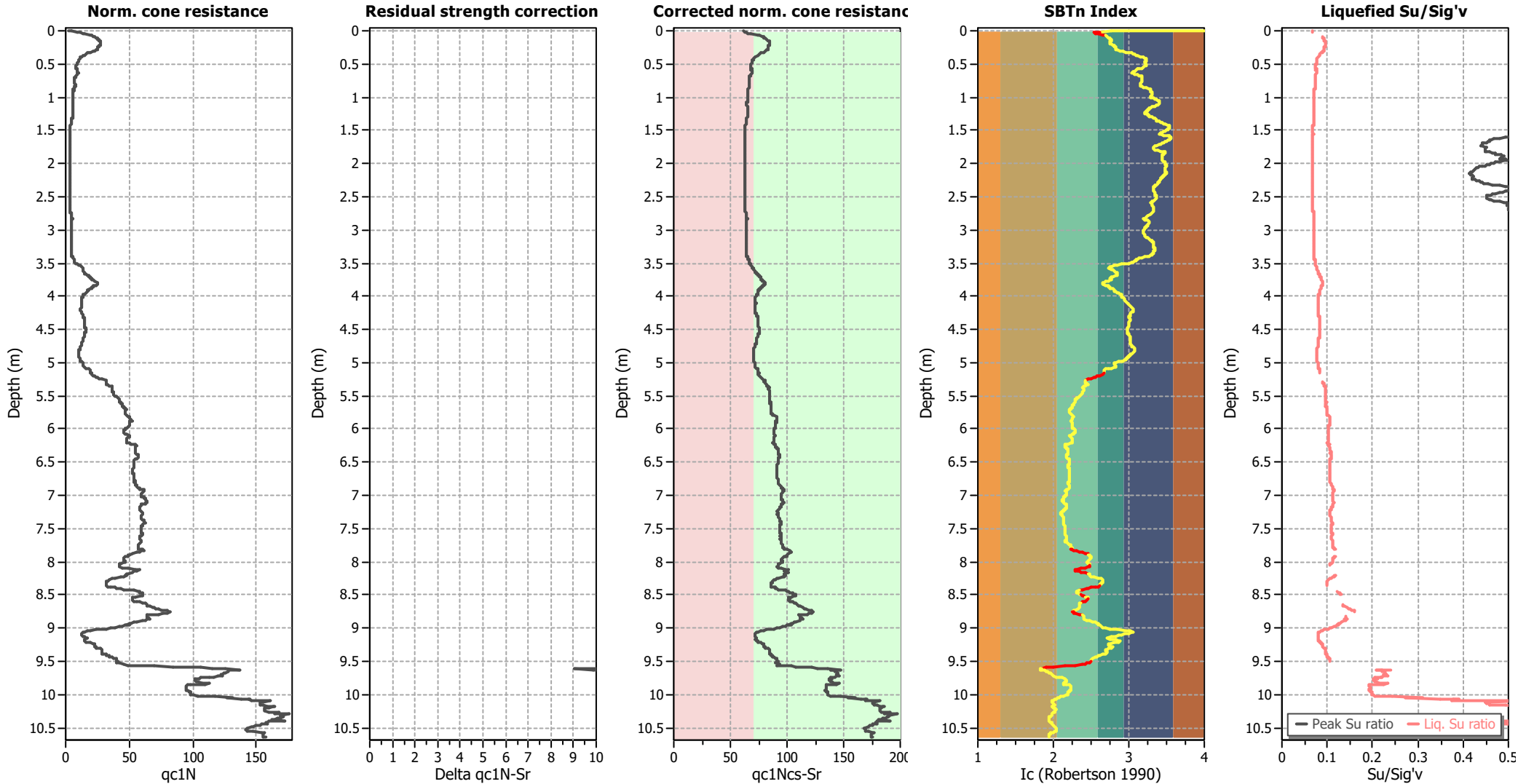


Check for strength loss plots (Idriss & Boulanger (2008))



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: | Yes        |
| Points to test:                       | Based on Ic value | Ic cut-off value:         | 2.60         | K <sub>o</sub> applied:     | Yes        |
| Earthquake magnitude M <sub>w</sub> : | 6.50              | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration:             | 0.05              | Use fill:                 | No           | Limit depth applied:        | Yes        |
| Depth to water table (insitu):        | 1.00 m            | Fill height:              | N/A          | Limit depth:                | 10.00 m    |

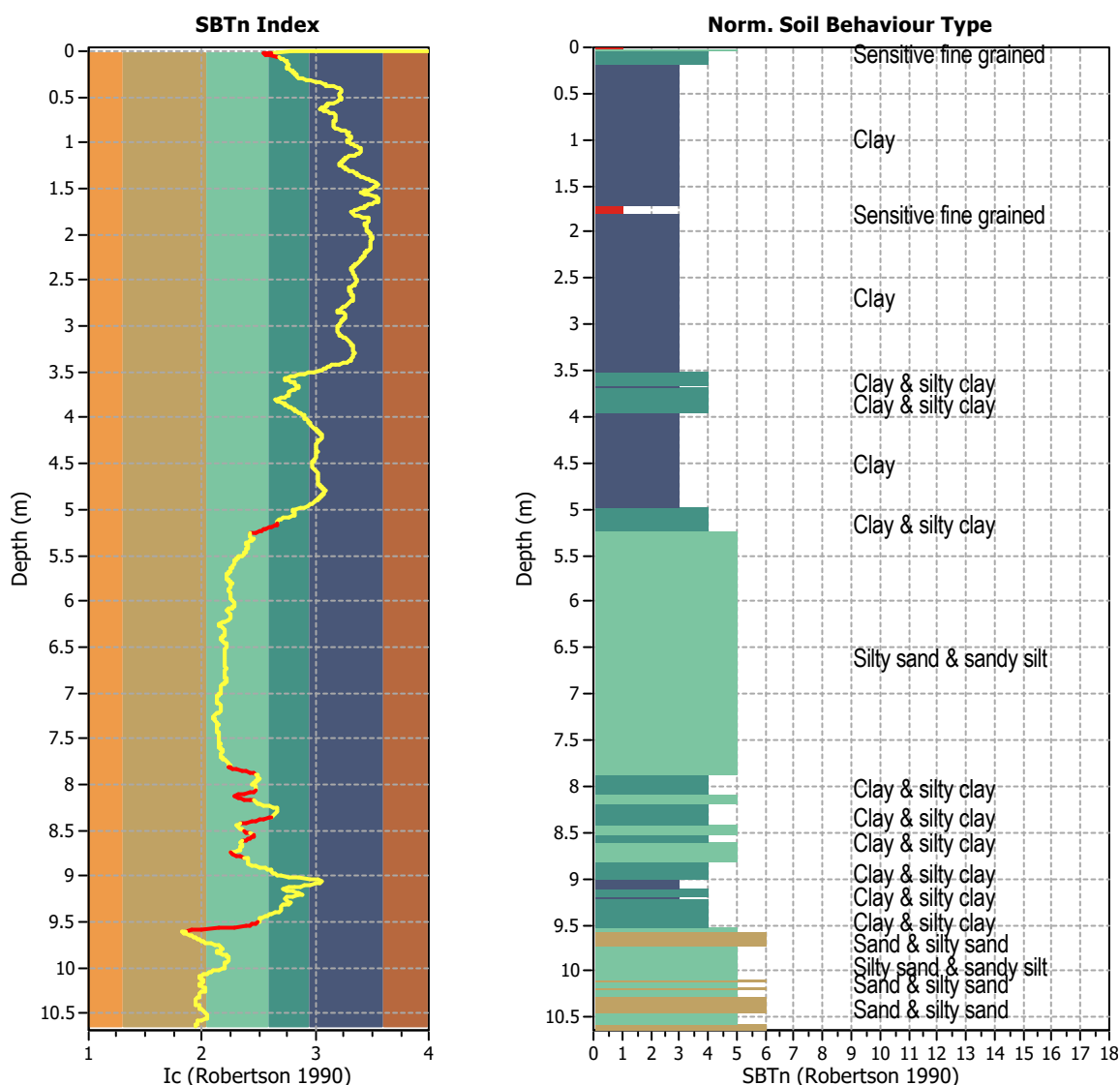
## TRANSITION LAYER DETECTION ALGORITHM REPORT

### Summary Details & Plots

#### Short description

The software will delete data when the cone is in transition from either clay to sand or vice-versa. To do this the software requires a range of  $I_c$  values over which the transition will be defined (typically somewhere between  $1.80 < I_c < 3.0$ ) and a rate of change of  $I_c$ . Transitions typically occur when the rate of change of  $I_c$  is fast (i.e.  $\Delta I_c$  is small).

The  $SBT_n$  plot below, displays in red the detected transition layers based on the parameters listed below the graphs.



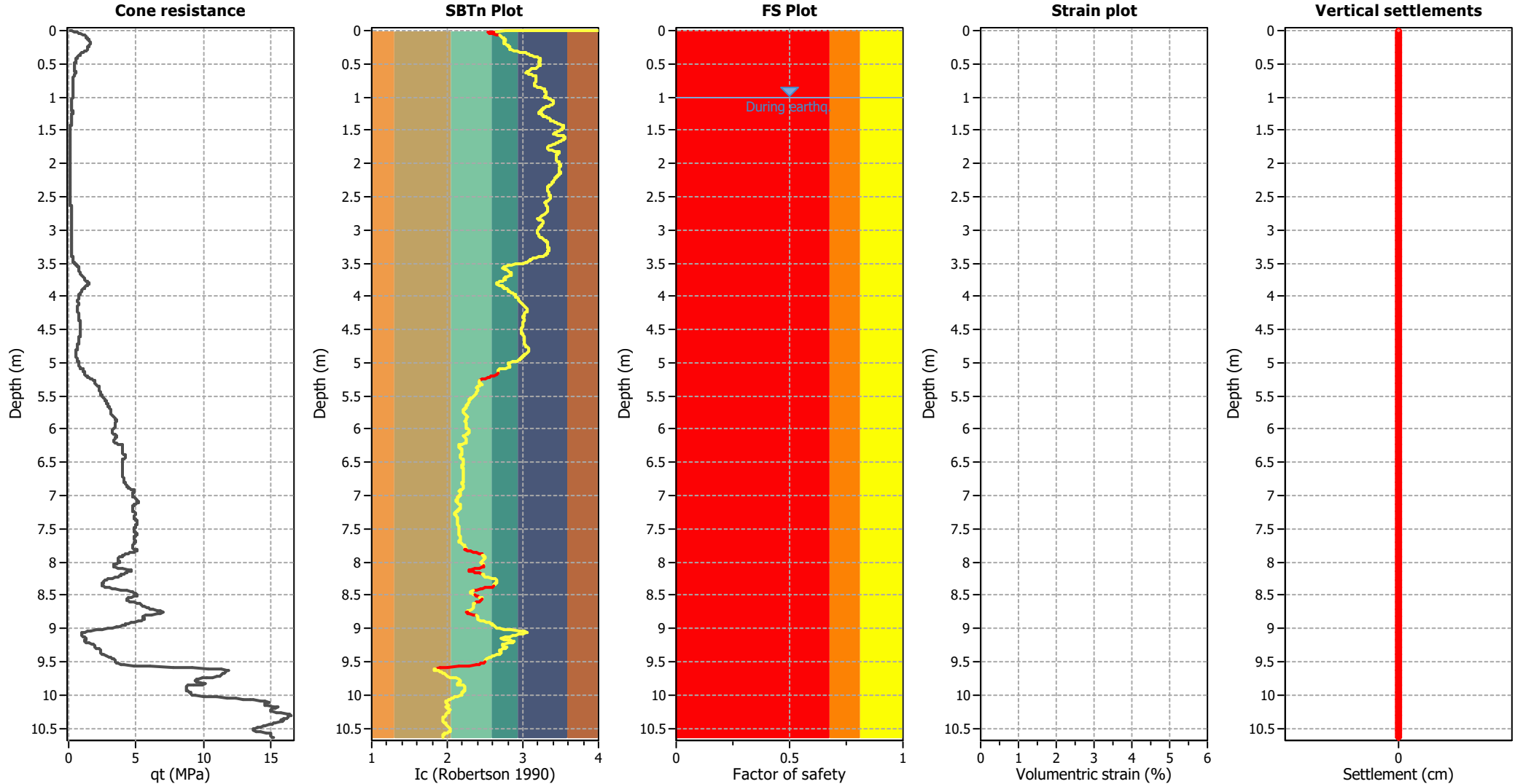
#### Transition layer algorithm properties

$I_c$  minimum check value: 1.70  
 $I_c$  maximum check value: 3.00  
 $I_c$  change ratio value: 0.0100  
 Minimum number of points in layer: 4

#### General statistics

Total points in CPT file: 1065  
 Total points excluded: 76  
 Exclusion percentage: 7.14%  
 Number of layers detected: 10

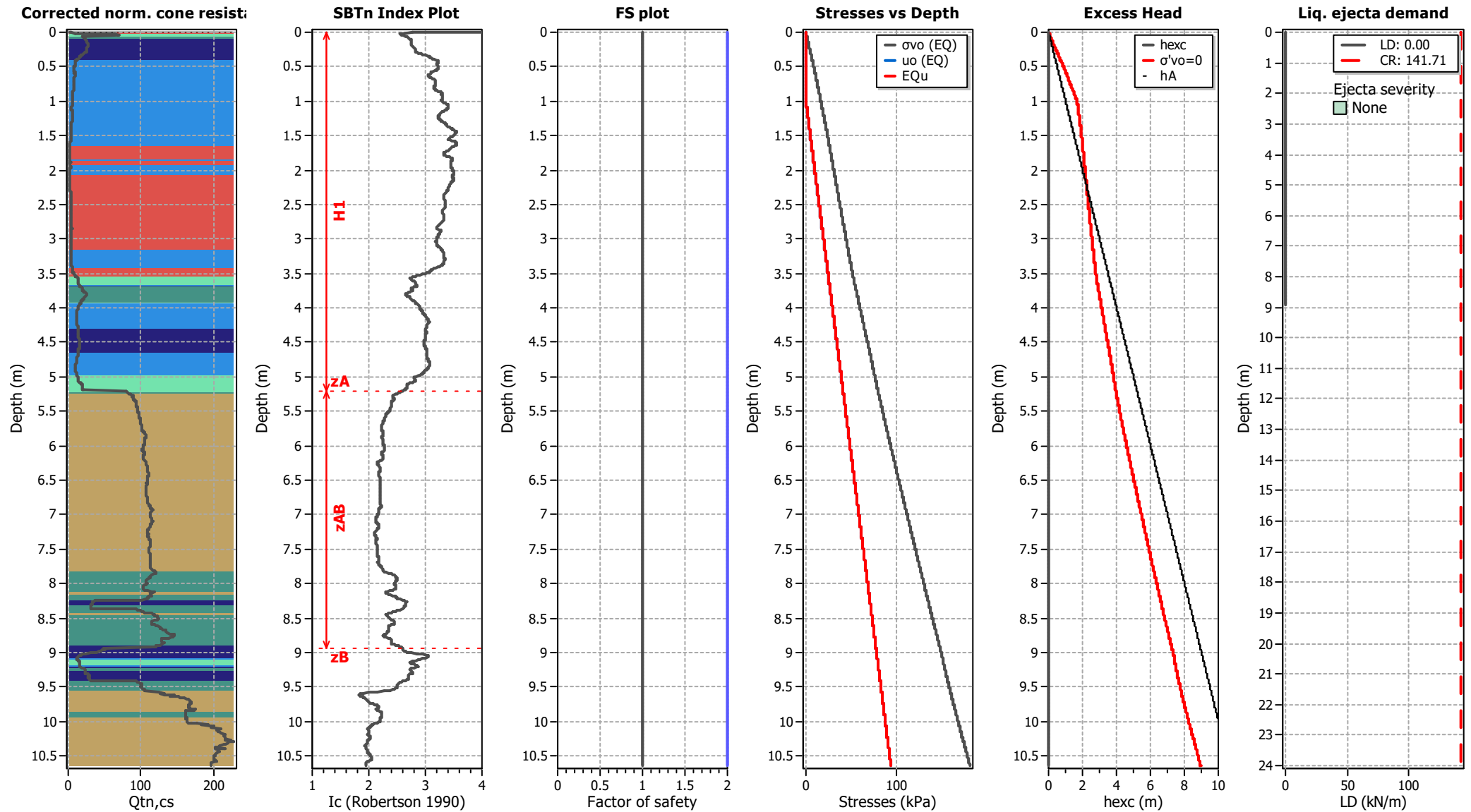
Estimation of post-earthquake settlements



Abbreviations

- q<sub>t</sub>: Total cone resistance (cone resistance q<sub>c</sub> corrected for pore water effects)
- I<sub>c</sub>: Soil Behaviour Type Index
- FS: Calculated Factor of Safety against liquefaction
- Volumetric strain: Post-liquefaction volumetric strain

## Ejecta Severity Estimation



## LIQUEFACTION ANALYSIS REPORT

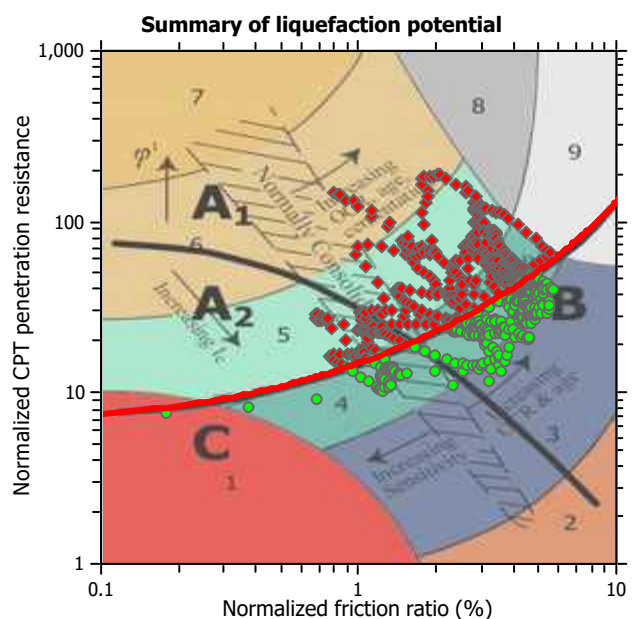
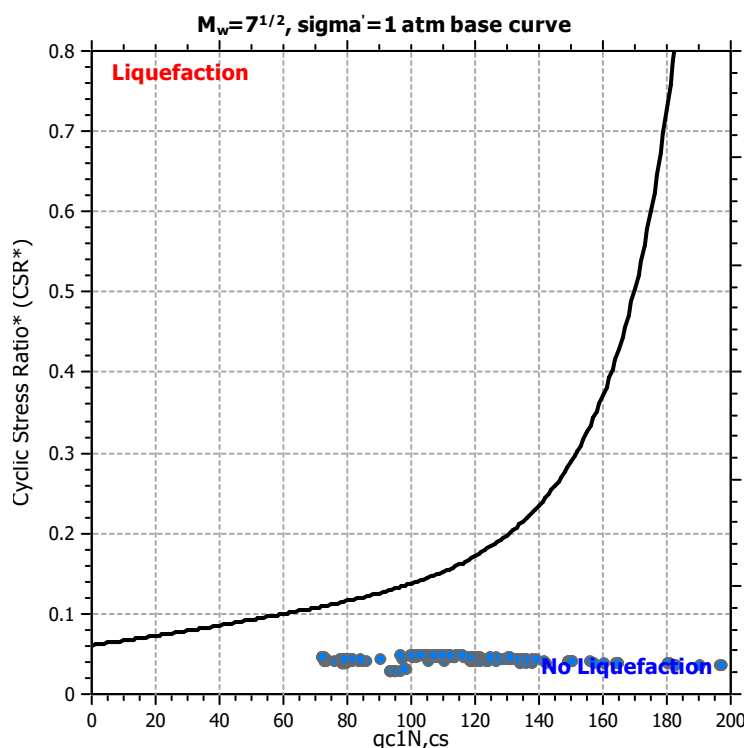
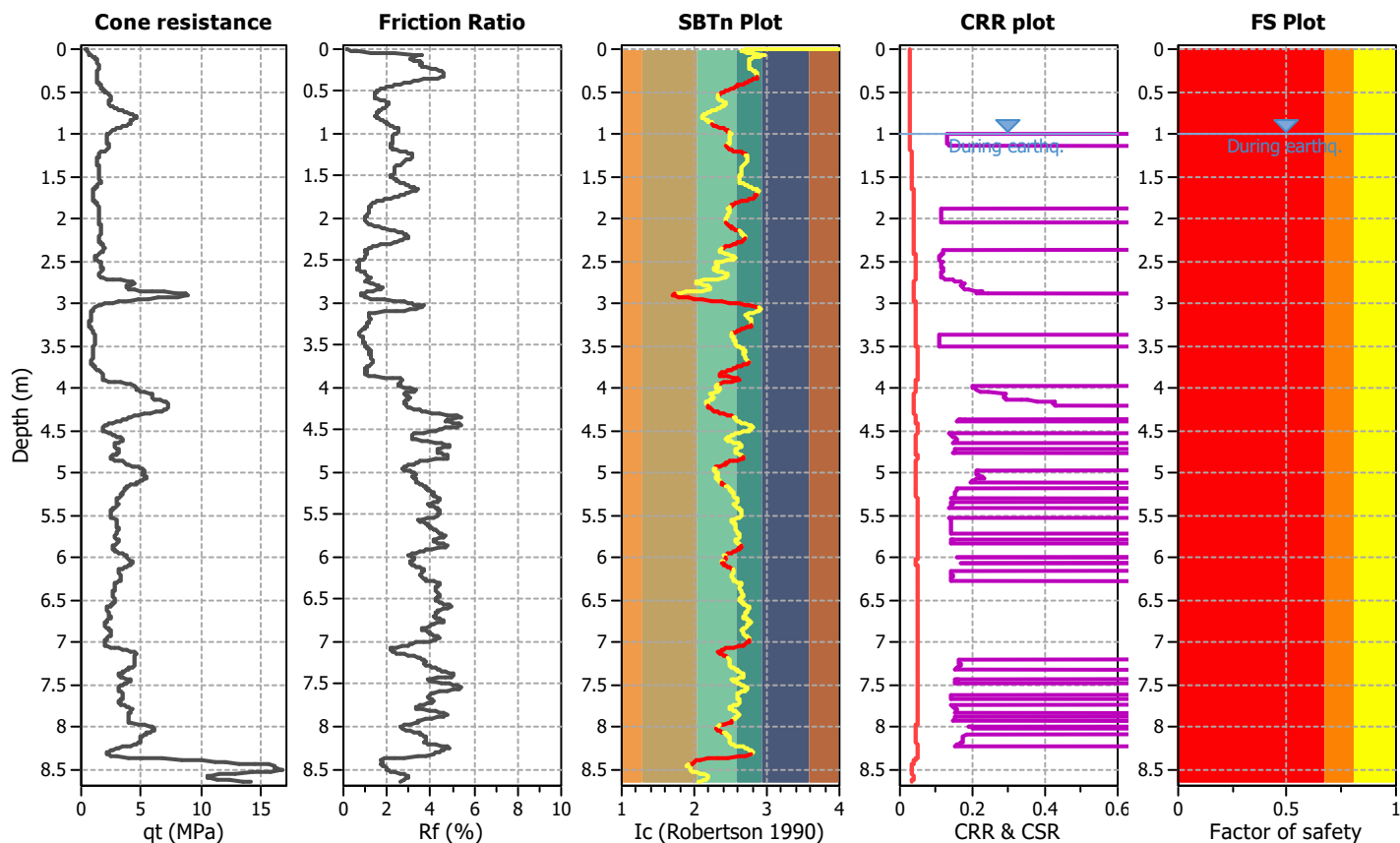
**Project title :**

