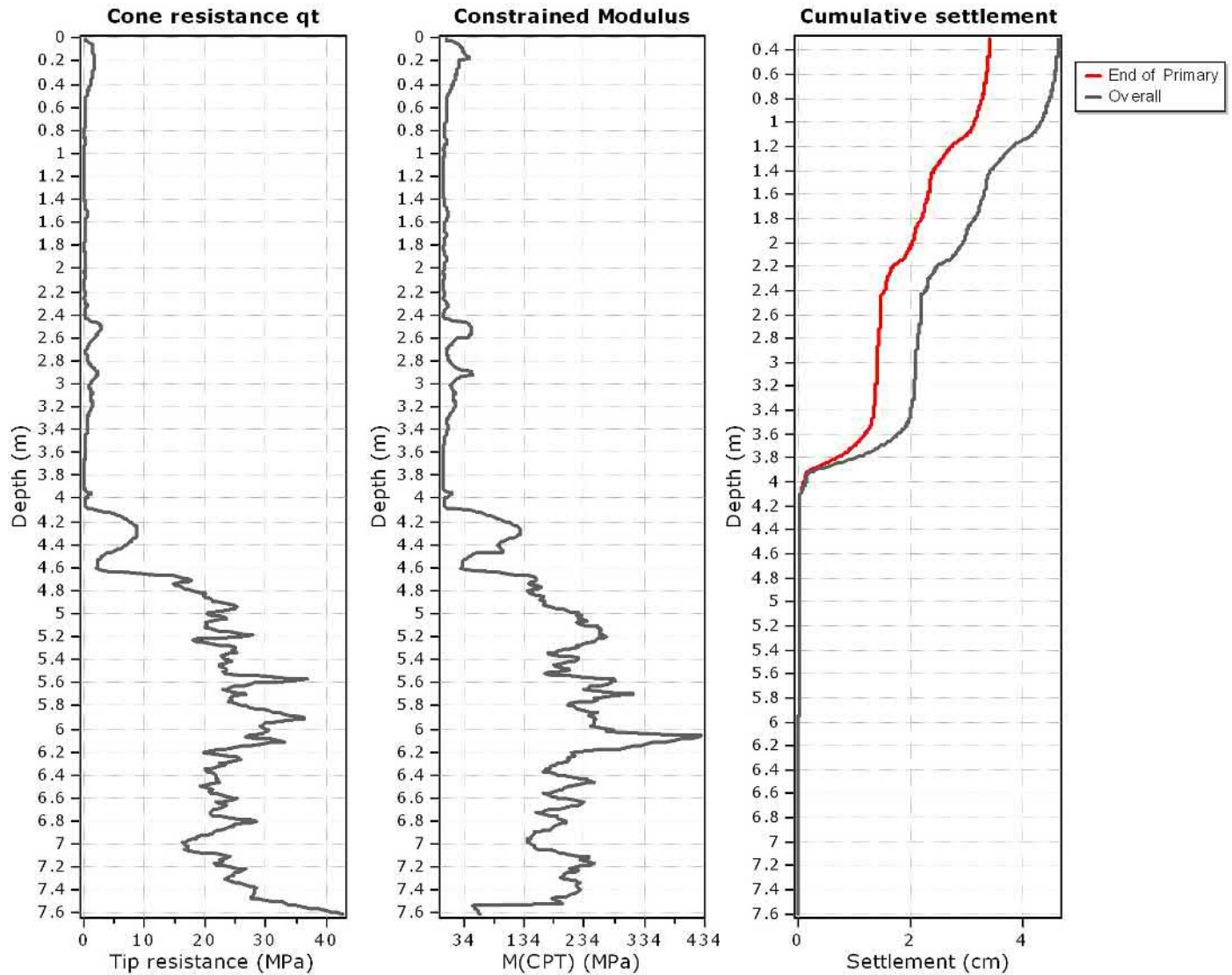
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**Settlements calculation according to theory of elasticity\***