**Location :**

**CPT file : CPT17**

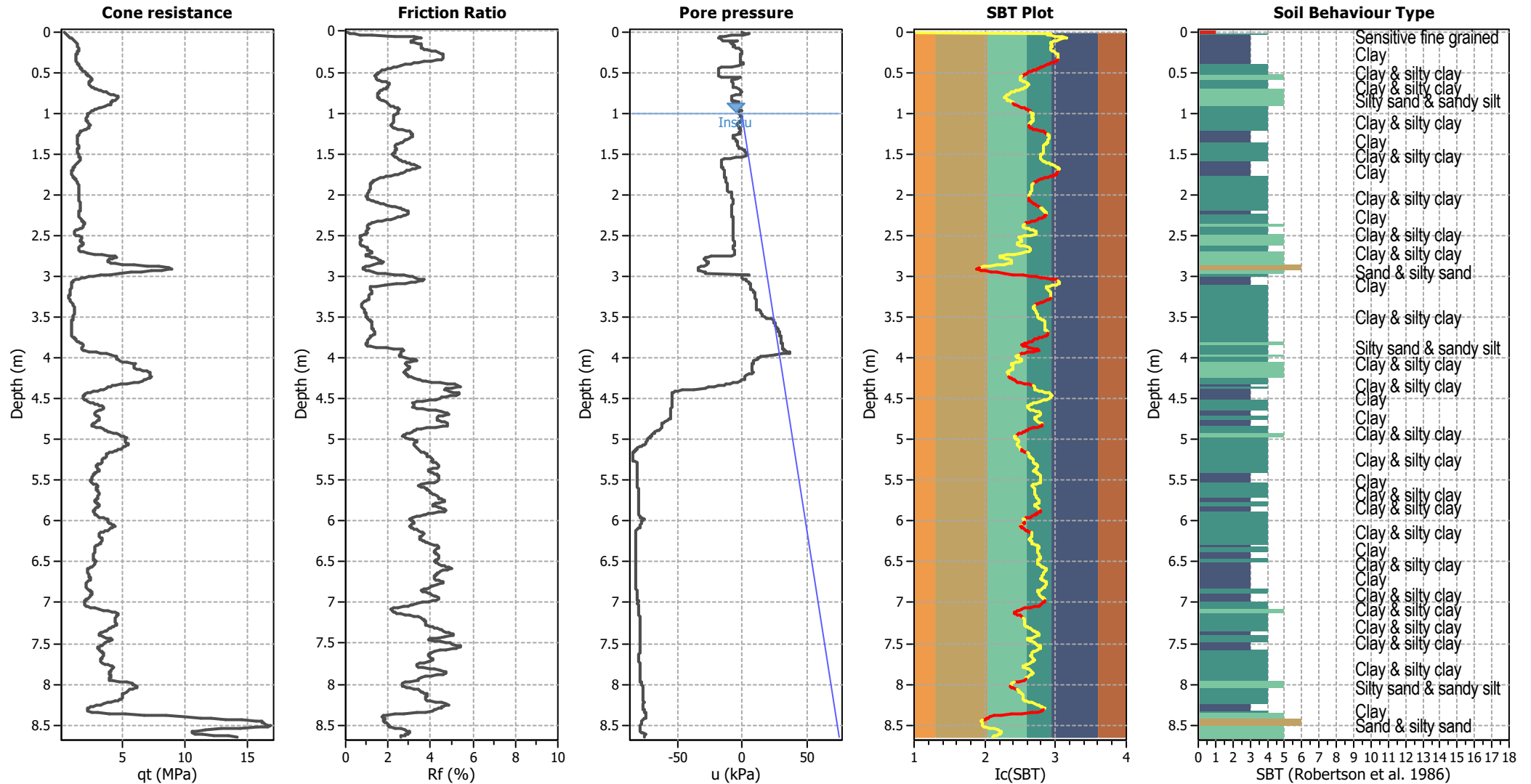
### Input parameters and analysis data

|                              |                   |                           |              |                         |     |                             |              |
|------------------------------|-------------------|---------------------------|--------------|-------------------------|-----|-----------------------------|--------------|
| Analysis method:             | B&I (2014)        | G.W.T. (in-situ):         | 1.00 m       | Use fill:               | No  | Clay like behavior applied: | Sands only   |
| Fines correction method:     | B&I (2014)        | G.W.T. (earthq.):         | 1.00 m       | Fill height:            | N/A | Limit depth applied:        | Yes          |
| Points to test:              | Based on Ic value | Average results interval: | 3            | Fill weight:            | N/A | MSF method:                 | Method based |
| Earthquake magnitude $M_w$ : | 6.50              | Ic cut-off value:         | 2.60         | Trans. detect. applied: | Yes |                             |              |
| Peak ground acceleration:    | 0.05              | Unit weight calculation:  | Based on SBT | $K_\sigma$ applied:     | Yes |                             |              |



Zone A<sub>1</sub>: Cyclic liquefaction likely depending on size and duration of cyclic loading  
 Zone A<sub>2</sub>: Cyclic liquefaction and strength loss likely depending on loading and ground geometry  
 Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening  
 Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

### Pore pressure

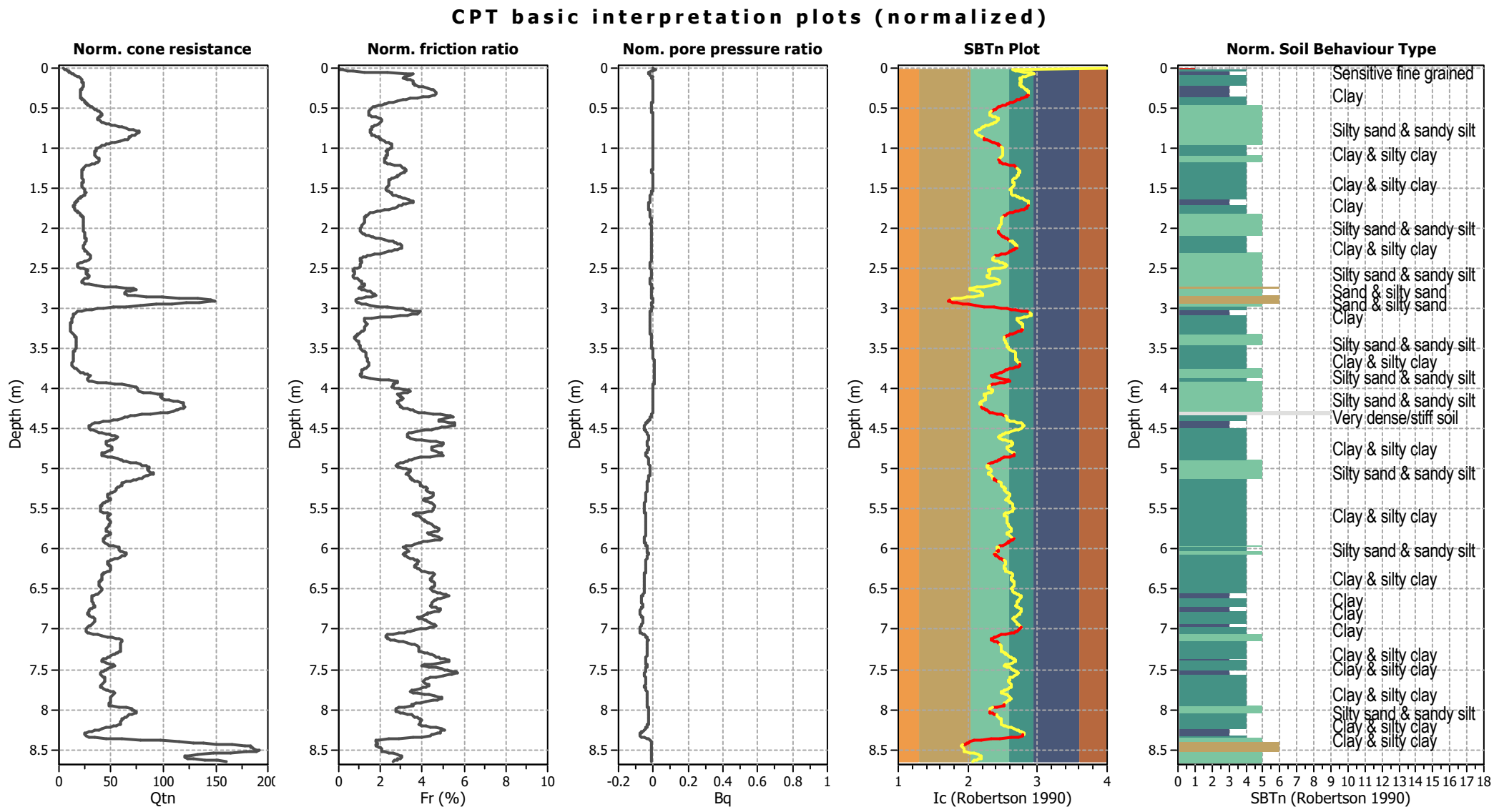


### Input parameters and analysis data

|                                       |                   |                           |              |                             |            |
|---------------------------------------|-------------------|---------------------------|--------------|-----------------------------|------------|
| 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: | Yes        |
| Points to test:                       | Based on Ic value | Ic cut-off value:         | 2.60         | K <sub>o</sub> applied:     | Yes        |
| Earthquake magnitude M <sub>w</sub> : | 6.50              | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration:             | 0.05              | 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 |



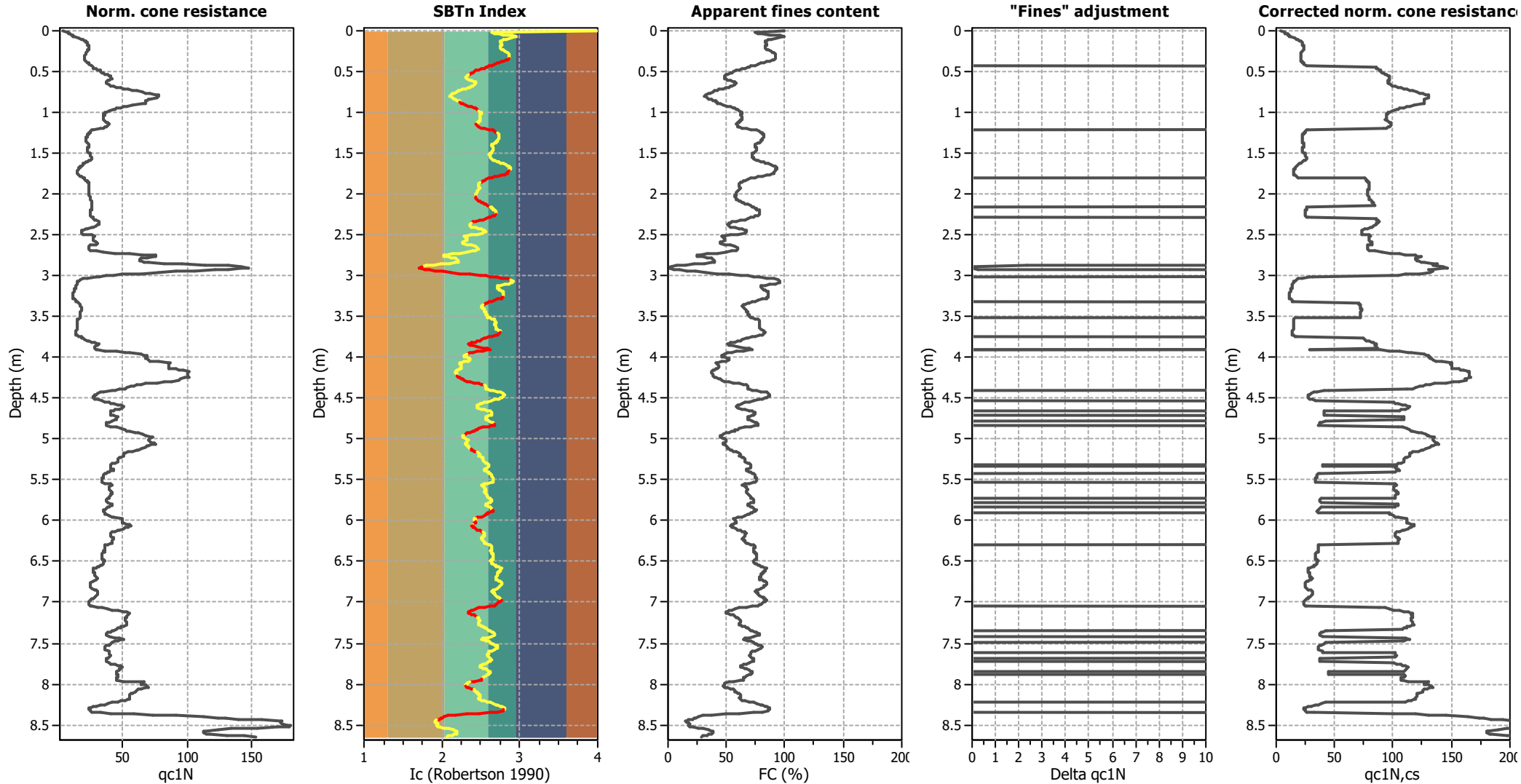
Input parameters and analysis data

|                                       |                   |                           |              |                             |            |
|---------------------------------------|-------------------|---------------------------|--------------|-----------------------------|------------|
| 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: | Yes        |
| Points to test:                       | Based on Ic value | Ic cut-off value:         | 2.60         | K <sub>o</sub> applied:     | Yes        |
| Earthquake magnitude M <sub>w</sub> : | 6.50              | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration:             | 0.05              | Use fill:                 | No           | Limit depth applied:        | Yes        |
| Depth to water table (insitu):        | 1.00 m            | Fill height:              | N/A          | Limit depth:                | 10.00 m    |

SBTn 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 |

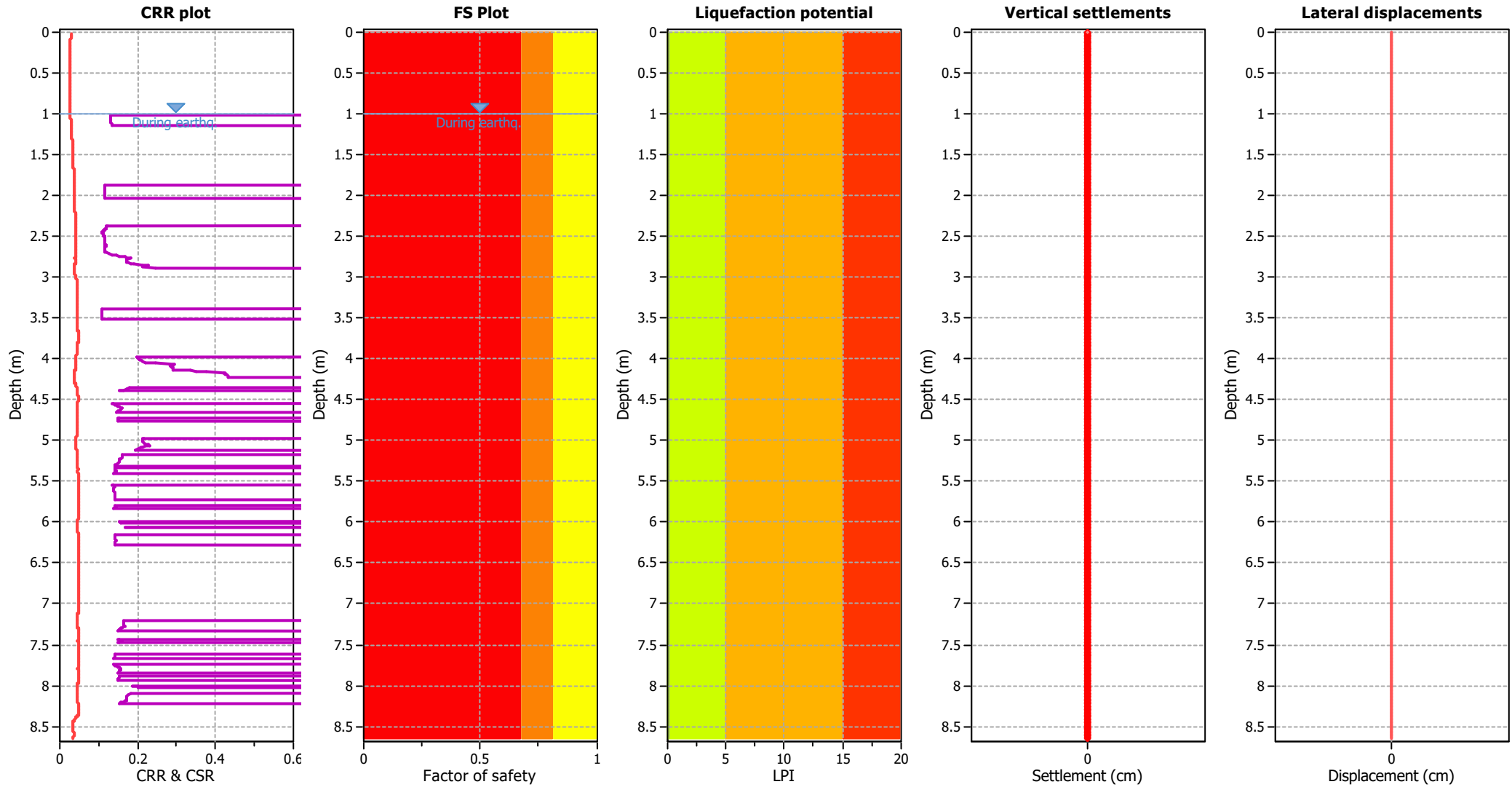
Liquefaction analysis overall plots (intermediate results)



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: | Yes        |
| Points to test:                       | Based on Ic value | Ic cut-off value:         | 2.60         | K <sub>o</sub> applied:     | Yes        |
| Earthquake magnitude M <sub>w</sub> : | 6.50              | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration:             | 0.05              | Use fill:                 | No           | Limit depth applied:        | Yes        |
| Depth to water table (insitu):        | 1.00 m            | Fill height:              | N/A          | Limit depth:                | 10.00 m    |

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: | Yes        |
| 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> : | 6.50              | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration:             | 0.05              | Use fill:                 | No           | Limit depth applied:        | Yes        |
| Depth to water table (insitu):        | 1.00 m            | Fill height:              | N/A          | Limit depth:                | 10.00 m    |

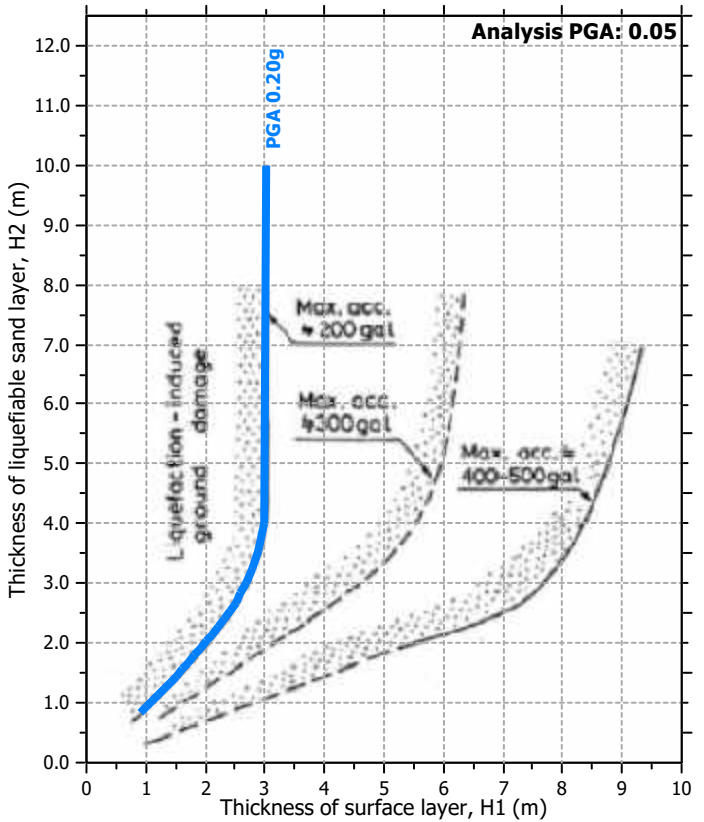
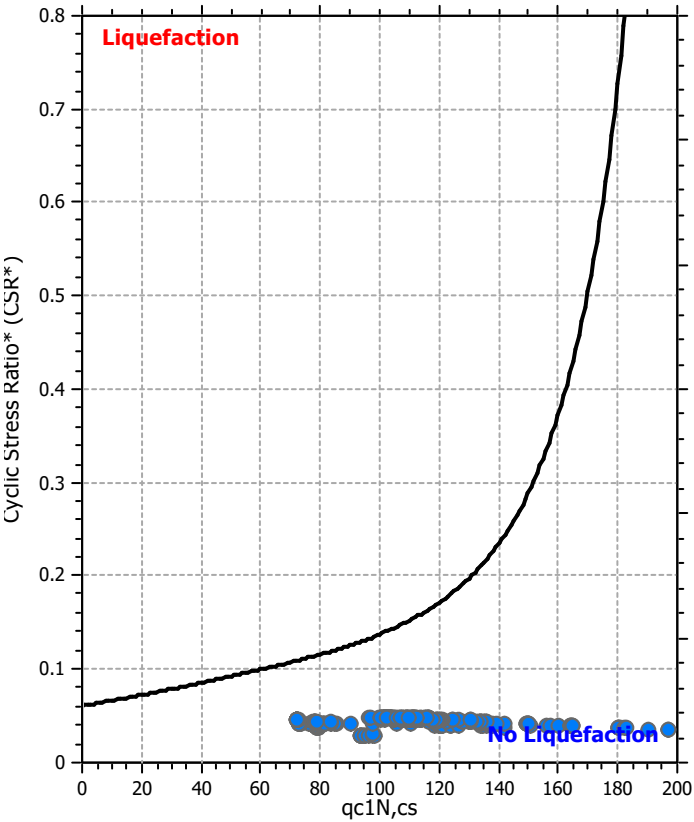
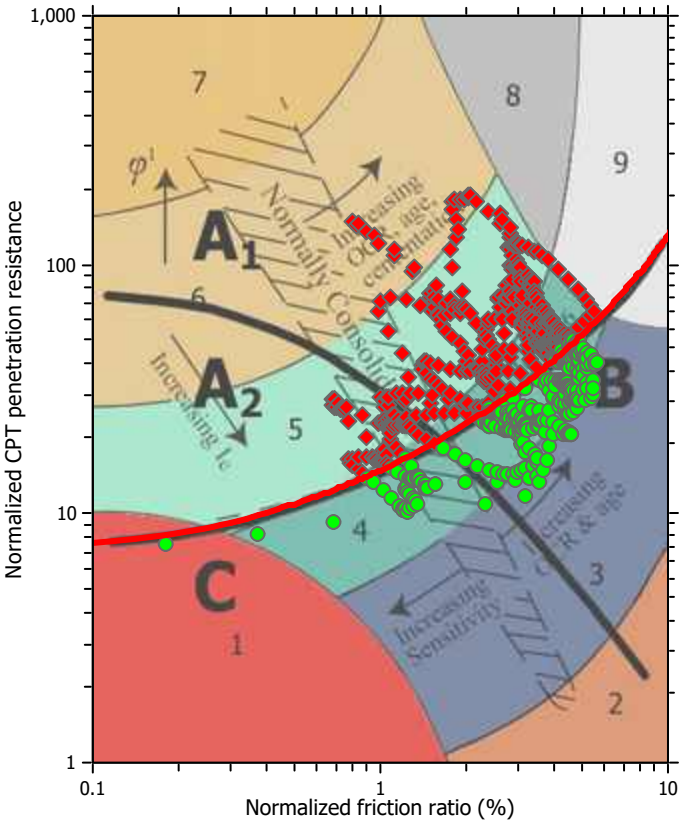
F.S. color scheme

|             |                                             |
|-------------|---------------------------------------------|
| Red         | Almost certain it will liquefy              |
| Orange      | Very likely to liquefy                      |
| Yellow      | Liquefaction and no liq. are equally likely |
| Light green | Unlike to liquefy                           |
| Dark green  | Almost certain it will not liquefy          |

LPI color scheme

|             |                |
|-------------|----------------|
| Red         | Very high risk |
| Orange      | High risk      |
| Light green | Low risk       |

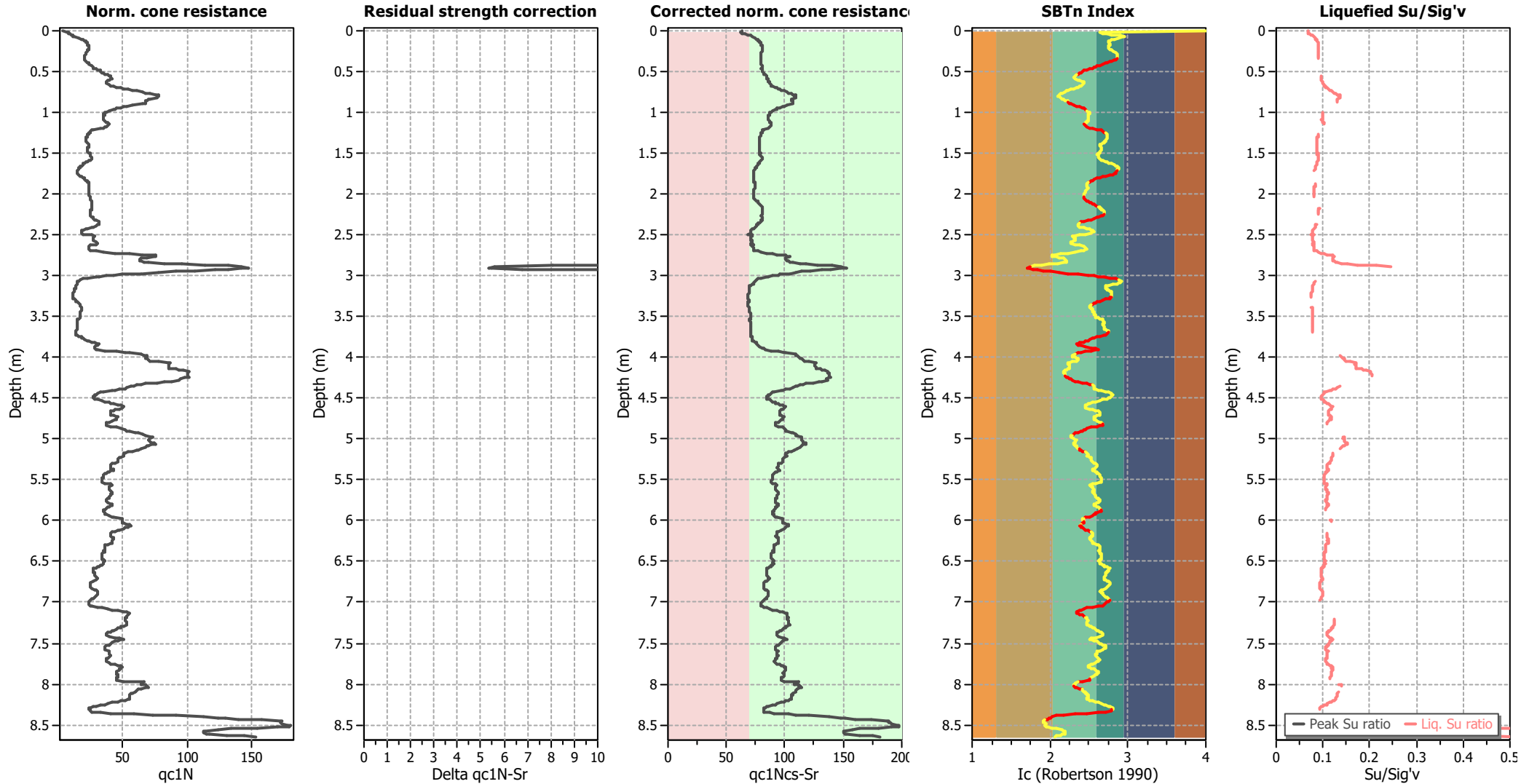
Liquefaction analysis summary plots



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: | Yes        |
| Points to test:                | Based on $I_c$ value | $I_c$ cut-off value:      | 2.60         | $K_o$ applied:              | Yes        |
| Earthquake magnitude $M_w$ :   | 6.50                 | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration:      | 0.05                 | Use fill:                 | No           | Limit depth applied:        | Yes        |
| Depth to water table (insitu): | 1.00 m               | Fill height:              | N/A          | Limit depth:                | 10.00 m    |

Check for strength loss plots (Idriss & Boulanger (2008))



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: | Yes        |
| Points to test:                       | Based on Ic value | Ic cut-off value:         | 2.60         | K <sub>o</sub> applied:     | Yes        |
| Earthquake magnitude M <sub>w</sub> : | 6.50              | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration:             | 0.05              | Use fill:                 | No           | Limit depth applied:        | Yes        |
| Depth to water table (insitu):        | 1.00 m            | Fill height:              | N/A          | Limit depth:                | 10.00 m    |

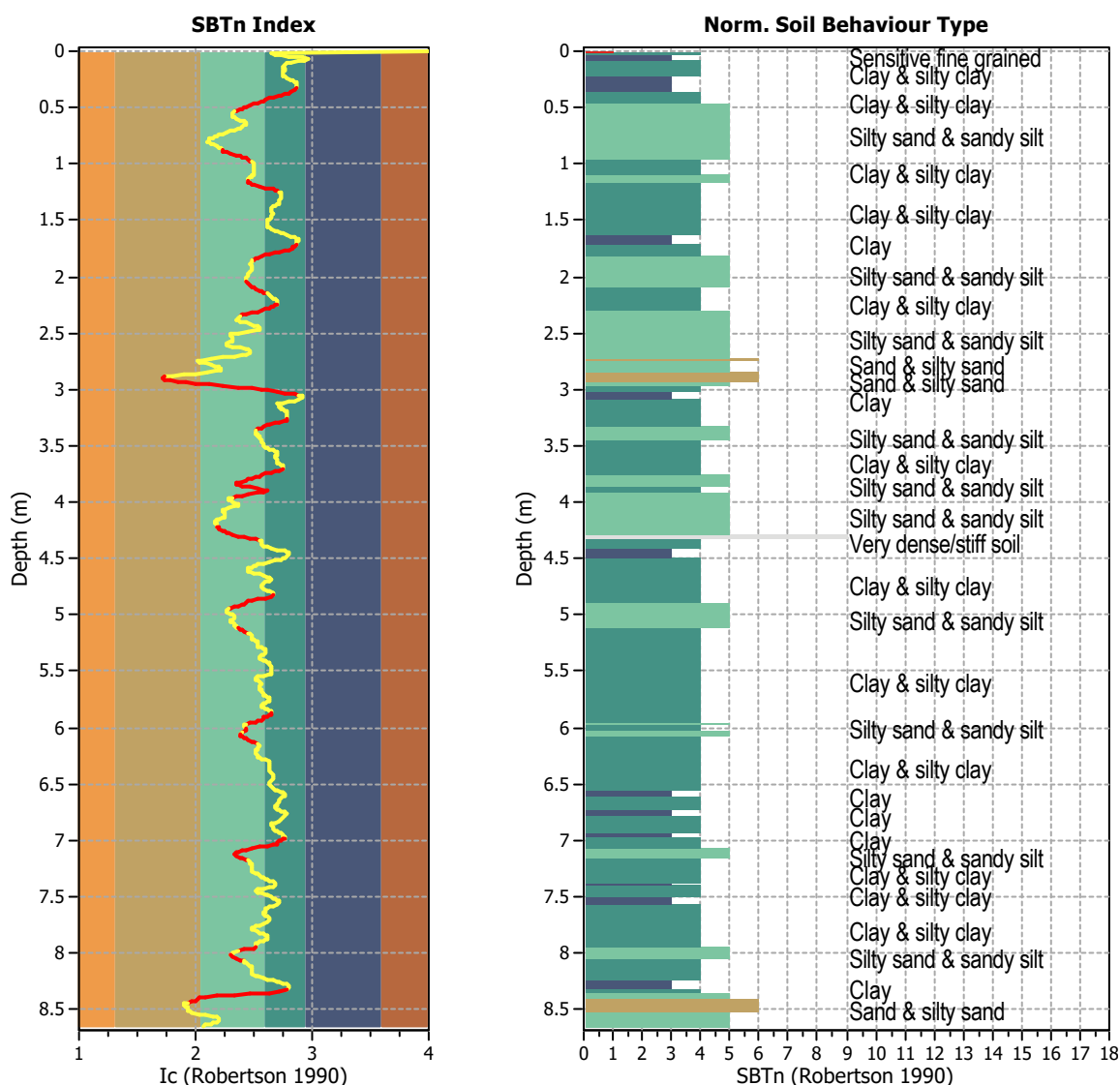
## TRANSITION LAYER DETECTION ALGORITHM REPORT

### Summary Details & Plots

#### Short description

The software will delete data when the cone is in transition from either clay to sand or vice-versa. To do this the software requires a range of  $I_c$  values over which the transition will be defined (typically somewhere between  $1.80 < I_c < 3.0$ ) and a rate of change of  $I_c$ . Transitions typically occur when the rate of change of  $I_c$  is fast (i.e.  $\Delta I_c$  is small).

The  $SBT_n$  plot below, displays in red the detected transition layers based on the parameters listed below the graphs.

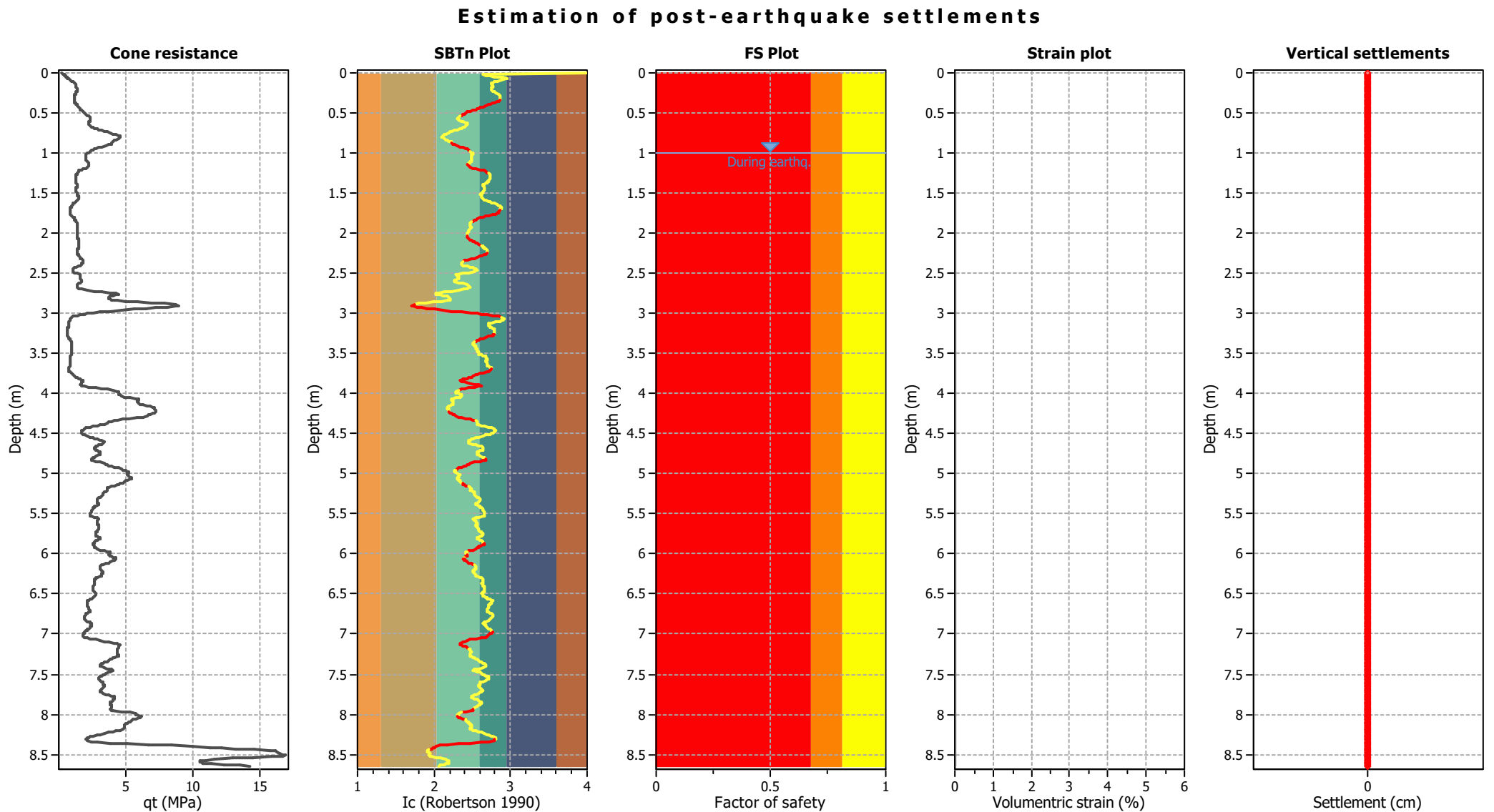


#### Transition layer algorithm properties

$I_c$  minimum check value: 1.70  
 $I_c$  maximum check value: 3.00  
 $I_c$  change ratio value: 0.0100  
 Minimum number of points in layer: 4

#### General statistics

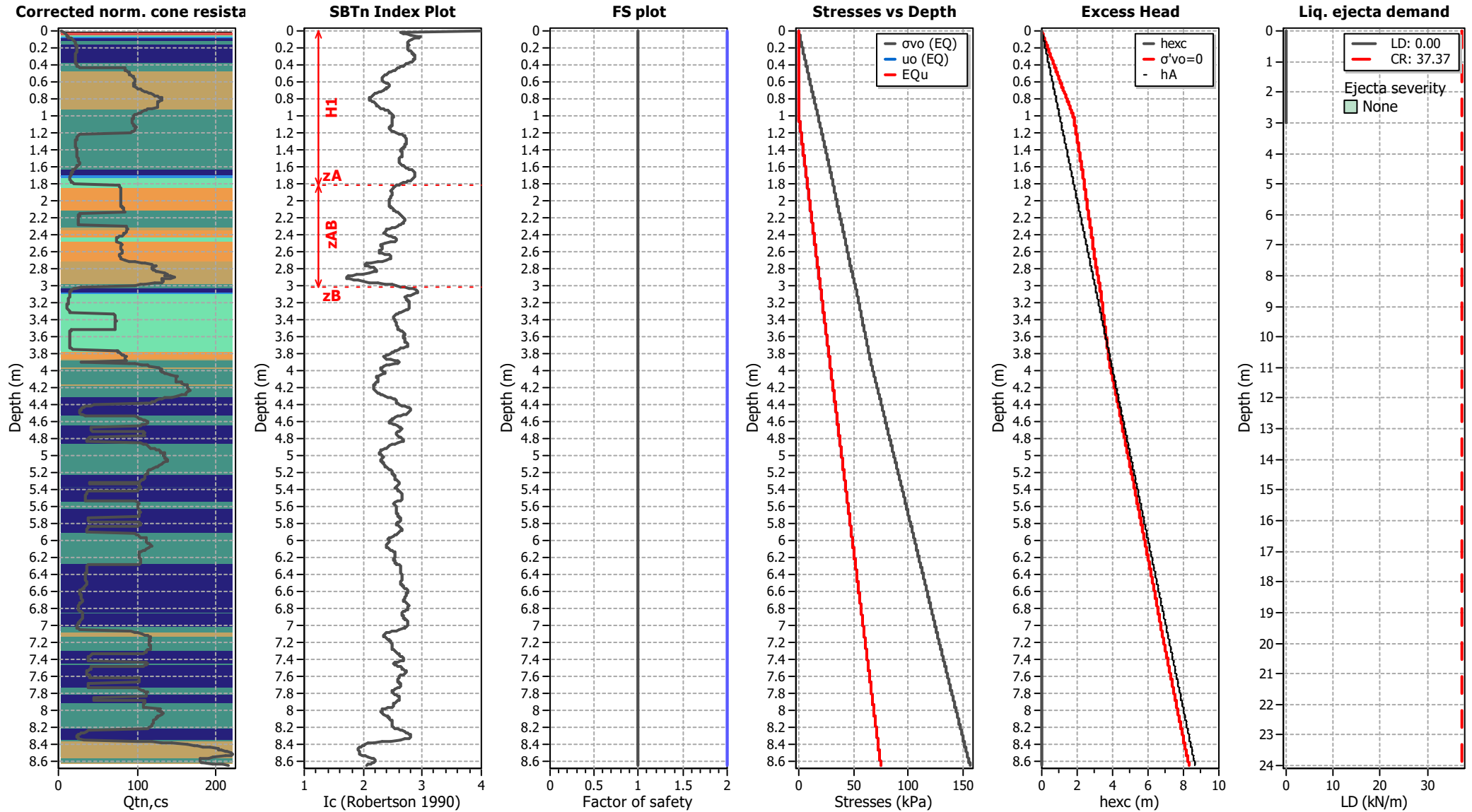
Total points in CPT file: 866  
 Total points excluded: 241  
 Exclusion percentage: 27.83%  
 Number of layers detected: 22



Abbreviations

- q<sub>t</sub>: Total cone resistance (cone resistance q<sub>c</sub> corrected for pore water effects)
- I<sub>c</sub>: Soil Behaviour Type Index
- FS: Calculated Factor of Safety against liquefaction
- Volumetric strain: Post-liquefaction volumetric strain

## Ejecta Severity Estimation



## LIQUEFACTION ANALYSIS REPORT

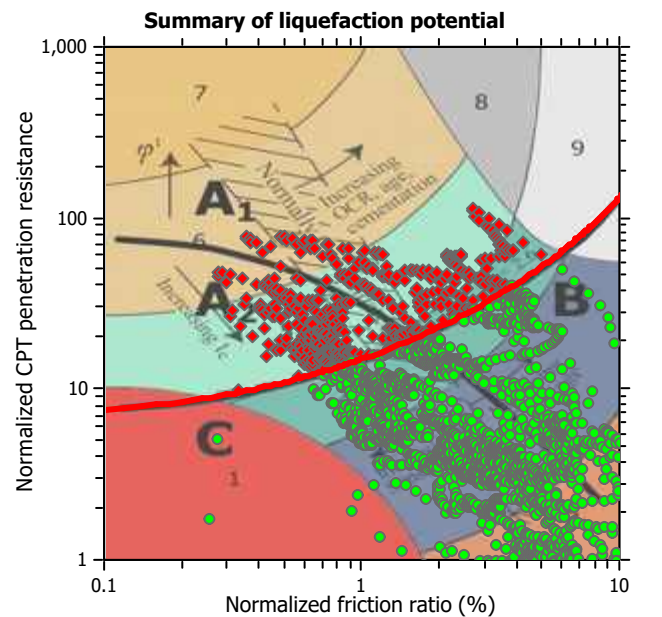
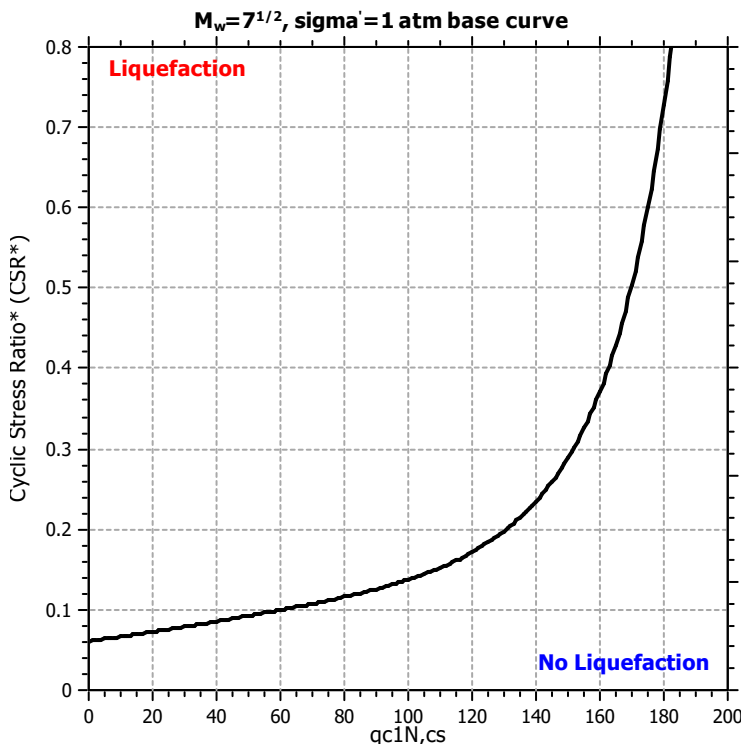
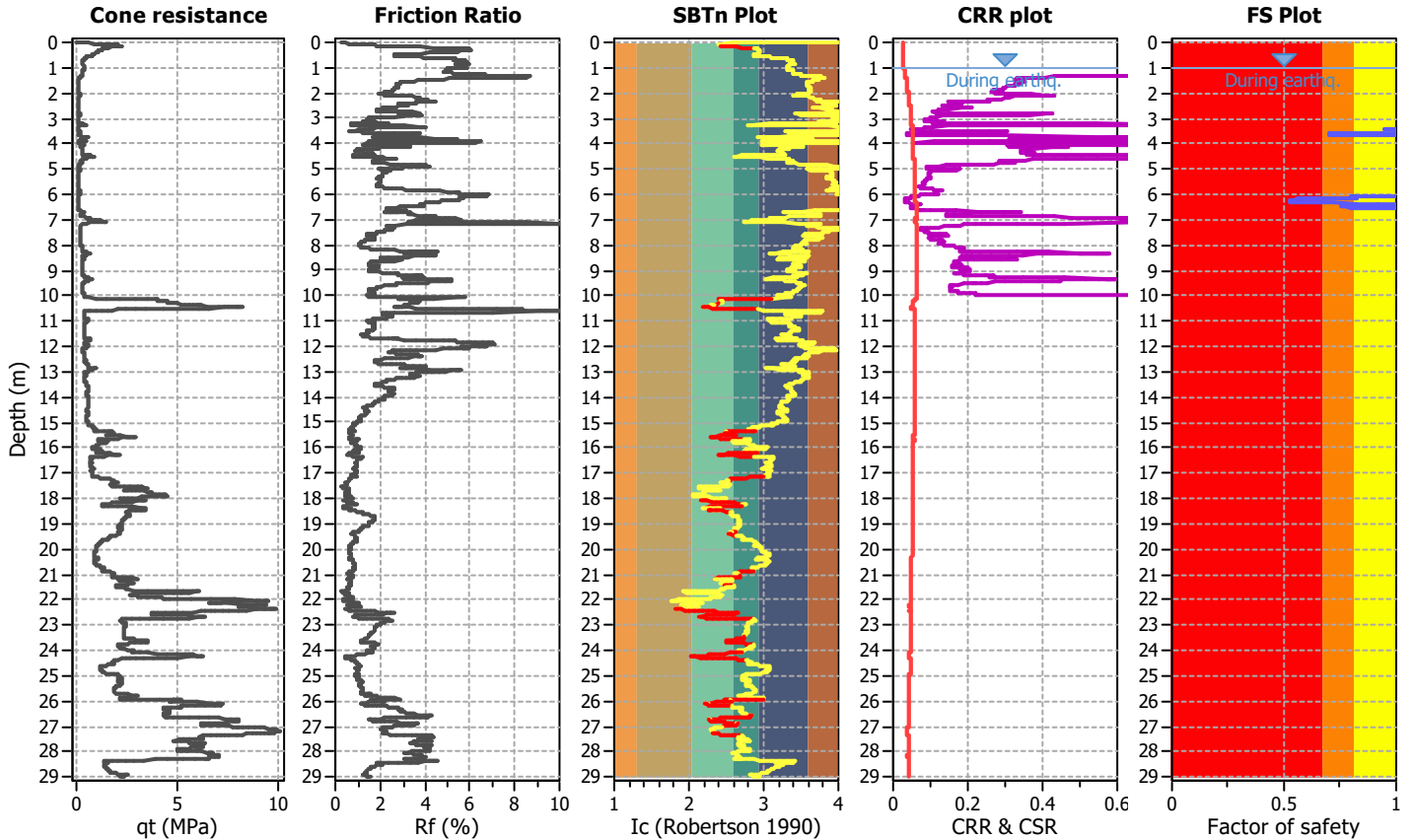
**Project title :**