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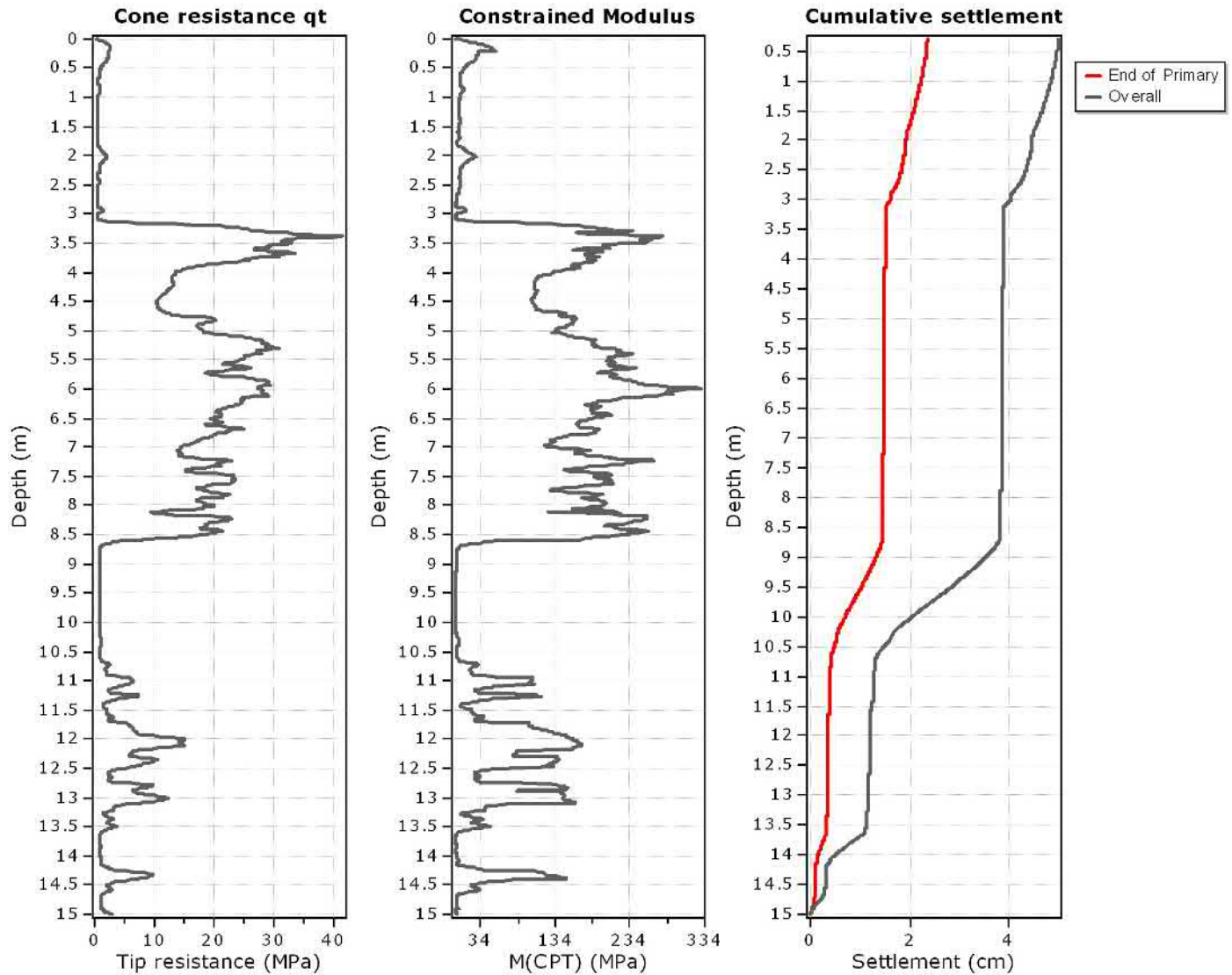
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**Location:**

**Settlements calculation according to theory of elasticity\***



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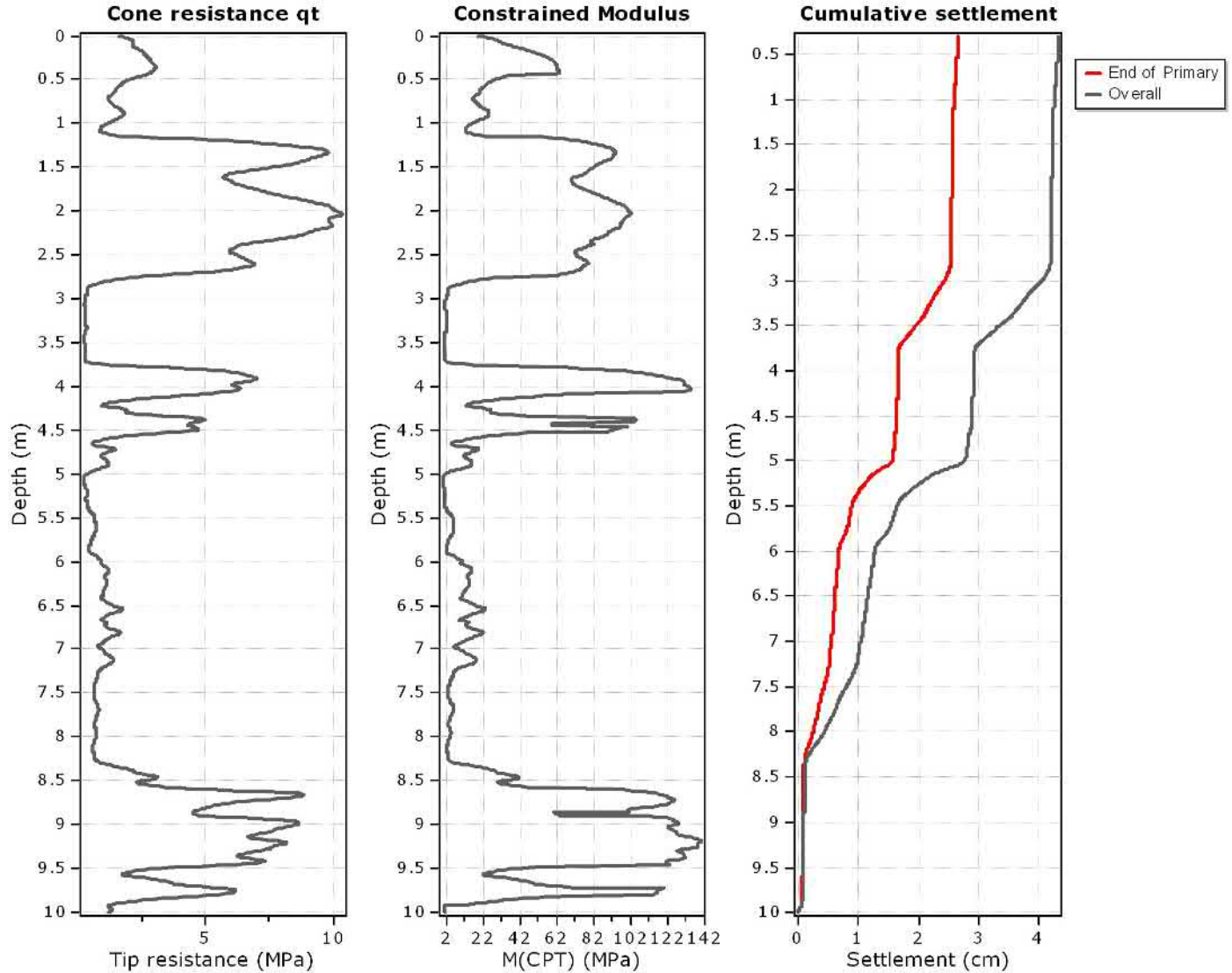
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**Settlements calculation according to theory of elasticity\***