**Location :**

**CPT file : CPT18**

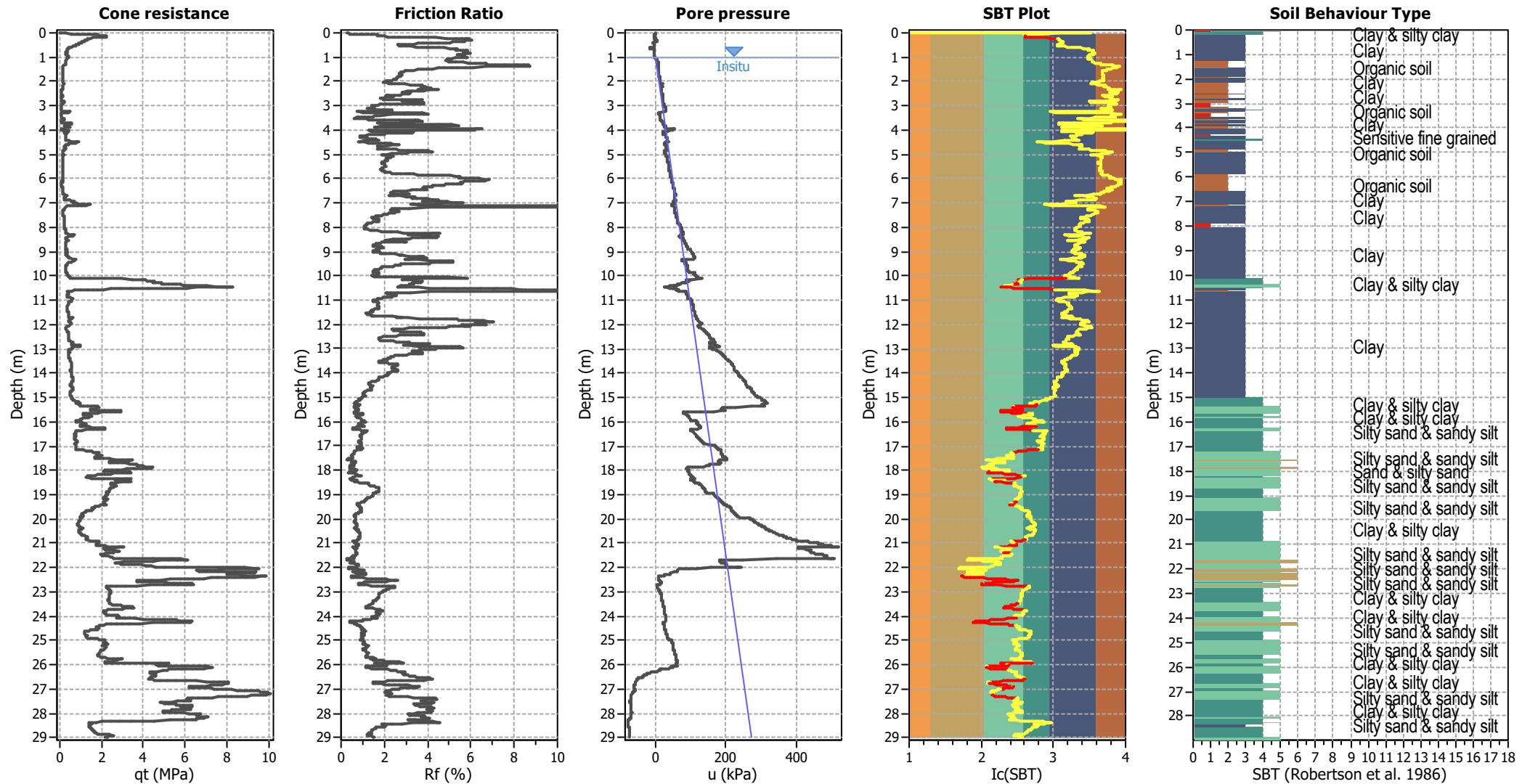
### Input parameters and analysis data

|                              |                   |                           |              |                         |     |                             |              |
|------------------------------|-------------------|---------------------------|--------------|-------------------------|-----|-----------------------------|--------------|
| Analysis method:             | B&I (2014)        | G.W.T. (in-situ):         | 1.00 m       | Use fill:               | No  | Clay like behavior applied: | Sand & Clay  |
| Fines correction method:     | B&I (2014)        | G.W.T. (earthq.):         | 1.00 m       | Fill height:            | N/A | Limit depth applied:        | Yes          |
| Points to test:              | Based on Ic value | Average results interval: | 3            | Fill weight:            | N/A | Limit depth:                | 10.00 m      |
| Earthquake magnitude $M_w$ : | 6.50              | Ic cut-off value:         | 2.60         | Trans. detect. applied: | Yes | MSF method:                 | Method based |
| Peak ground acceleration:    | 0.05              | Unit weight calculation:  | Based on SBT | $K_\sigma$ applied:     | Yes |                             |              |



Zone A<sub>1</sub>: Cyclic liquefaction likely depending on size and duration of cyclic loading  
Zone A<sub>2</sub>: Cyclic liquefaction and strength loss likely depending on loading and ground geometry  
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening  
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

## CPT basic interpretation plots



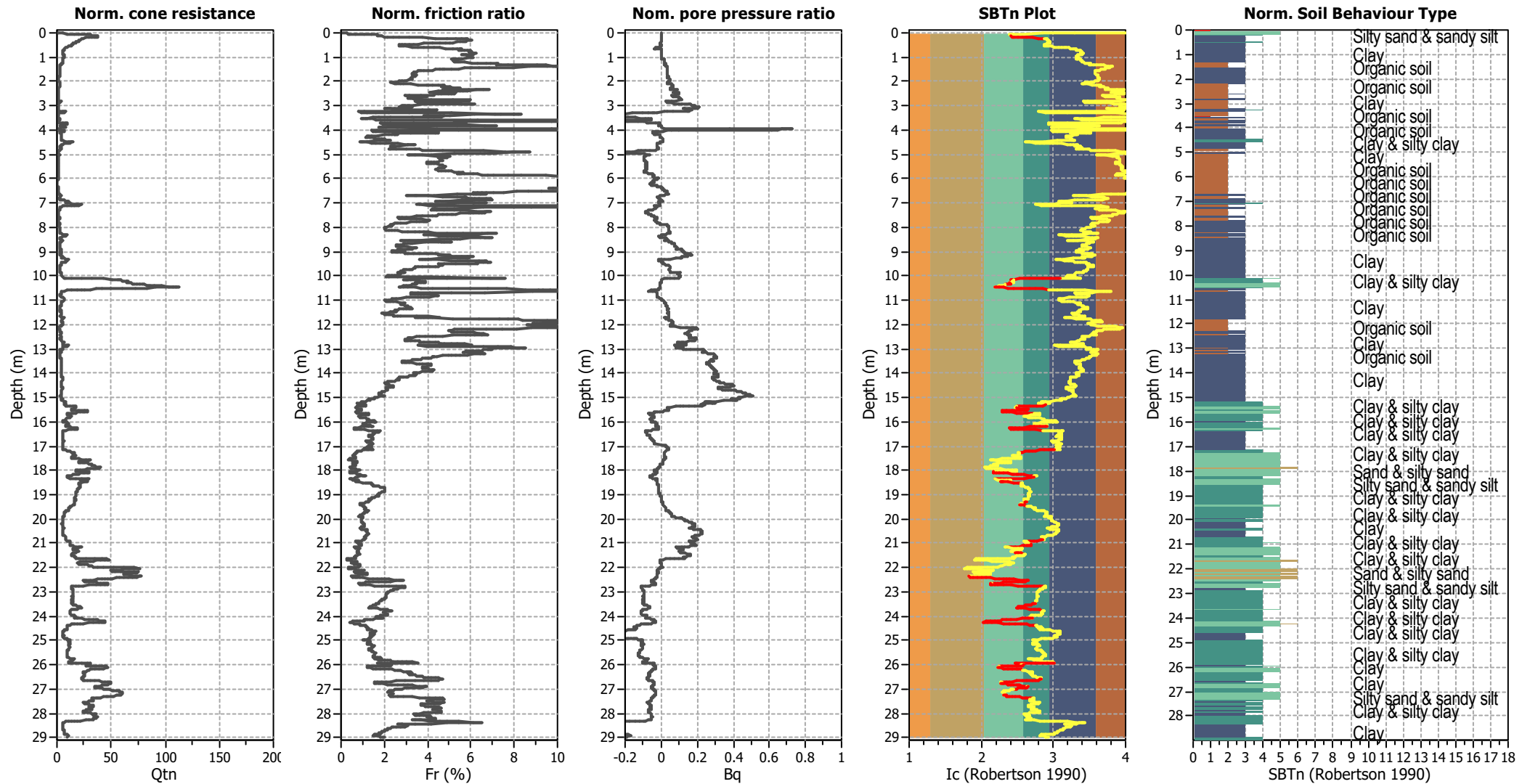
## Input parameters and analysis data

|                                       |                   |                           |              |                             |             |
|---------------------------------------|-------------------|---------------------------|--------------|-----------------------------|-------------|
| 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: | Yes         |
| 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> : | 6.50              | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sand & Clay |
| Peak ground acceleration:             | 0.05              | 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 (normalized)



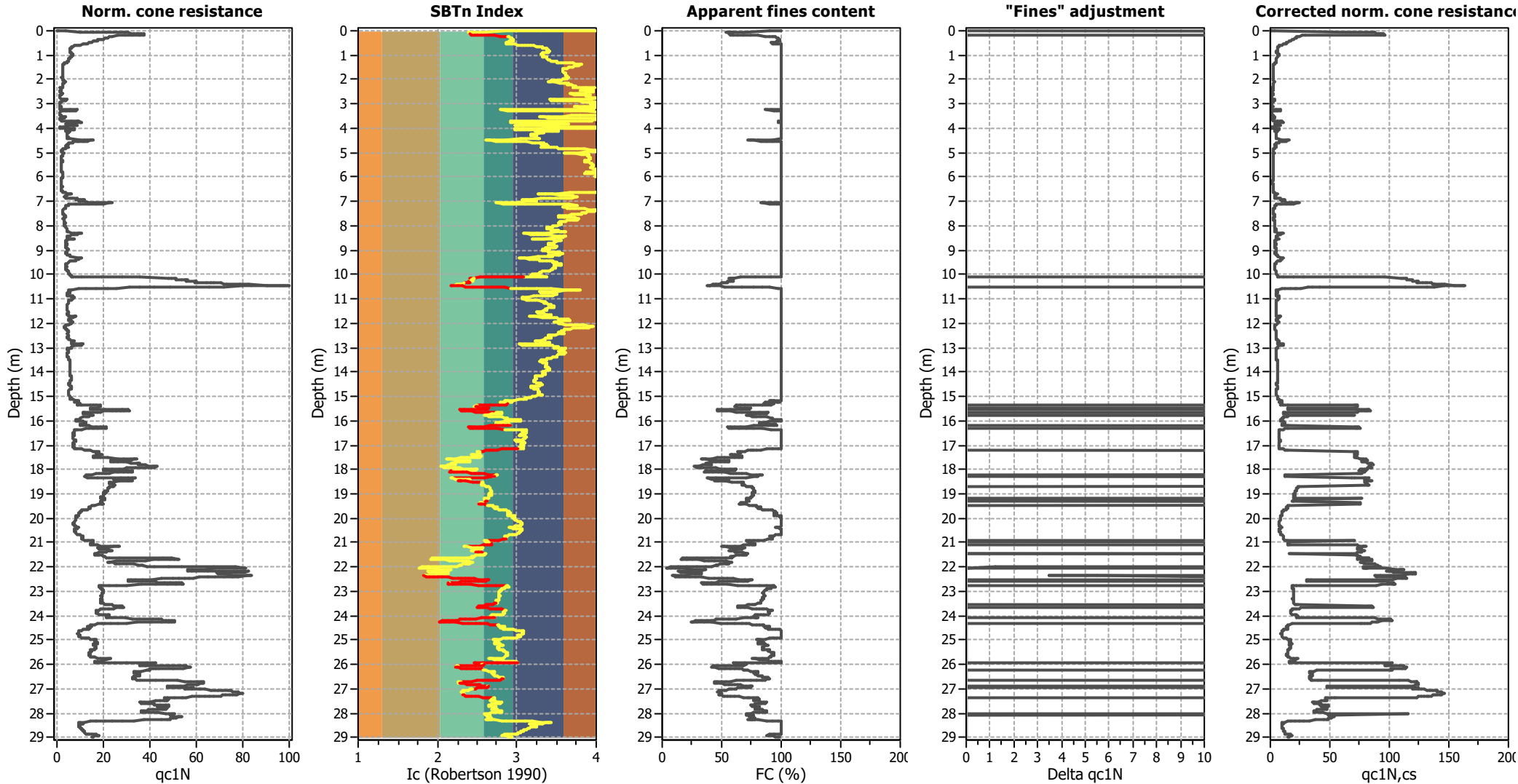
## Input parameters and analysis data

|                                       |                   |                           |              |                             |             |
|---------------------------------------|-------------------|---------------------------|--------------|-----------------------------|-------------|
| 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: | Yes         |
| 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> : | 6.50              | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sand & Clay |
| Peak ground acceleration:             | 0.05              | Use fill:                 | No           | Limit depth applied:        | Yes         |
| Depth to water table (insitu):        | 1.00 m            | Fill height:              | N/A          | Limit depth:                | 10.00 m     |

## SBTn 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 |

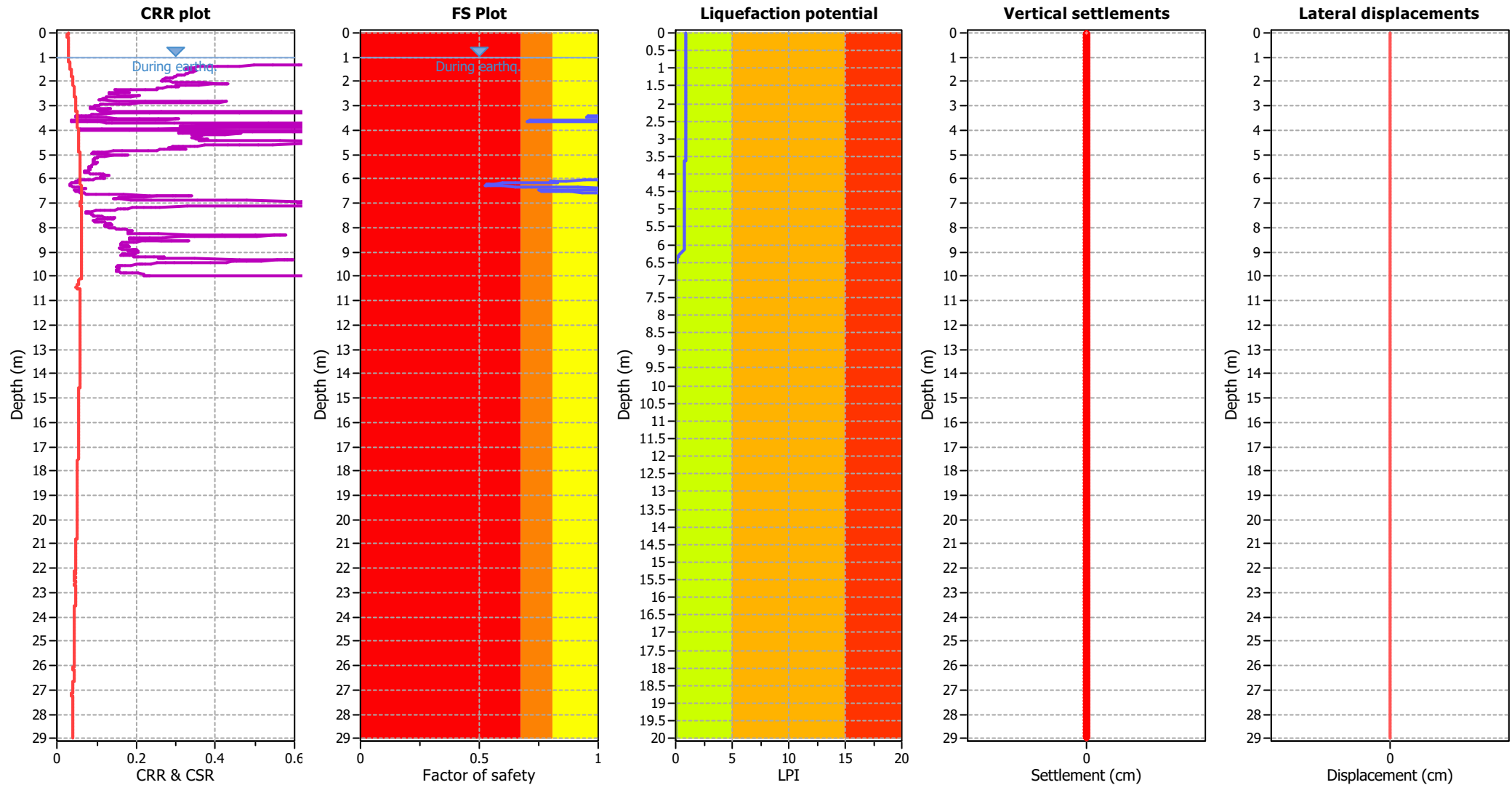
Liquefaction analysis overall plots (intermediate results)



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: | Yes         |
| Points to test:                       | Based on Ic value | Ic cut-off value:         | 2.60         | K <sub>o</sub> applied:     | Yes         |
| Earthquake magnitude M <sub>w</sub> : | 6.50              | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sand & Clay |
| Peak ground acceleration:             | 0.05              | Use fill:                 | No           | Limit depth applied:        | Yes         |
| Depth to water table (insitu):        | 1.00 m            | Fill height:              | N/A          | Limit depth:                | 10.00 m     |

## 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: | Yes         |
| Points to test:                | Based on Ic value | Ic cut-off value:         | 2.60         | $K_{\sigma}$ applied:       | Yes         |
| Earthquake magnitude $M_w$ :   | 6.50              | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sand & Clay |
| Peak ground acceleration:      | 0.05              | Use fill:                 | No           | Limit depth applied:        | Yes         |
| Depth to water table (insitu): | 1.00 m            | Fill height:              | N/A          | Limit depth:                | 10.00 m     |

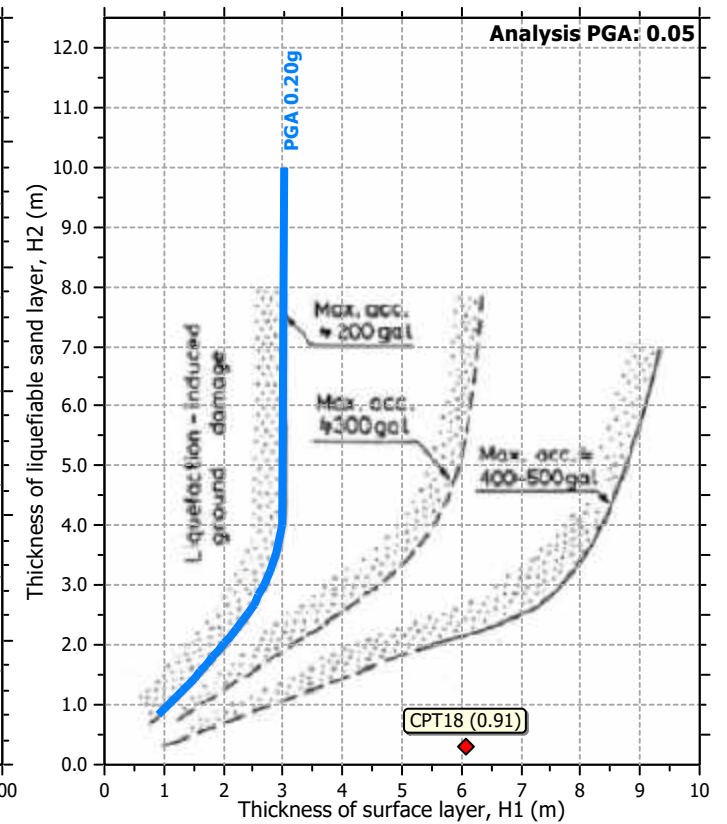
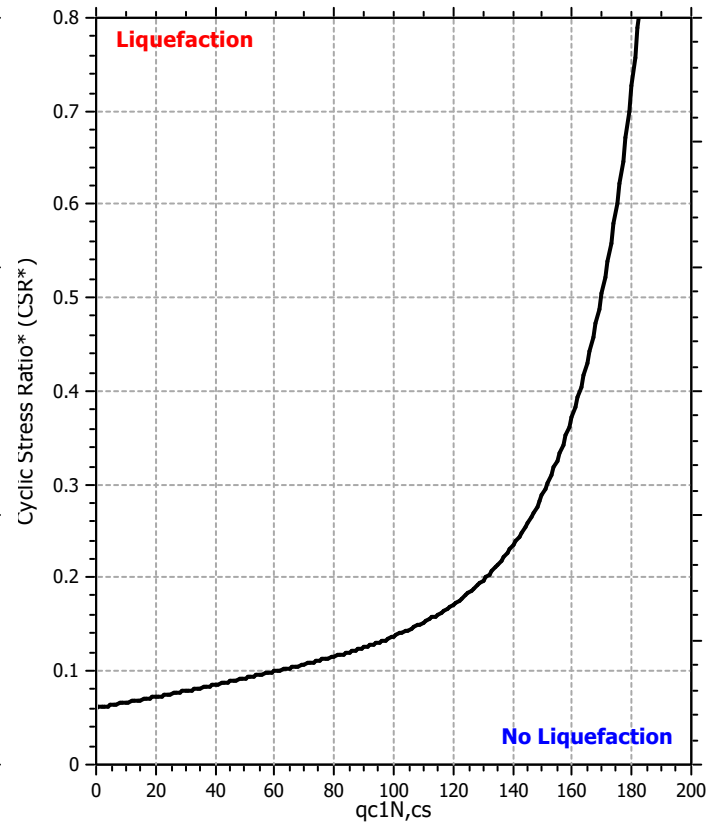
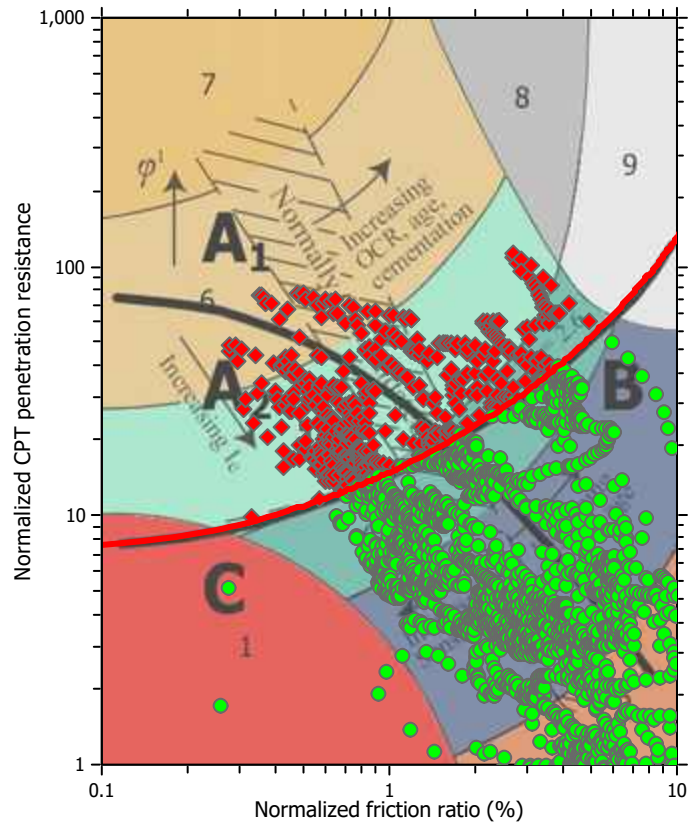
### F.S. color scheme

|             |                                             |
|-------------|---------------------------------------------|
| Red         | Almost certain it will liquefy              |
| Orange      | Very likely to liquefy                      |
| Yellow      | Liquefaction and no liq. are equally likely |
| Light Green | Unlike to liquefy                           |
| Dark Green  | Almost certain it will not liquefy          |

### LPI color scheme

|        |                |
|--------|----------------|
| Red    | Very high risk |
| Orange | High risk      |
| Yellow | Low risk       |

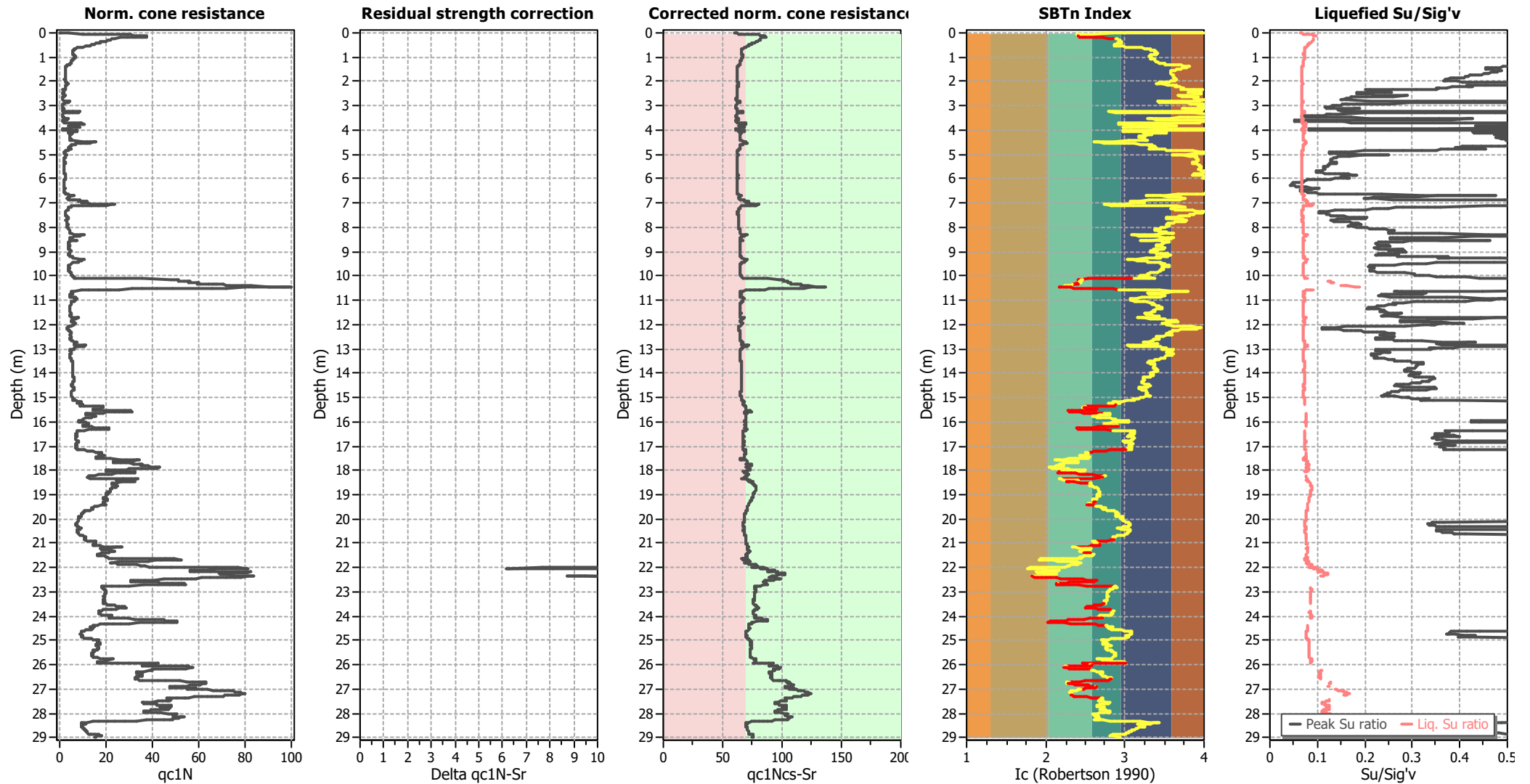
## Liquefaction analysis summary plots



### 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: | Yes         |
| Points to test:                | Based on $I_c$ value | $I_c$ cut-off value:      | 2.60         | $K_0$ applied:              | Yes         |
| Earthquake magnitude $M_w$ :   | 6.50                 | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sand & Clay |
| Peak ground acceleration:      | 0.05                 | Use fill:                 | No           | Limit depth applied:        | Yes         |
| Depth to water table (insitu): | 1.00 m               | Fill height:              | N/A          | Limit depth:                | 10.00 m     |

## Check for strength loss plots (Idriss & Boulanger (2008))



### 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: | Yes         |
| Points to test:                | Based on Ic value | Ic cut-off value:         | 2.60         | $K_g$ applied:              | Yes         |
| Earthquake magnitude $M_w$ :   | 6.50              | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sand & Clay |
| Peak ground acceleration:      | 0.05              | Use fill:                 | No           | Limit depth applied:        | Yes         |
| Depth to water table (insitu): | 1.00 m            | Fill height:              | N/A          | Limit depth:                | 10.00 m     |

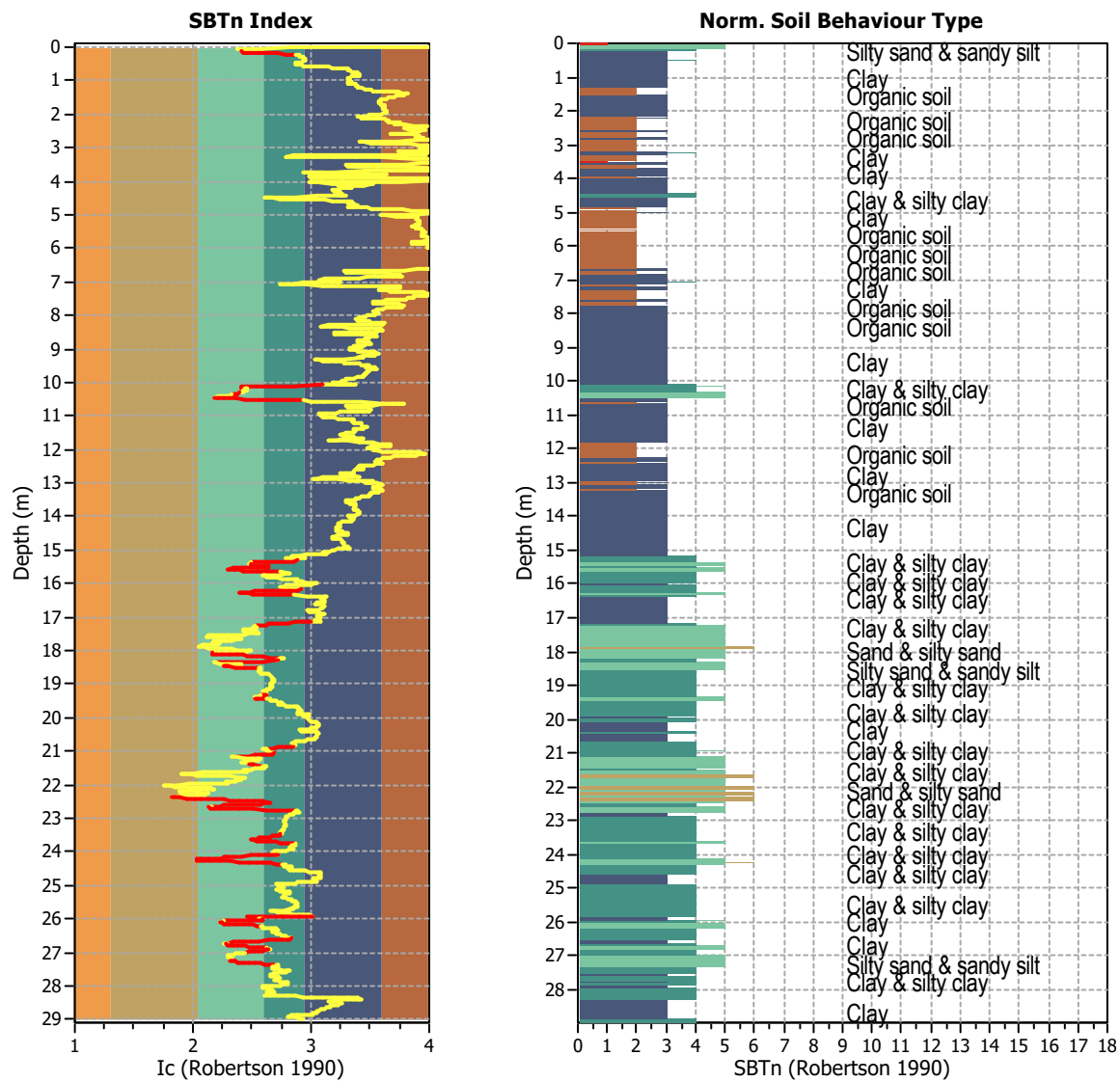
TRANSITION LAYER DETECTION ALGORITHM REPORT

Summary Details & Plots

Short description

The software will delete data when the cone is in transition from either clay to sand or vise-versa. To do this the software requires a range of  $I_c$  values over which the transition will be defined (typically somewhere between  $1.80 < I_c < 3.0$ ) and a rate of change of  $I_c$ . Transitions typically occur when the rate of change of  $I_c$  is fast (i.e.  $\Delta I_c$  is small).

The  $SBT_n$  plot below, displays in red the detected transition layers based on the parameters listed below the graphs.



Transition layer algorithm properties

$I_c$  minimum check value:1.70

$I_c$  maximum check value:3.00

$I_c$  change ratio value:0.0100

Minimum number of points in layer:4

General statistics

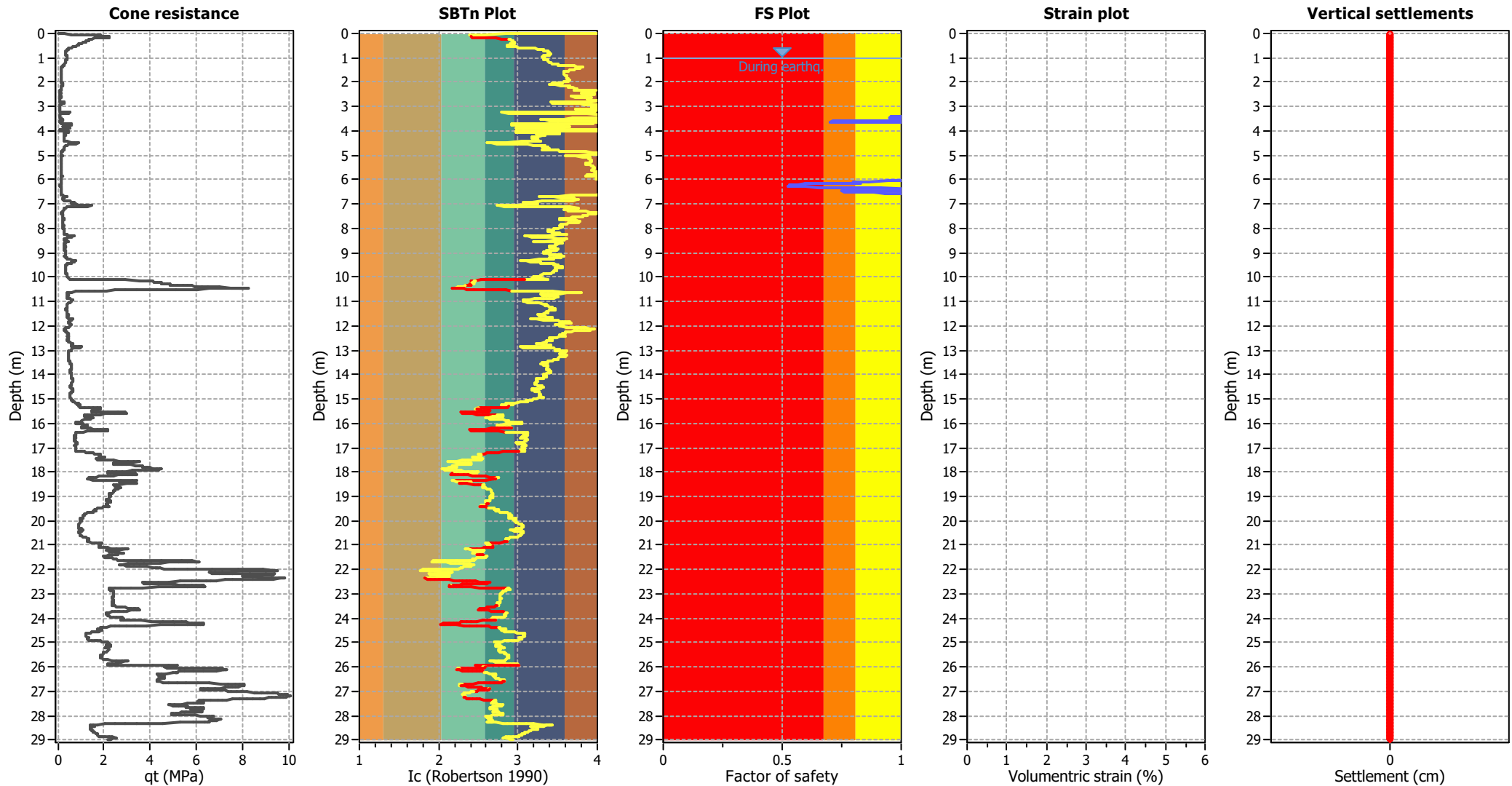
Total points in CPT file:2899

Total points excluded:351

Exclusion percentage:12.11%

Number of layers detected:35

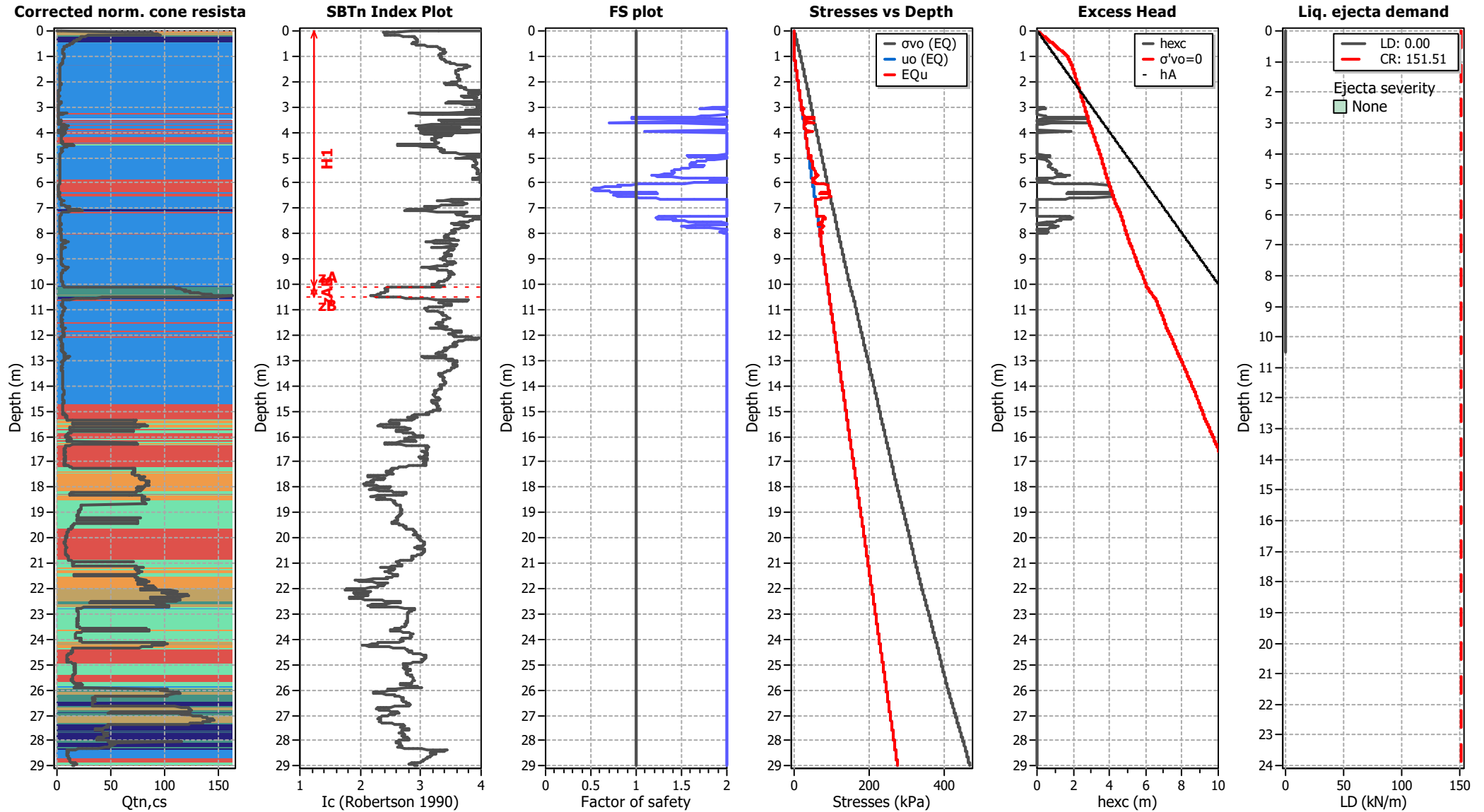
Estimation of post-earthquake settlements



Abbreviations

- q<sub>t</sub>: Total cone resistance (cone resistance q<sub>c</sub> corrected for pore water effects)
- I<sub>c</sub>: Soil Behaviour Type Index
- FS: Calculated Factor of Safety against liquefaction
- Volumetric strain: Post-liquefaction volumetric strain