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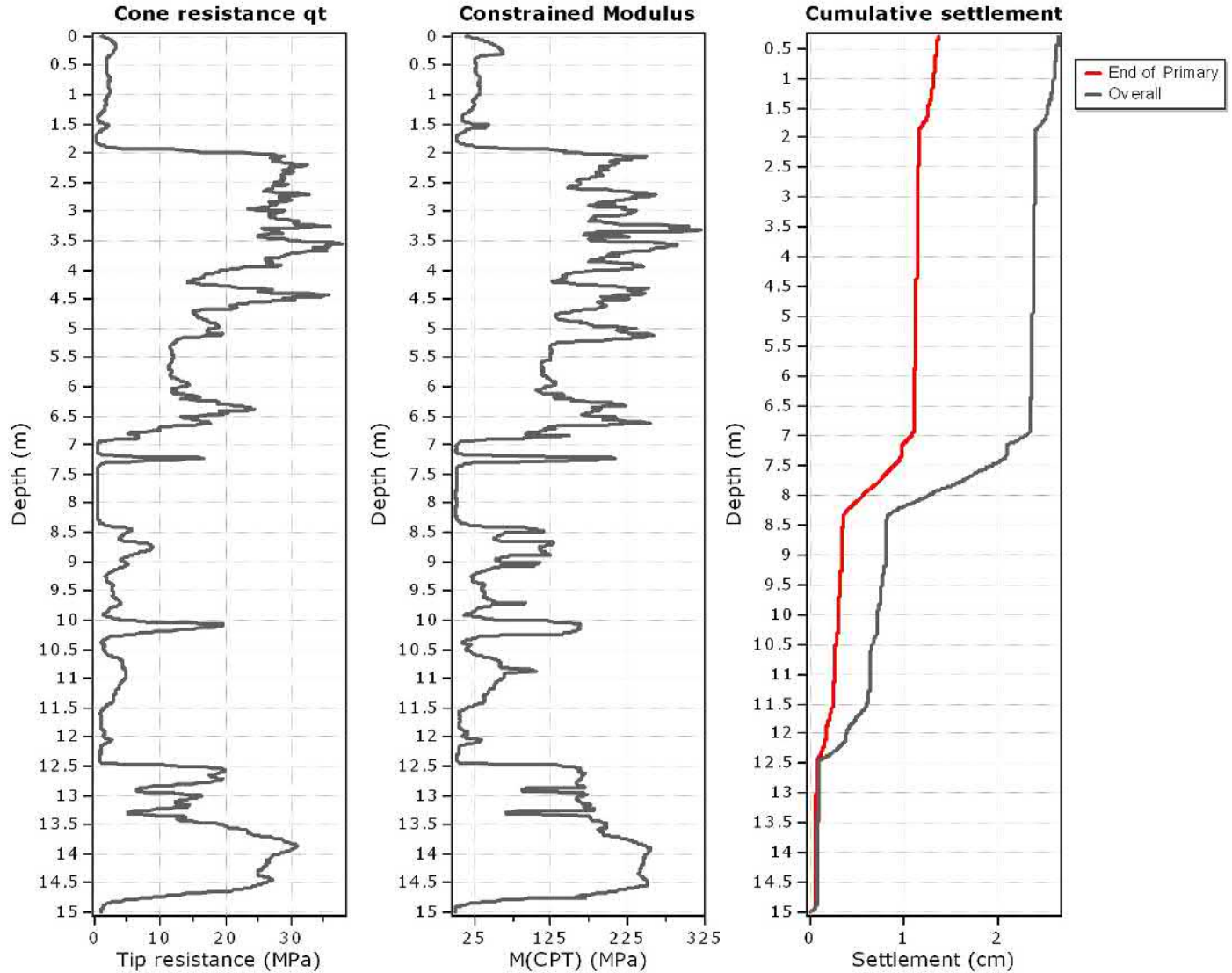
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**Settlements calculation according to theory of elasticity\***



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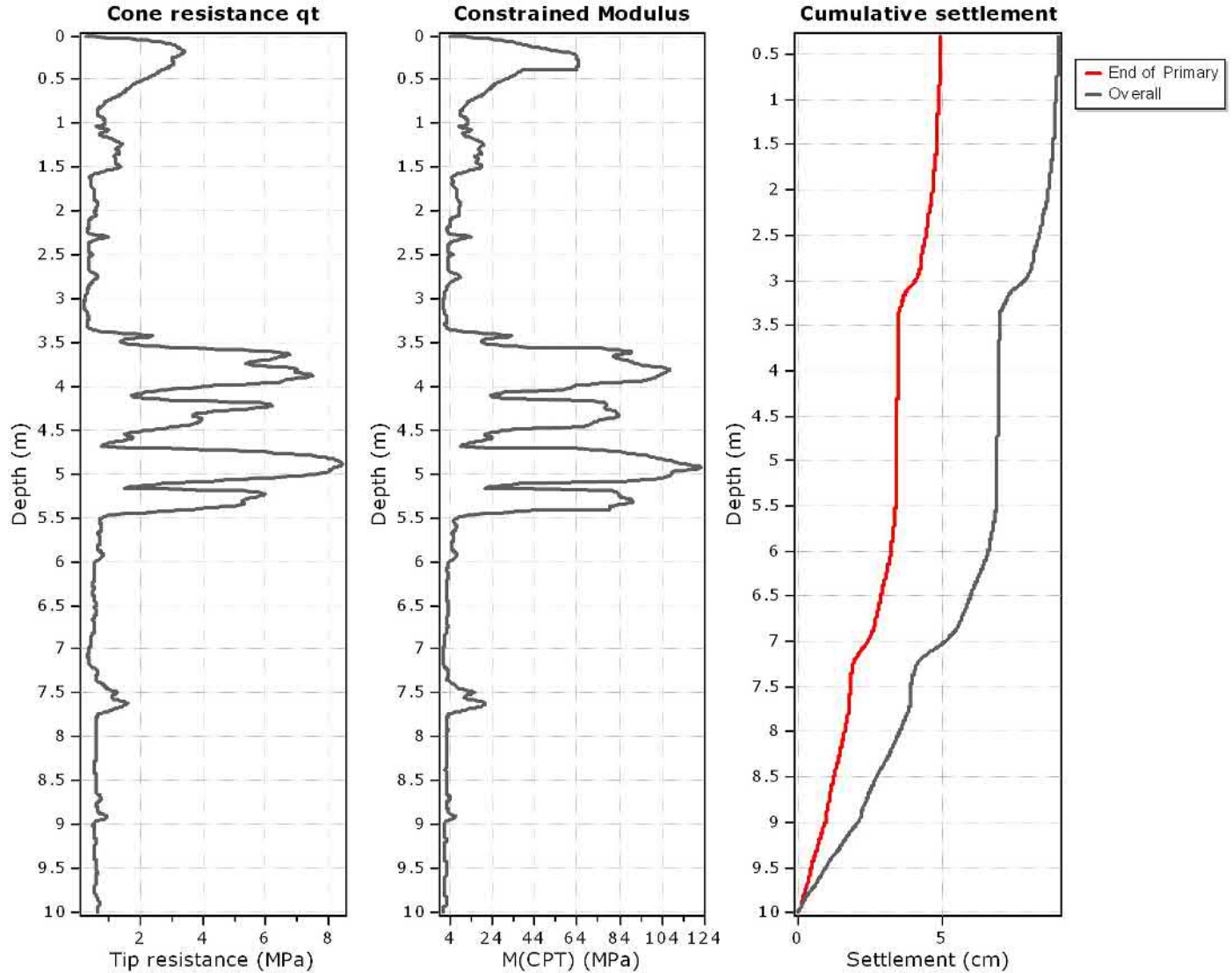
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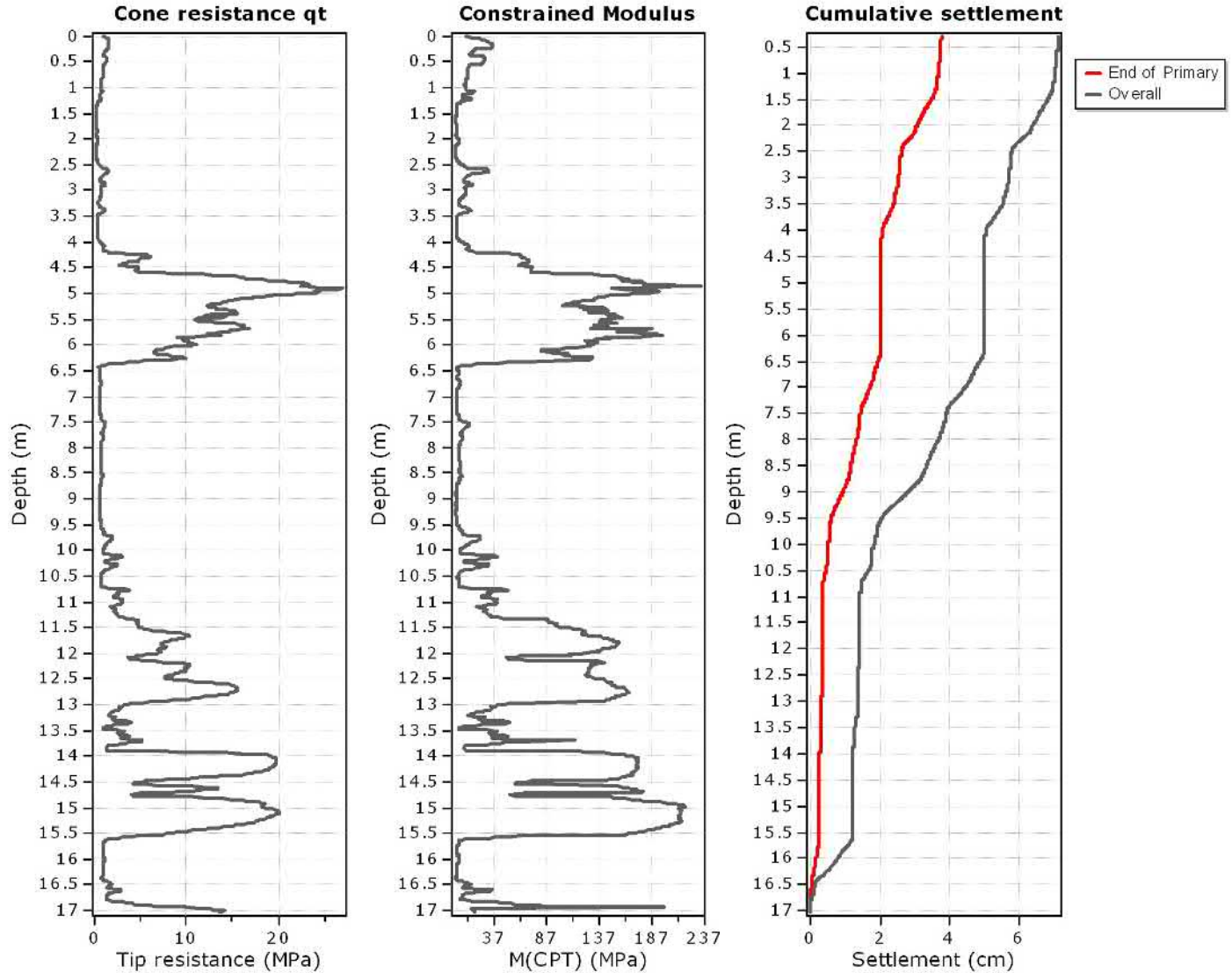
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**Settlements calculation according to theory of elasticity\***