## Ejecta Severity Estimation



## LIQUEFACTION ANALYSIS REPORT

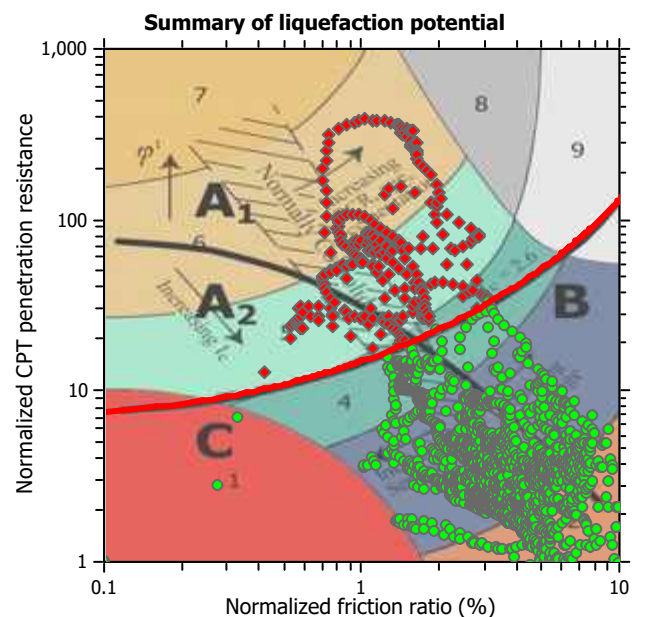
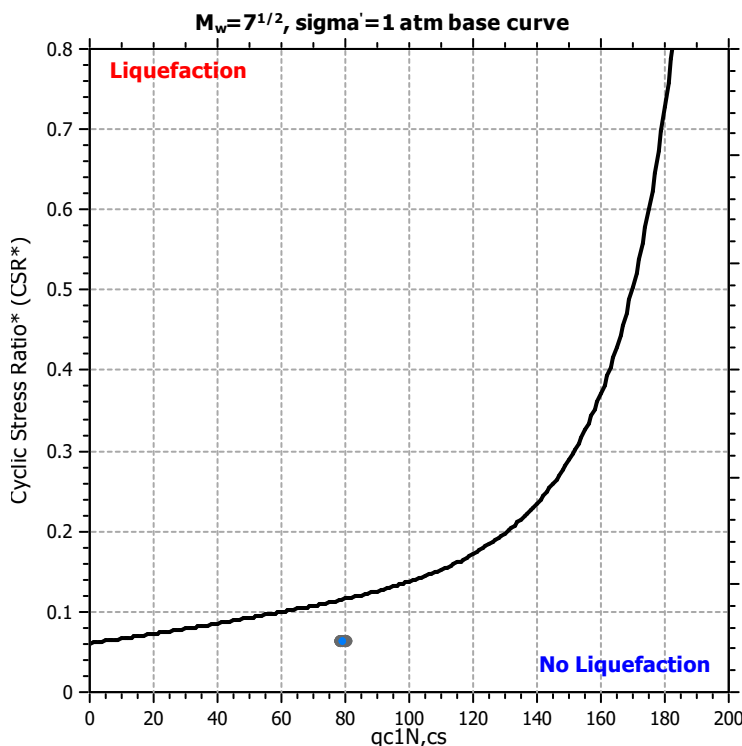
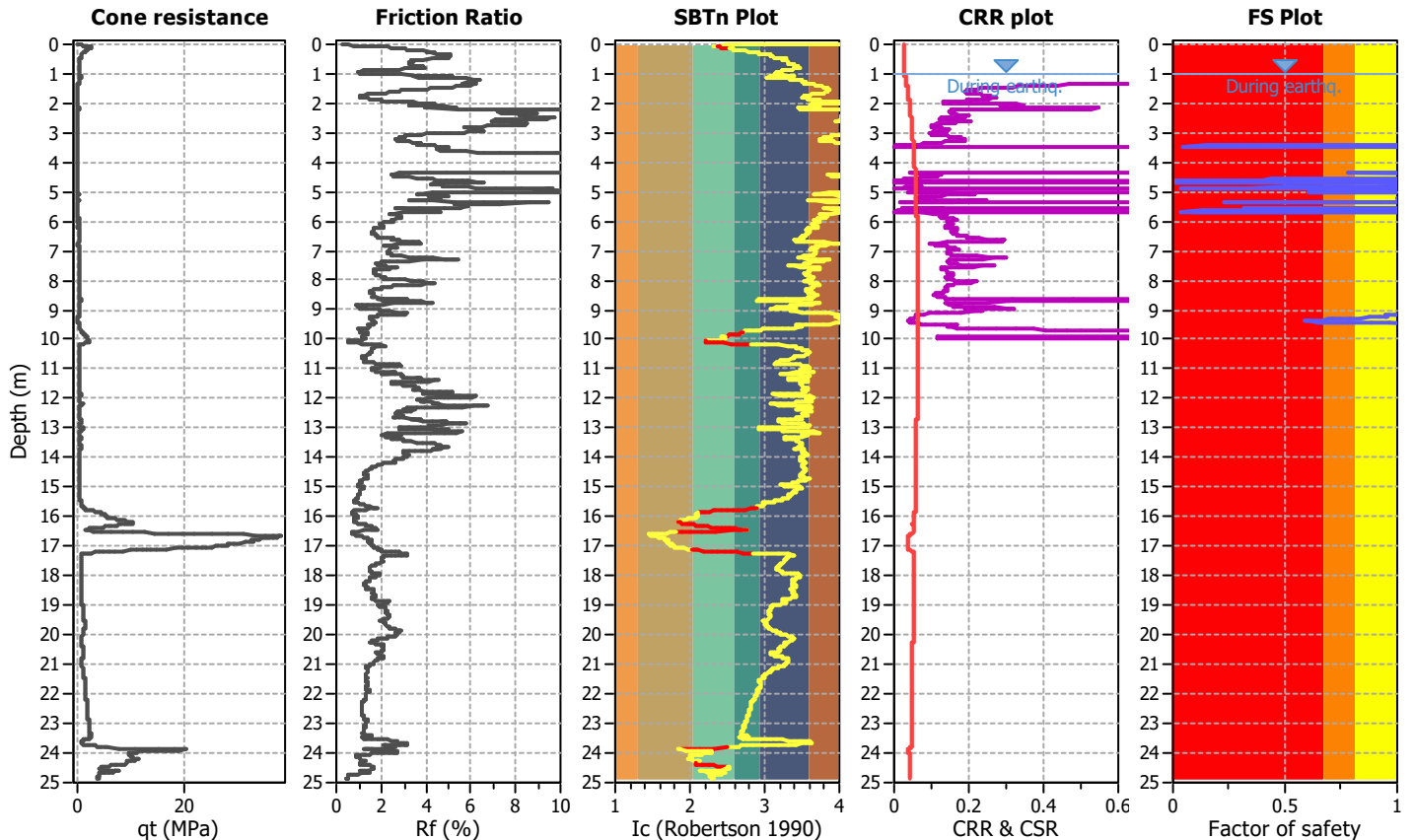
**Project title :**

**Location :**

**CPT file : CPT19A**

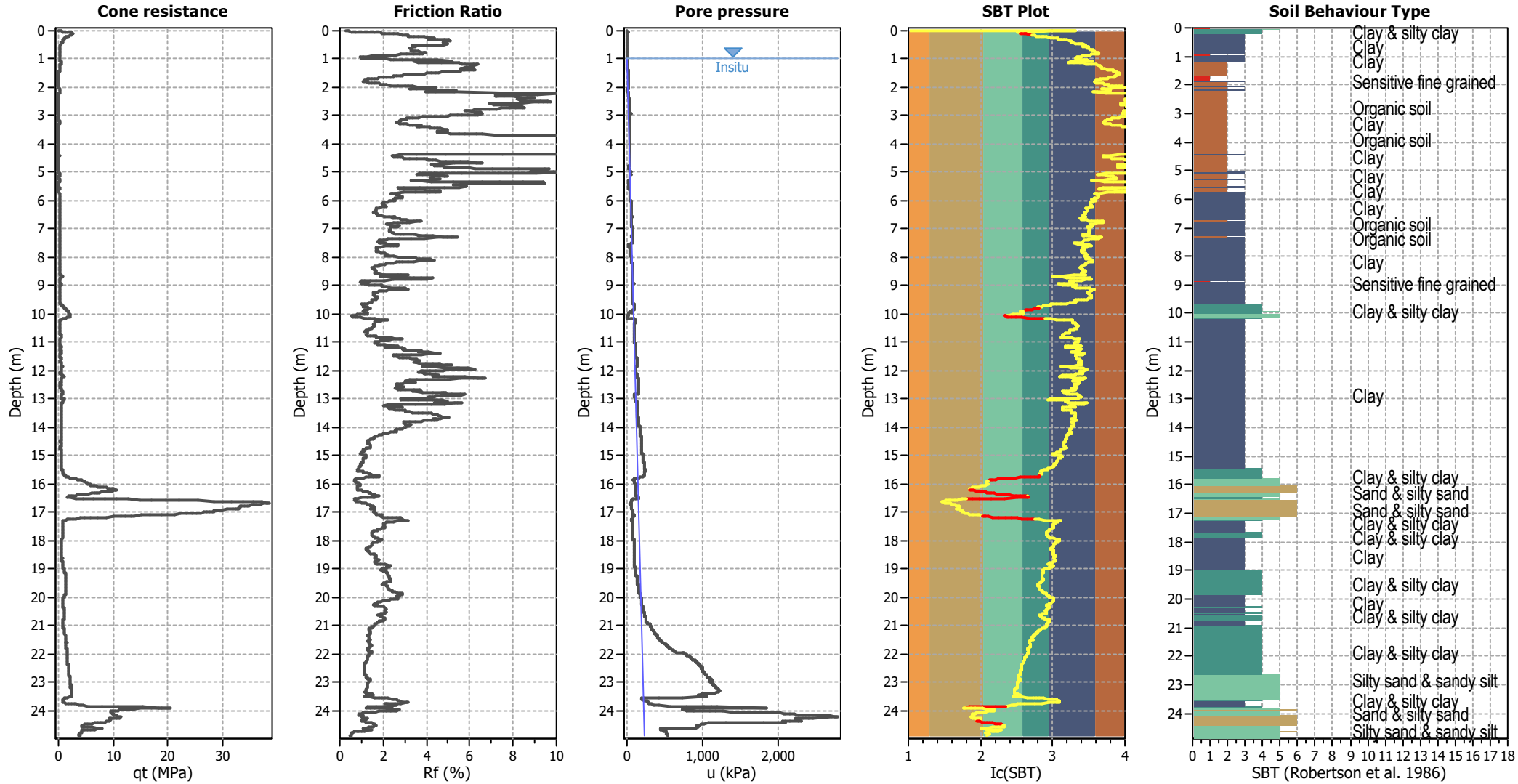
### Input parameters and analysis data

|                              |                   |                           |              |                         |     |                             |              |
|------------------------------|-------------------|---------------------------|--------------|-------------------------|-----|-----------------------------|--------------|
| Analysis method:             | B&I (2014)        | G.W.T. (in-situ):         | 1.00 m       | Use fill:               | No  | Clay like behavior applied: | Sand & Clay  |
| Fines correction method:     | B&I (2014)        | G.W.T. (earthq.):         | 1.00 m       | Fill height:            | N/A | Limit depth applied:        | Yes          |
| Points to test:              | Based on Ic value | Average results interval: | 3            | Fill weight:            | N/A | Limit depth:                | 10.00 m      |
| Earthquake magnitude $M_w$ : | 6.50              | Ic cut-off value:         | 2.60         | Trans. detect. applied: | Yes | MSF method:                 | Method based |
| Peak ground acceleration:    | 0.05              | Unit weight calculation:  | Based on SBT | $K_\sigma$ applied:     | Yes |                             |              |



Zone A<sub>1</sub>: Cyclic liquefaction likely depending on size and duration of cyclic loading  
Zone A<sub>2</sub>: Cyclic liquefaction and strength loss likely depending on loading and ground geometry  
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening  
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



Soil Behaviour Type

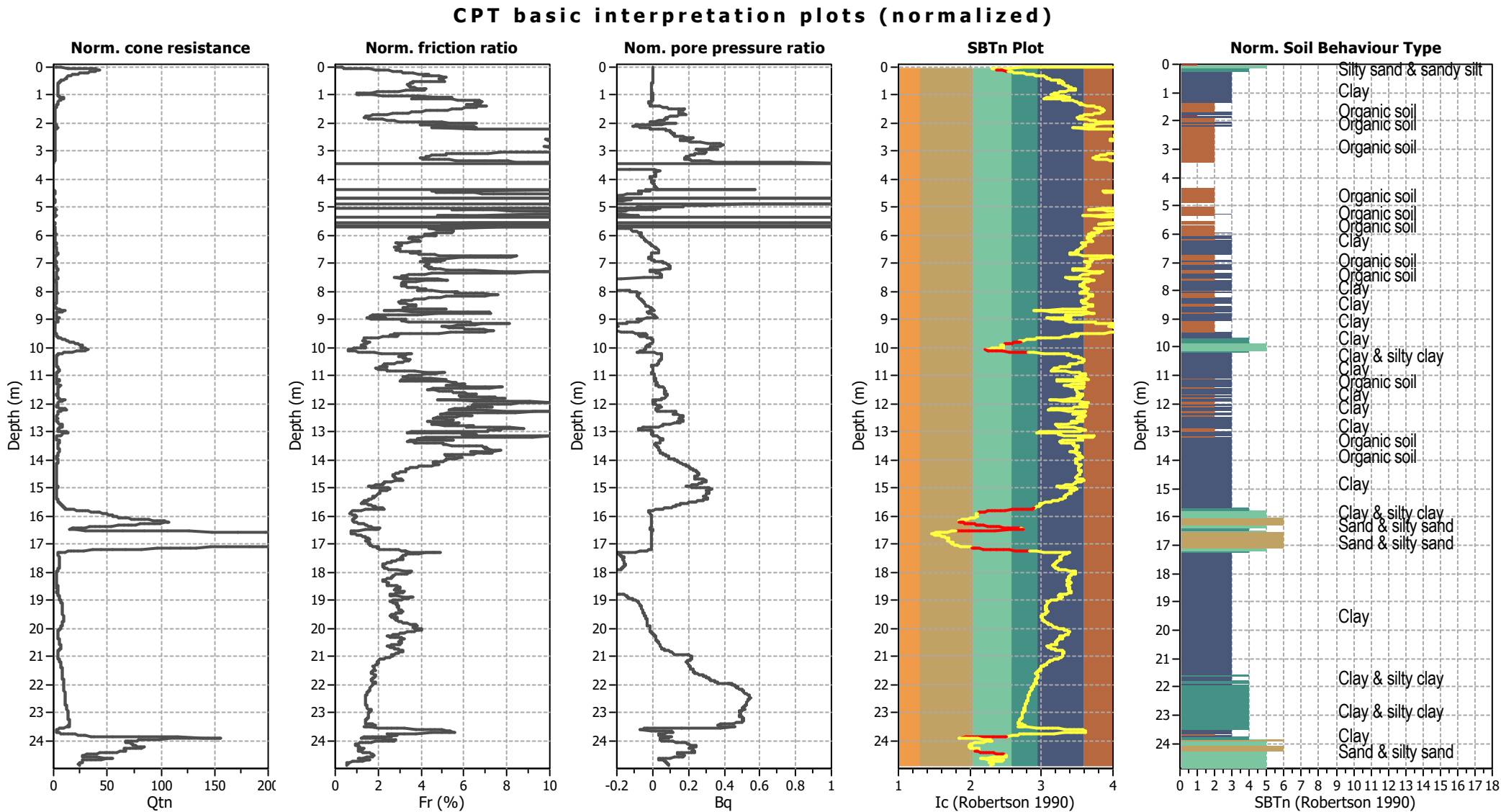
|    |                         |
|----|-------------------------|
| 0  | Clay & silty clay       |
| 1  | Clay                    |
| 2  | Clay                    |
| 3  | Sensitive fine grained  |
| 4  | Organic soil            |
| 5  | Clay                    |
| 6  | Organic soil            |
| 7  | Clay                    |
| 8  | Clay                    |
| 9  | Organic soil            |
| 10 | Organic soil            |
| 11 | Clay                    |
| 12 | Sensitive fine grained  |
| 13 | Clay & silty clay       |
| 14 | Clay                    |
| 15 | Clay                    |
| 16 | Clay & silty clay       |
| 17 | Sand & silty sand       |
| 18 | Sand & silty sand       |
| 19 | Clay & silty clay       |
| 20 | Clay & silty clay       |
| 21 | Clay                    |
| 22 | Clay & silty clay       |
| 23 | Clay & silty clay       |
| 24 | Silty sand & sandy silt |
| 25 | Clay & silty clay       |
| 26 | Sand & silty sand       |
| 27 | Silty sand & sandy silt |

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: | Yes         |
| Points to test:                       | Based on Ic value | Ic cut-off value:         | 2.60         | K <sub>o</sub> applied:     | Yes         |
| Earthquake magnitude M <sub>w</sub> : | 6.50              | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sand & Clay |
| Peak ground acceleration:             | 0.05              | 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 |



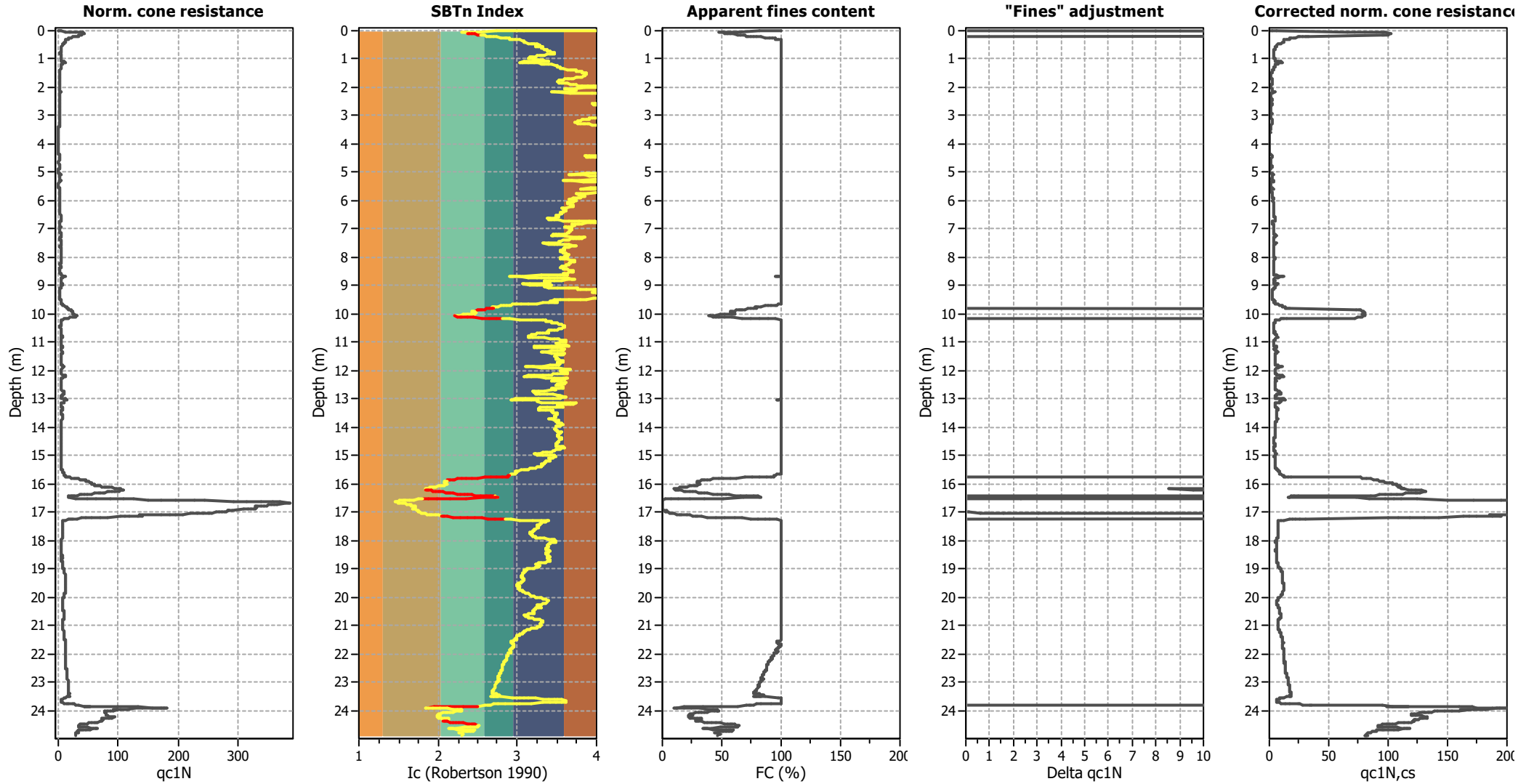
**Input parameters and analysis data**

|                                |                      |                           |              |                             |             |
|--------------------------------|----------------------|---------------------------|--------------|-----------------------------|-------------|
| 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: | Yes         |
| Points to test:                | Based on $I_c$ value | $I_c$ cut-off value:      | 2.60         | $K_o$ applied:              | Yes         |
| Earthquake magnitude $M_w$ :   | 6.50                 | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sand & Clay |
| Peak ground acceleration:      | 0.05                 | Use fill:                 | No           | Limit depth applied:        | Yes         |
| Depth to water table (insitu): | 1.00 m               | Fill height:              | N/A          | Limit depth:                | 10.00 m     |

**SBTn legend**

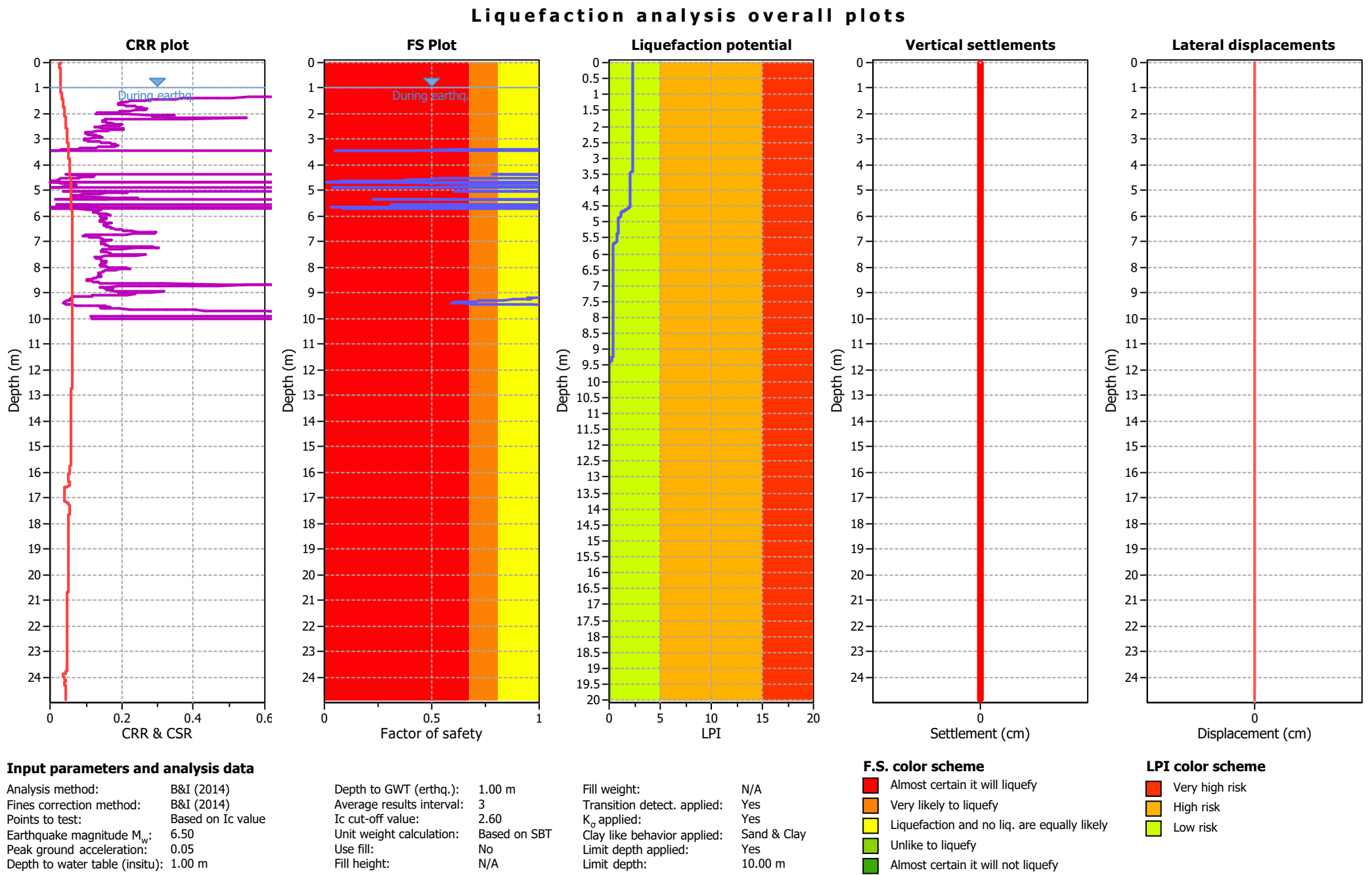
|                           |                             |                            |
|---------------------------|-----------------------------|----------------------------|
| 1. Sensitive fine grained | 4. Clayey silt to silty     | 7. Gravely sand to sand    |
| 2. Organic material       | 5. Silty 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 |