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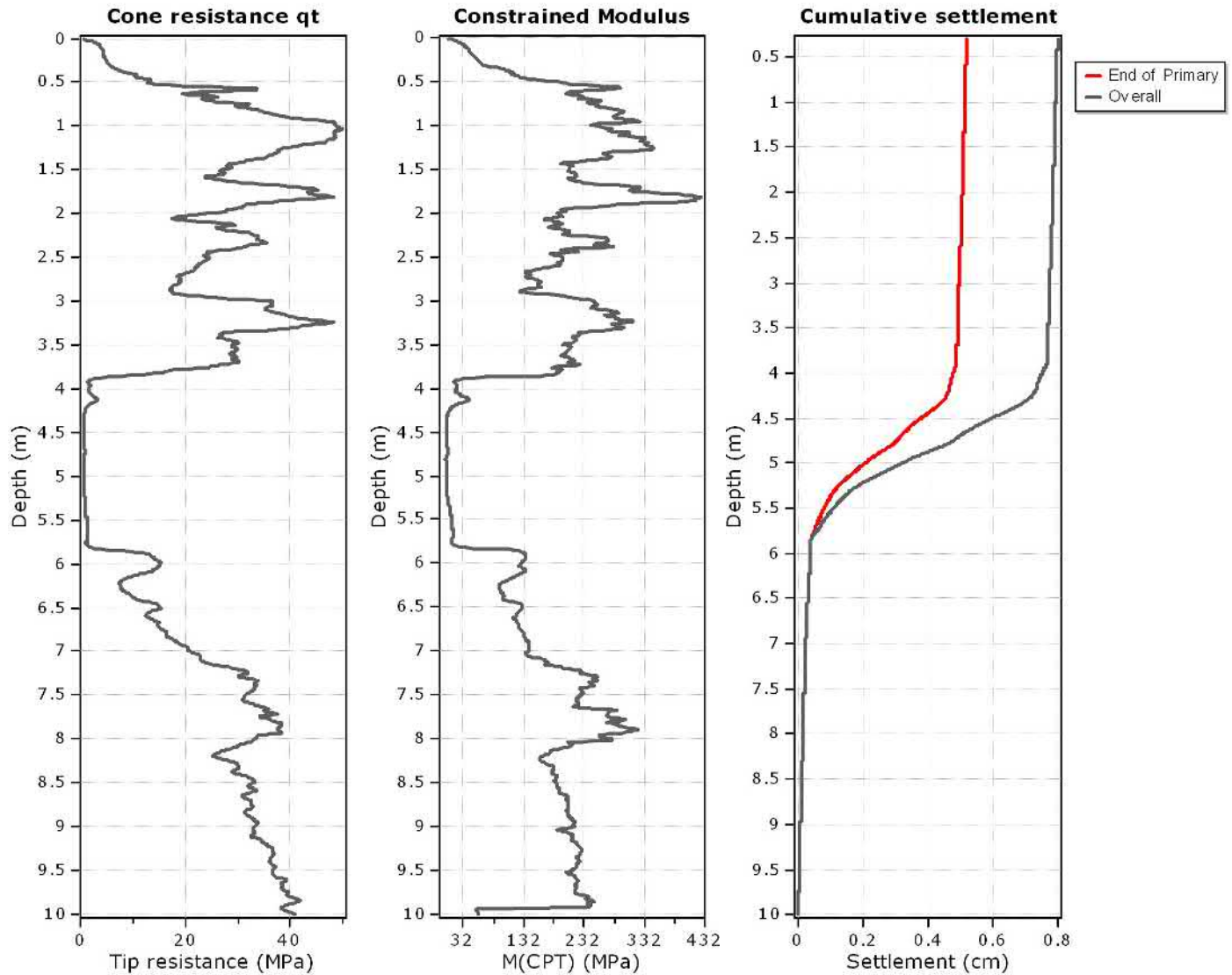
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**Settlements calculation according to theory of elasticity\***