Liquefaction analysis overall plots (intermediate results)

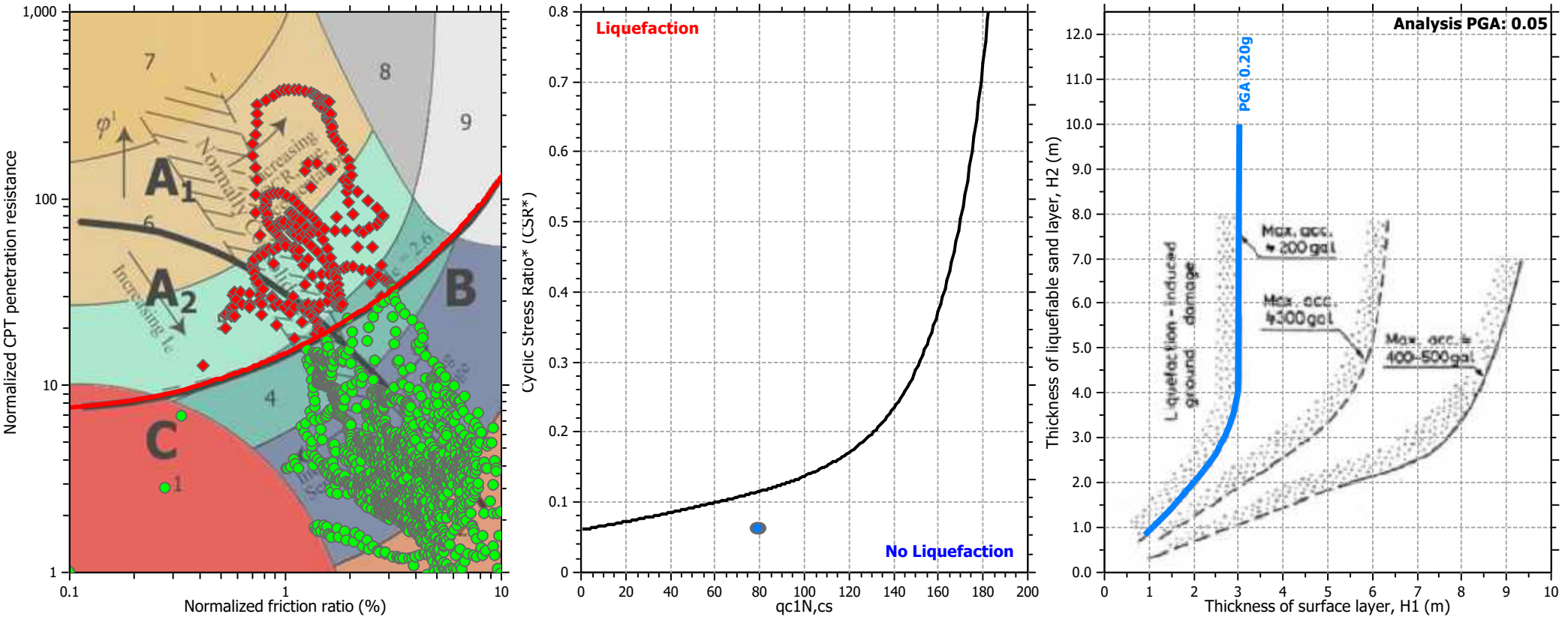


Input parameters and analysis data

|                                       |                   |                           |              |                             |             |
|---------------------------------------|-------------------|---------------------------|--------------|-----------------------------|-------------|
| 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: | Yes         |
| Points to test:                       | Based on Ic value | Ic cut-off value:         | 2.60         | K <sub>o</sub> applied:     | Yes         |
| Earthquake magnitude M <sub>w</sub> : | 6.50              | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sand & Clay |
| Peak ground acceleration:             | 0.05              | Use fill:                 | No           | Limit depth applied:        | Yes         |
| Depth to water table (insitu):        | 1.00 m            | Fill height:              | N/A          | Limit depth:                | 10.00 m     |



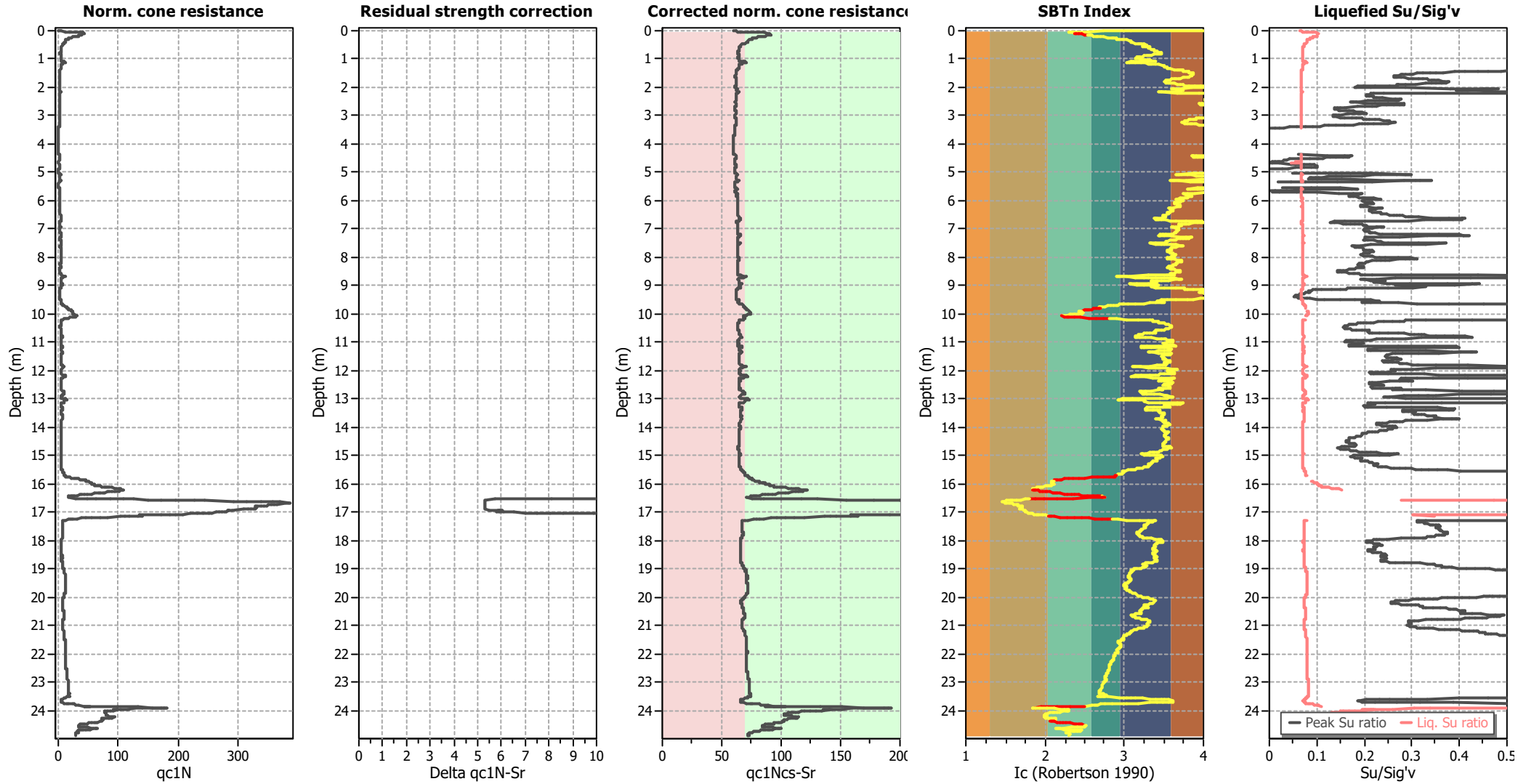
Liquefaction analysis summary plots



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: | Yes         |
| 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> : | 6.50              | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sand & Clay |
| Peak ground acceleration:             | 0.05              | Use fill:                 | No           | Limit depth applied:        | Yes         |
| Depth to water table (insitu):        | 1.00 m            | Fill height:              | N/A          | Limit depth:                | 10.00 m     |

Check for strength loss plots (Idriss & Boulanger (2008))



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: | Yes         |
| Points to test:                       | Based on Ic value | Ic cut-off value:         | 2.60         | K <sub>o</sub> applied:     | Yes         |
| Earthquake magnitude M <sub>w</sub> : | 6.50              | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sand & Clay |
| Peak ground acceleration:             | 0.05              | Use fill:                 | No           | Limit depth applied:        | Yes         |
| Depth to water table (insitu):        | 1.00 m            | Fill height:              | N/A          | Limit depth:                | 10.00 m     |

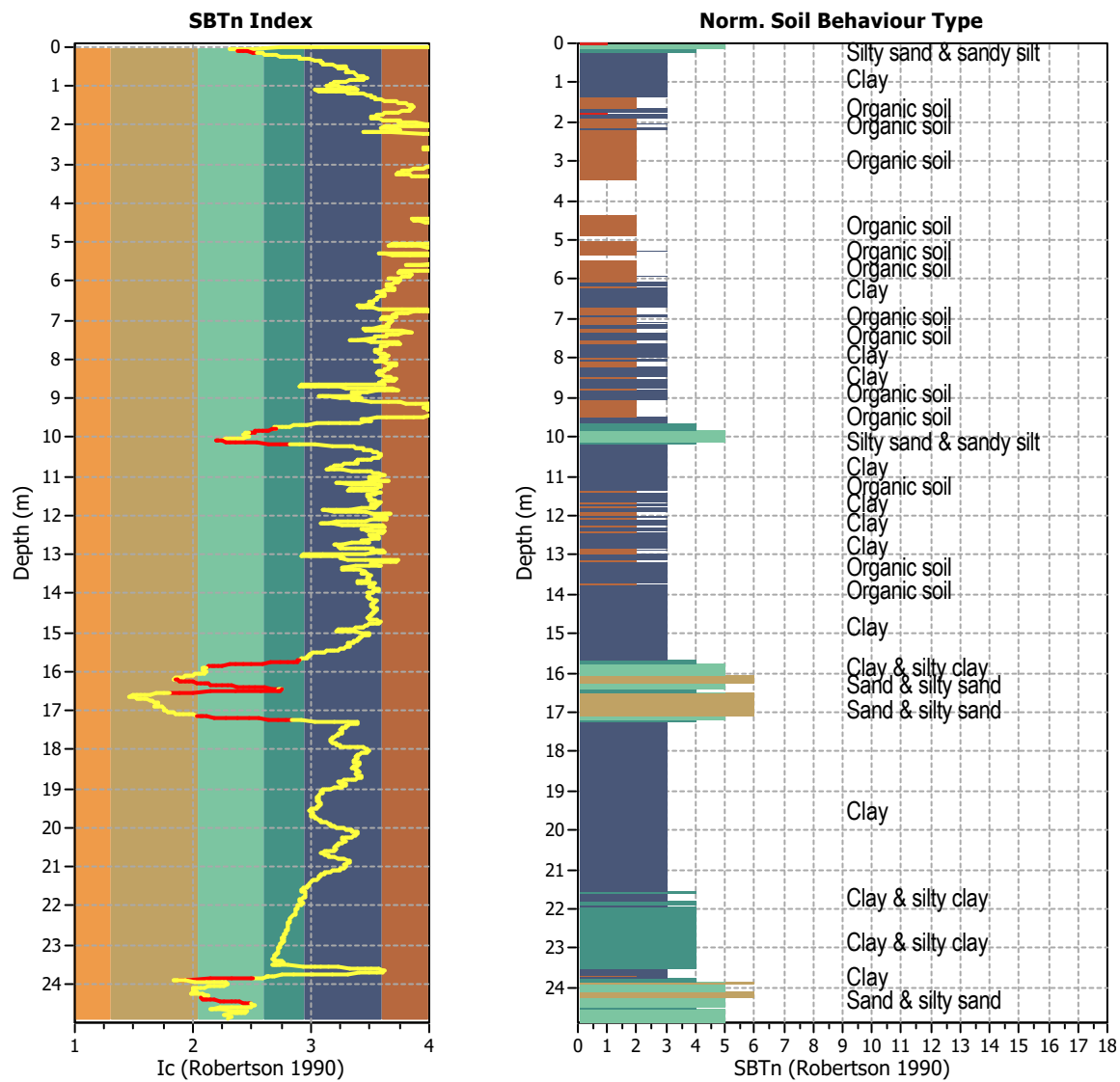
TRANSITION LAYER DETECTION ALGORITHM REPORT

Summary Details & Plots

Short description

The software will delete data when the cone is in transition from either clay to sand or vise-versa. To do this the software requires a range of  $I_c$  values over which the transition will be defined (typically somewhere between  $1.80 < I_c < 3.0$ ) and a rate of change of  $I_c$ . Transitions typically occur when the rate of change of  $I_c$  is fast (i.e.  $\Delta I_c$  is small).

The  $SBT_n$  plot below, displays in red the detected transition layers based on the parameters listed below the graphs.



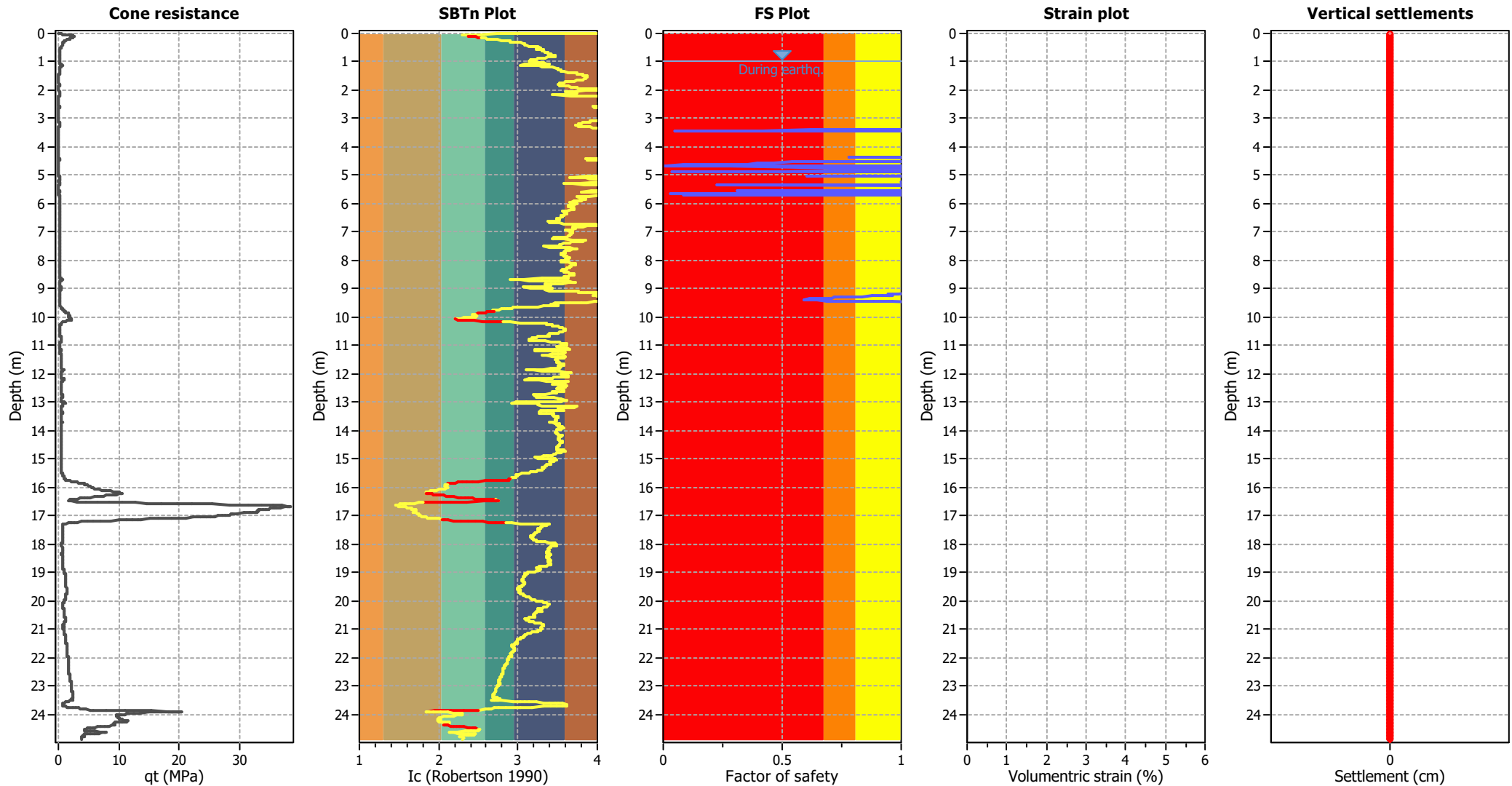
Transition layer algorithm properties

$I_c$  minimum check value: 1.70  
 $I_c$  maximum check value: 3.00  
 $I_c$  change ratio value: 0.0100  
Minimum number of points in layer: 4

General statistics

Total points in CPT file: 2490  
Total points excluded: 118  
Exclusion percentage: 4.74%  
Number of layers detected: 9

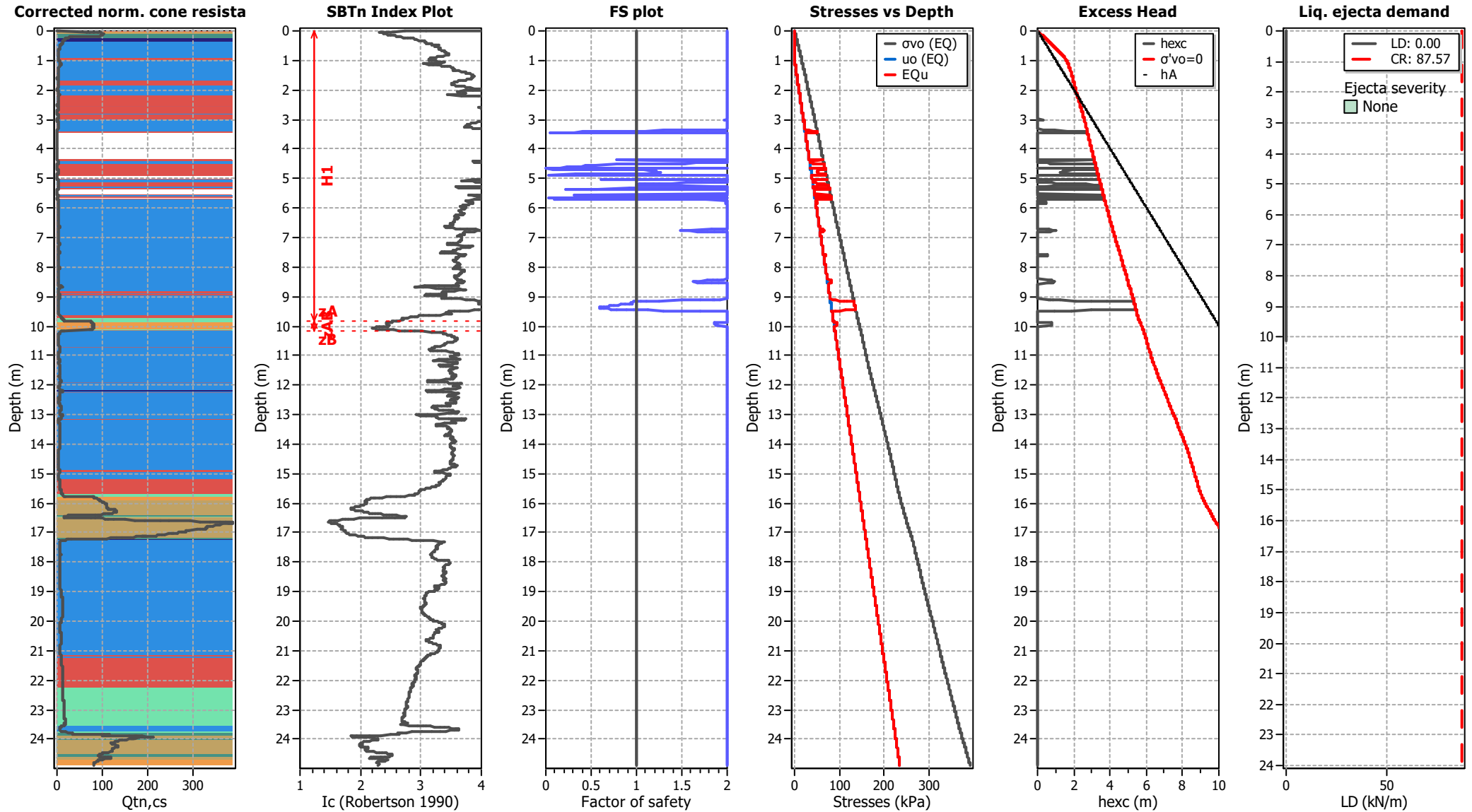
Estimation of post-earthquake settlements



Abbreviations

- q<sub>t</sub>: Total cone resistance (cone resistance q<sub>c</sub> corrected for pore water effects)
- I<sub>c</sub>: Soil Behaviour Type Index
- FS: Calculated Factor of Safety against liquefaction
- Volumetric strain: Post-liquefaction volumetric strain