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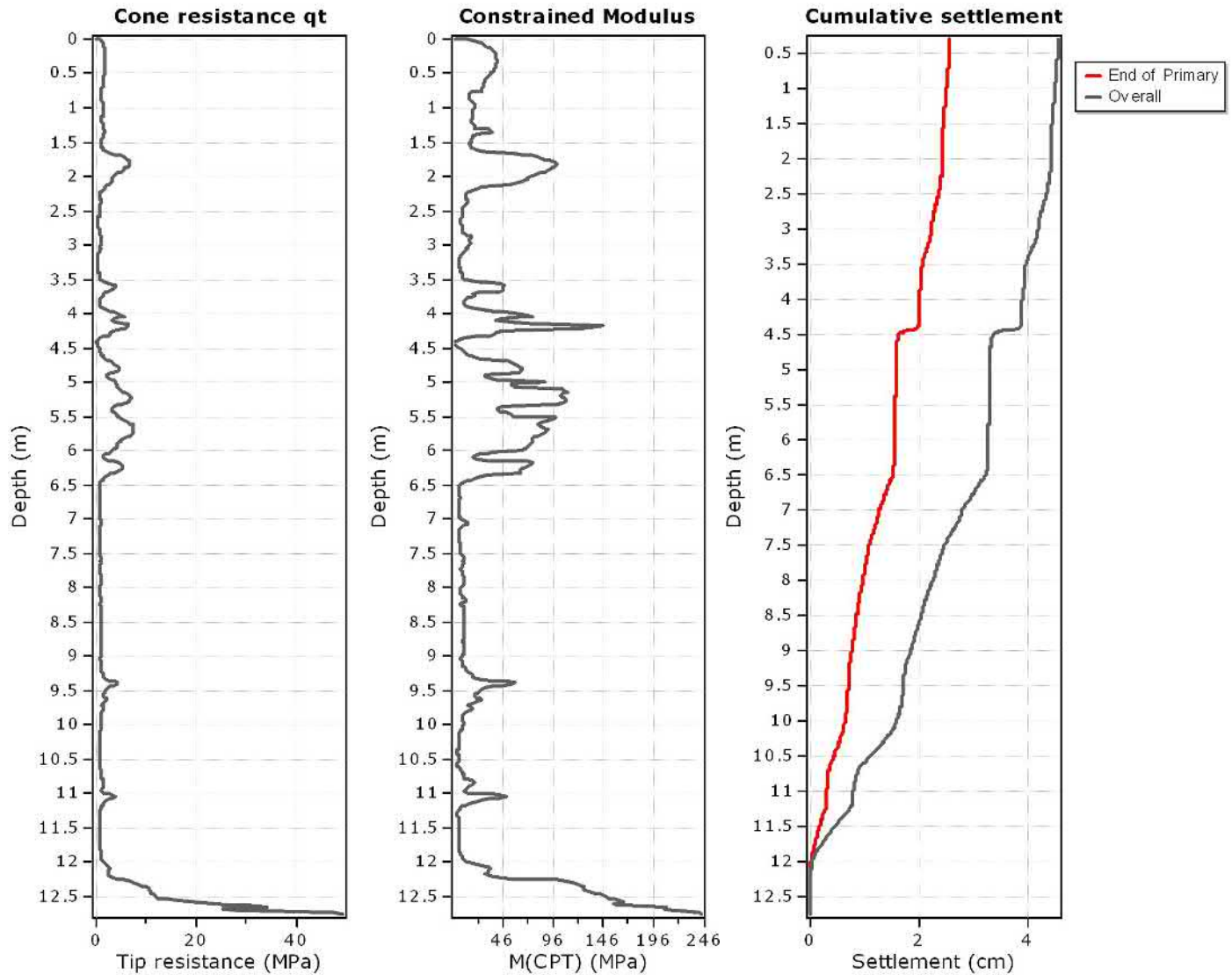
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**Settlements calculation according to theory of elasticity\***



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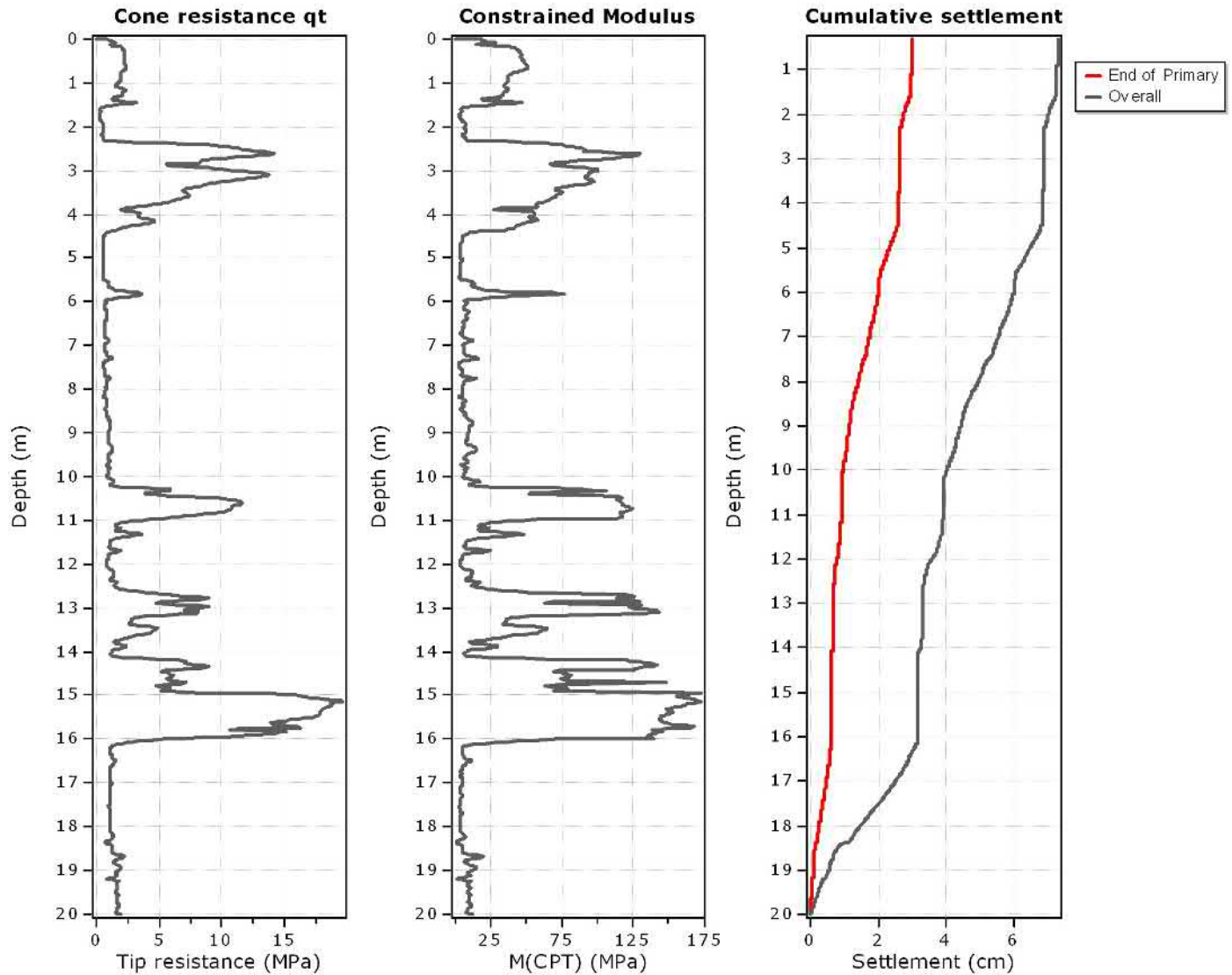
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 Time period for second. settlements: 600 months

\* Primary settlements calculation is performed according to the following formula:

$$S = \sum \frac{\Delta\sigma_v}{M_{CPT}} \Delta z$$

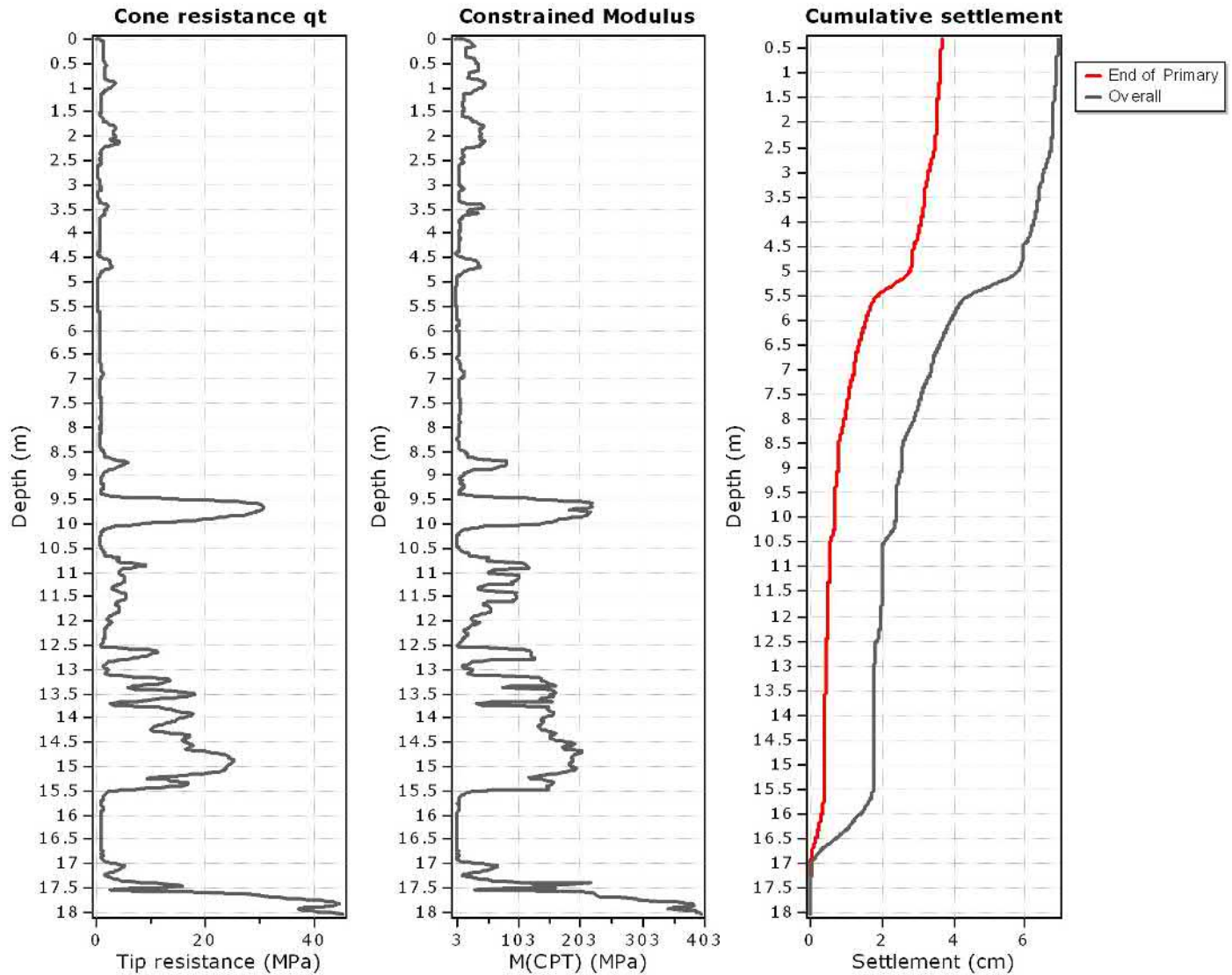
\* Secondary (creep) settlements calculation is performed according to the following formula:

$$S = C_a \cdot \Delta z \cdot \log(t)$$

**Project:**

**Location:**

**Settlements calculation according to theory of elasticity\***



**Calculation properties**

Footing type: Rectangular  
 Footing width: 20.00 (m)  
 L/B: 1.0  
 Footing pressure: 20.00 (kPa)  
 Embedment depth: 0.30 (m)  
 Footing is rigid: No  
 Remove excavation load: No  
 Apply 20% rule: No  
 Calculate secondary settlements: Yes  
 Time period for primary consolidation: 6 months  
 Time period for second. settlements: 600 months

\* Primary settlements calculation is performed according to the following formula:

$$S = \sum \frac{\Delta\sigma_v}{M_{CPT}} \Delta z$$

\* Secondary (creep) settlements calculation is performed according to the following formula:





$$S = C_a \cdot \Delta z \cdot \log(t)$$



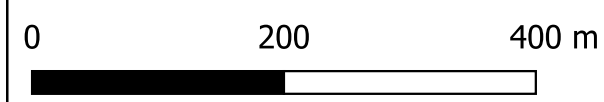
### **Appendix 3**



### Legend

-  Site boundary
-  Elliot Sinclair Investigation Extent
-  Water Course
-  Approximate Area of Artesian Water

New Zealand Imagery



Projection: NZTM 2000NZGD2000 / New Zealand Transverse Mercator 2000

Client: Suburban Estates Ltd

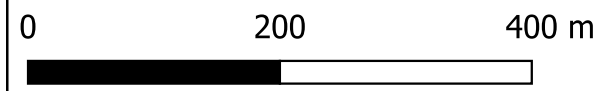
Title: Site Plan		Appendix No. Size: A3 Sheet
Project:	Drawn: DD	
Date: 11/12/2023	Checked: NC	
Proj No: 19640.000.001	Scale: 800 @ A3	Version: 1.0

## **Appendix 4**



### Legend

- Site boundary
- Area of Uncertainty
  
- CPT Investigation Location (CPT ID/LSN Value)**
- ▲ Low Liquefaction Vulnerability
- ▲ Medium Liquefaction Vulnerability
- ▲ High Liquefaction Vulnerability
  
- 100 yr Liquefaction Vulnerability Category**
- Low Liquefaction Vulnerability
- Medium Liquefaction Vulnerability
- High Liquefaction Vulnerability
  
- New Zealand Imagery



Notes:  
 Liquefaction Vulnerability (LV) Categories are based on Liquefaction Severity Numbers where LSN of 0 to 5 = Low LV, 5 - 15 = Medium LV, and >15 = High LV.





Projection: NZTM 2000NZGD2000 / New Zealand Transverse Mercator 2000

Client: Suburban Estates Ltd		
Title: Gressons and Main North Road MBIE Liquefaction Vulnerability Category Map		Appendix No.
Project:	Drawn: DD	Size: A3 Sheet
Date: 11/12/2023	Checked: NC	
Proj No: 19640.000.001	Scale: 800 @ A3	Version: 1.0



**Appendix 5**





### Legend

-  Site boundary
-  Area of Uncertainty

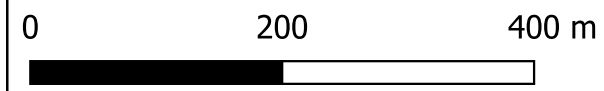
#### CPT Investigation Location (CPT ID/Settlement)

-  <100 mm
-  >=100 mm

#### 150 yr Settlement

-  >=100 mm
-  <100 mm

New Zealand Imagery



Projection: NZTM 2000NZGD2000 / New Zealand Transverse Mercator 2000

Client: Suburban Estates Ltd

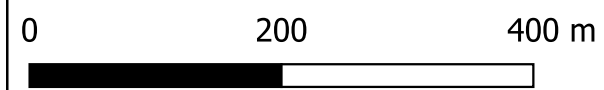
Title: Gressons and Main North Road 150 Year Verticle Settlement Map		Appendix No. Size: A3 Sheet
Project:	Drawn: DD	
Date: 14/12/2023	Checked: NC	
Proj No: 19640.000.001	Scale: 800 @ A3	Version: 1.0

**Appendix 6**



### Legend

- Site boundary
- Area of Uncertainty
- CPT Investigation Location
- Settlement Over 50 Year Design Life**
- 0 - 25 mm
- 25 - 50 mm
- >50 mm
- New Zealand Imagery



Projection: NZTM 2000NZGD2000 / New Zealand Transverse Mercator 2000

Client: Suburban Estates Ltd

Title: 50 Year Consolidation Settlement Map		Appendix No. Size: A3 Sheet
Project:	Drawn: DD	
Date: 11/12/2023	Checked: NC	
Proj No: 19640.000.001	Scale: 800 @ A3	Version: 1.0