## Ejecta Severity Estimation



## LIQUEFACTION ANALYSIS REPORT

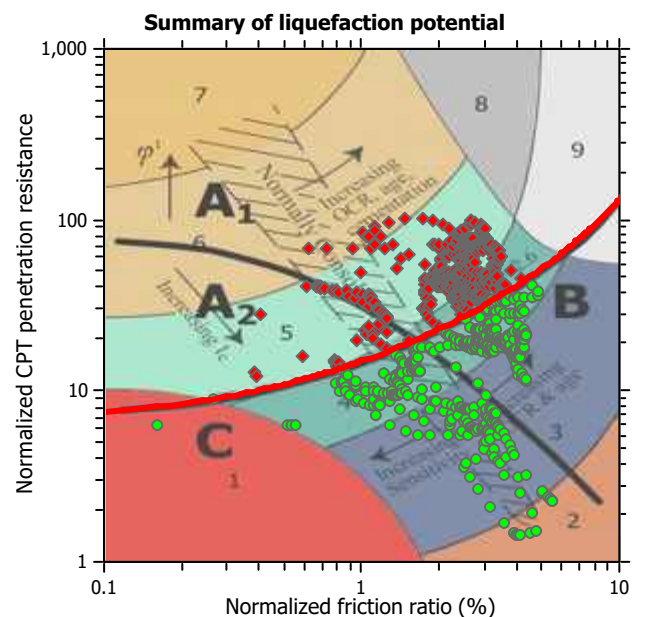
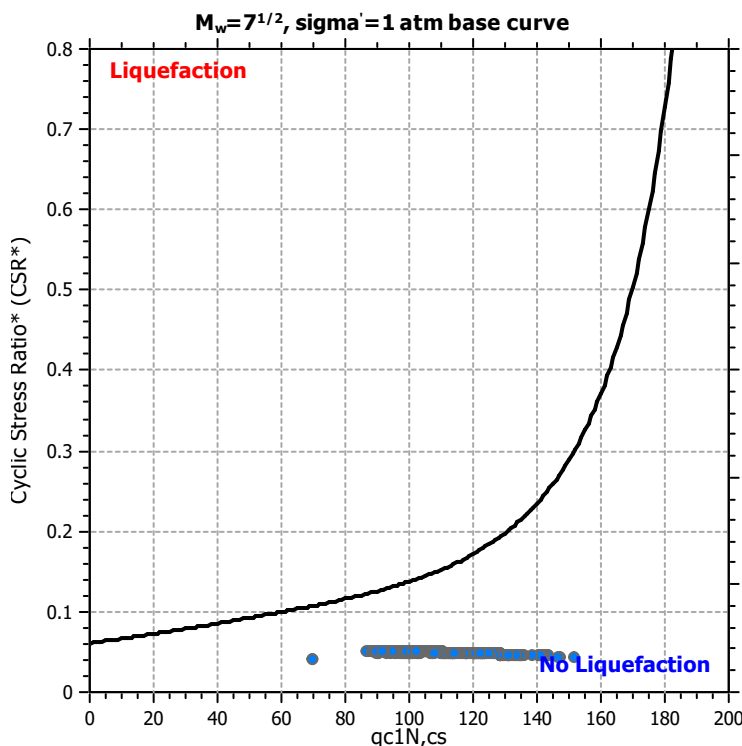
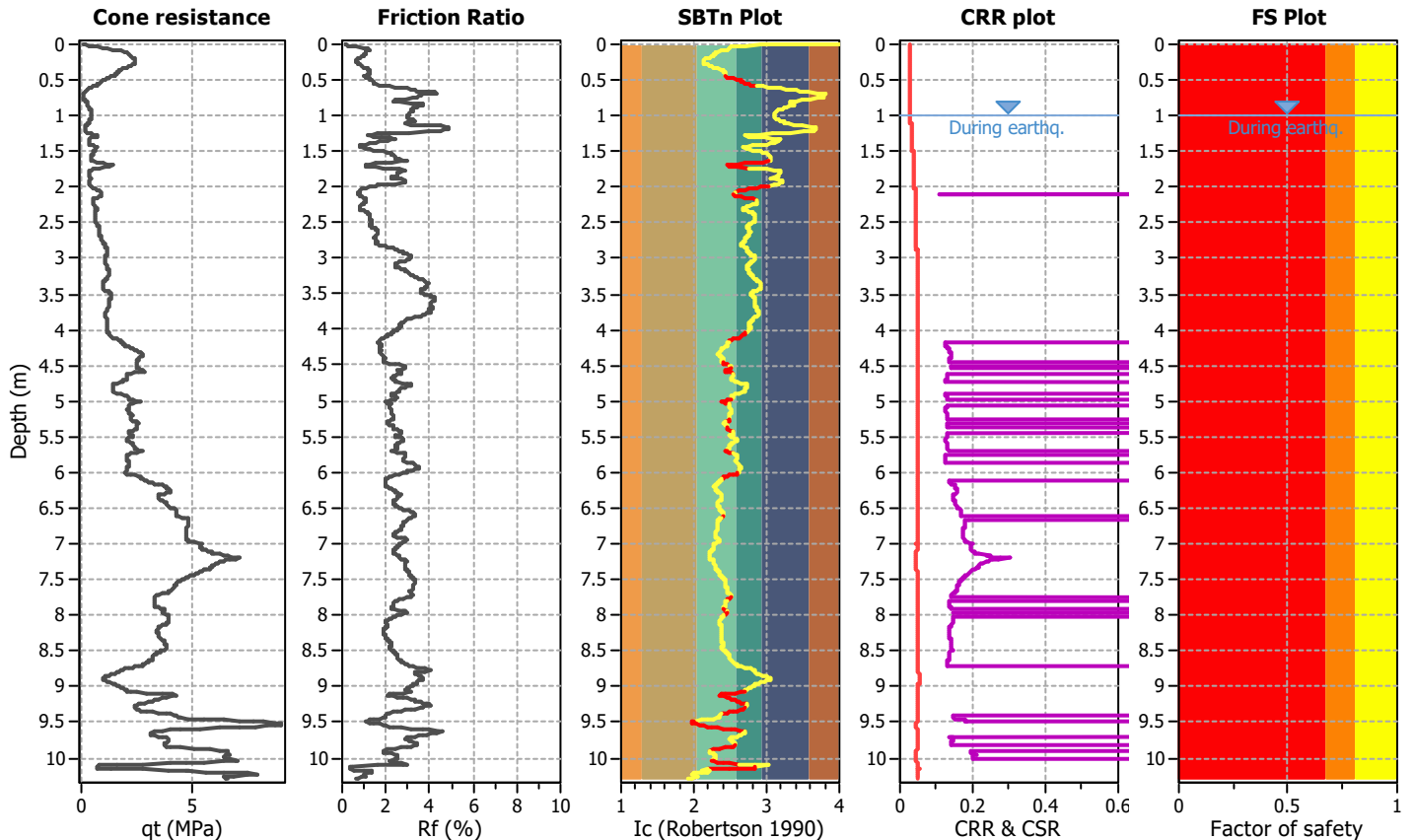
**Project title :**

**Location :**

**CPT file : CPT20**

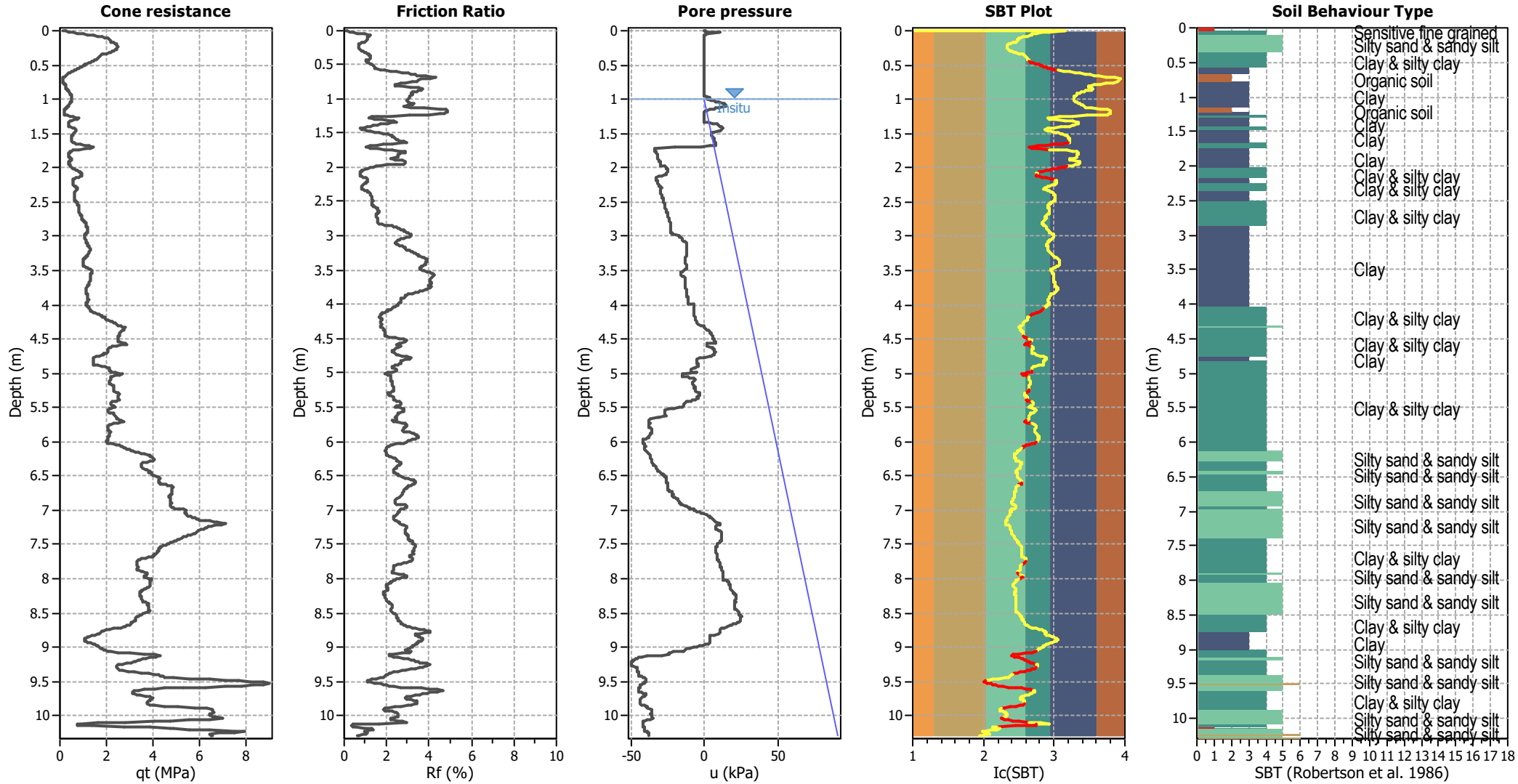
### Input parameters and analysis data

|                              |                   |                           |              |                         |     |                      |              |
|------------------------------|-------------------|---------------------------|--------------|-------------------------|-----|----------------------|--------------|
| Analysis method:             | B&I (2014)        | G.W.T. (in-situ):         | 1.00 m       | Use fill:               | No  | Clay like behavior   |              |
| Fines correction method:     | B&I (2014)        | G.W.T. (earthq.):         | 1.00 m       | Fill height:            | N/A | applied:             | Sands only   |
| Points to test:              | Based on Ic value | Average results interval: | 3            | Fill weight:            | N/A | Limit depth applied: | Yes          |
| Earthquake magnitude $M_w$ : | 6.50              | Ic cut-off value:         | 2.60         | Trans. detect. applied: | Yes | Limit depth:         | 10.00 m      |
| Peak ground acceleration:    | 0.05              | Unit weight calculation:  | Based on SBT | $K_\sigma$ applied:     | Yes | MSF method:          | Method based |



Zone A<sub>1</sub>: Cyclic liquefaction likely depending on size and duration of cyclic loading  
Zone A<sub>2</sub>: Cyclic liquefaction and strength loss likely depending on loading and ground geometry  
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening  
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots

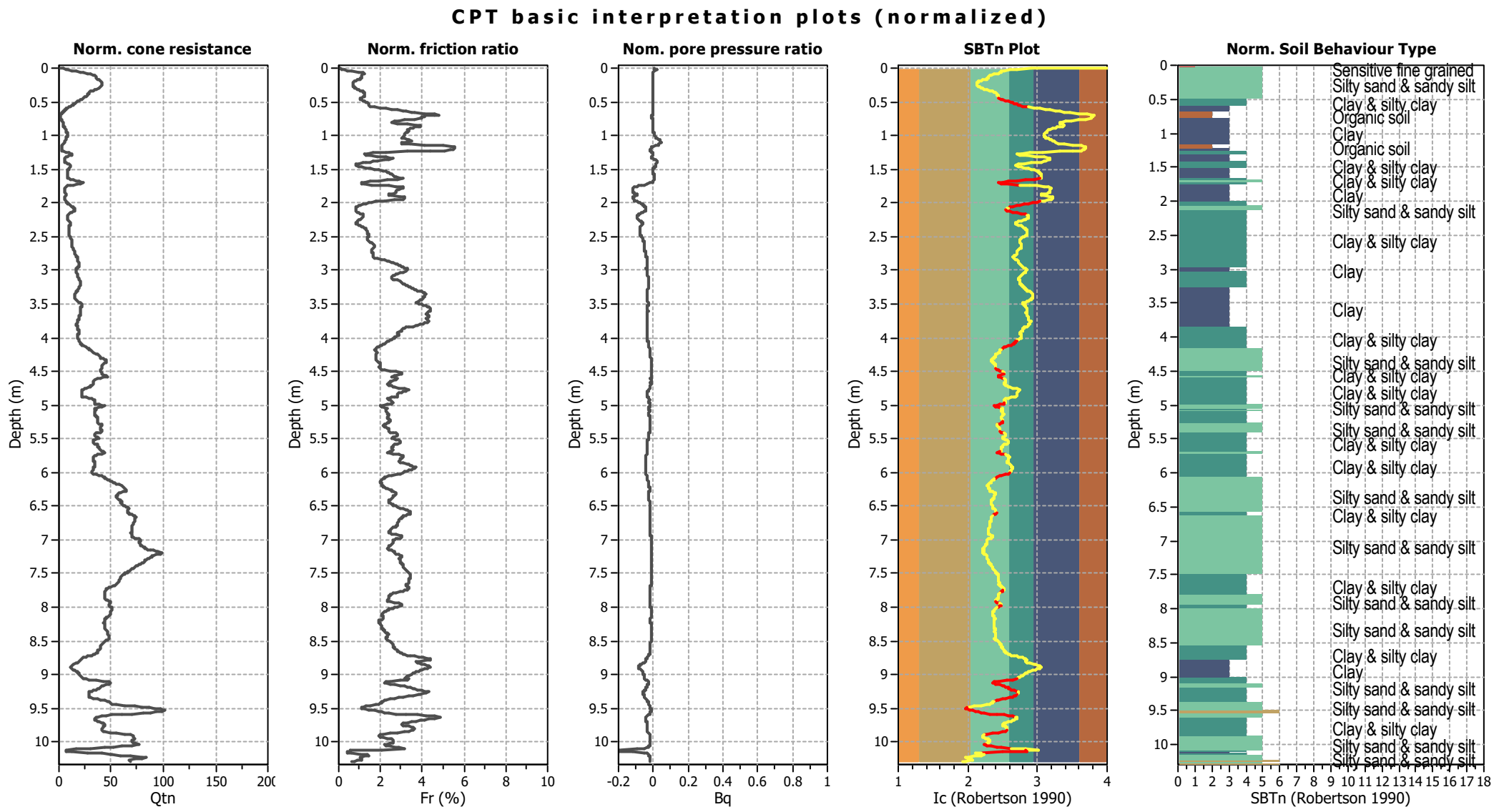


Input parameters and analysis data

|                                       |                   |                           |              |                             |            |
|---------------------------------------|-------------------|---------------------------|--------------|-----------------------------|------------|
| 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: | Yes        |
| 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> : | 6.50              | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration:             | 0.05              | 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 |



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: | Yes        |
| 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> : | 6.50              | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration:             | 0.05              | Use fill:                 | No           | Limit depth applied:        | Yes        |
| Depth to water table (insitu):        | 1.00 m            | Fill height:              | N/A          | Limit depth:                | 10.00 m    |

SBTn legend

1. Sensitive fine grained

2. Organic material

3. Clay to silty clay

4. Clayey silt to silty

5. Silty sand to sandy silt

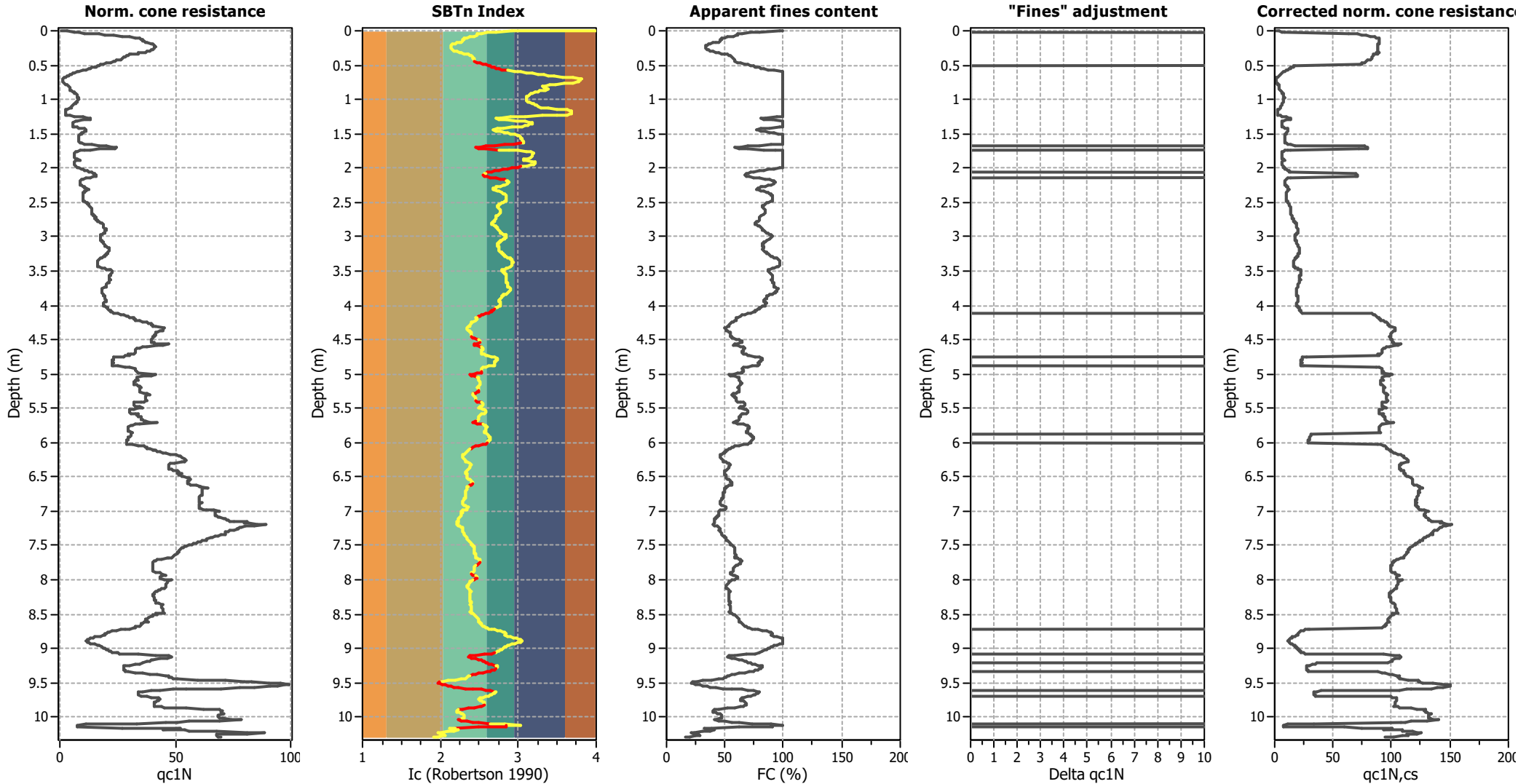
6. Clean sand to silty sand

7. Gravely sand to sand

8. Very stiff sand to

9. Very stiff fine grained

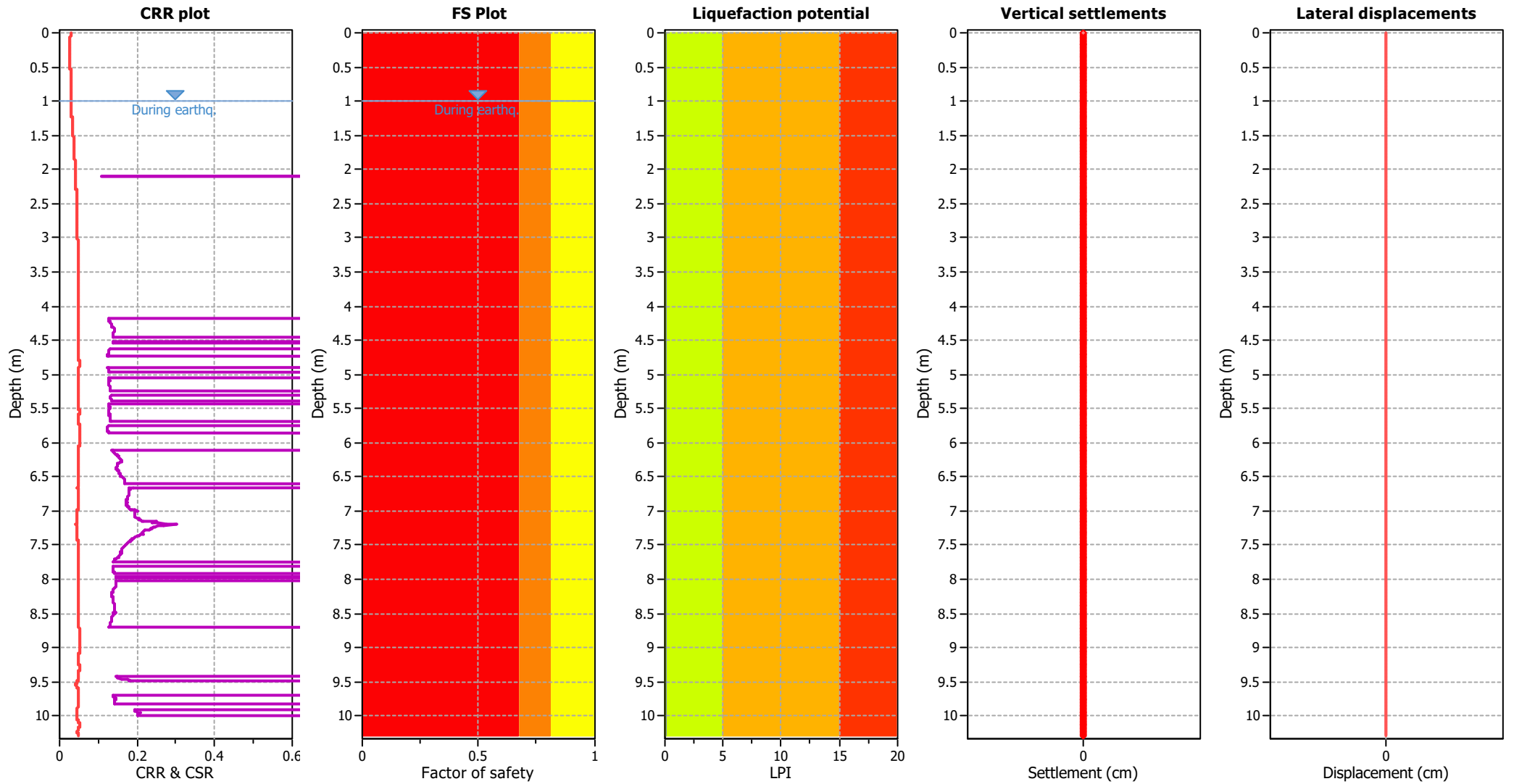
Liquefaction analysis overall plots (intermediate results)



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: | Yes        |
| Points to test:                       | Based on Ic value | Ic cut-off value:         | 2.60         | K <sub>o</sub> applied:     | Yes        |
| Earthquake magnitude M <sub>w</sub> : | 6.50              | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration:             | 0.05              | Use fill:                 | No           | Limit depth applied:        | Yes        |
| Depth to water table (insitu):        | 1.00 m            | Fill height:              | N/A          | Limit depth:                | 10.00 m    |

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: | Yes        |
| 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> : | 6.50              | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration:             | 0.05              | Use fill:                 | No           | Limit depth applied:        | Yes        |
| Depth to water table (insitu):        | 1.00 m            | Fill height:              | N/A          | Limit depth:                | 10.00 m    |

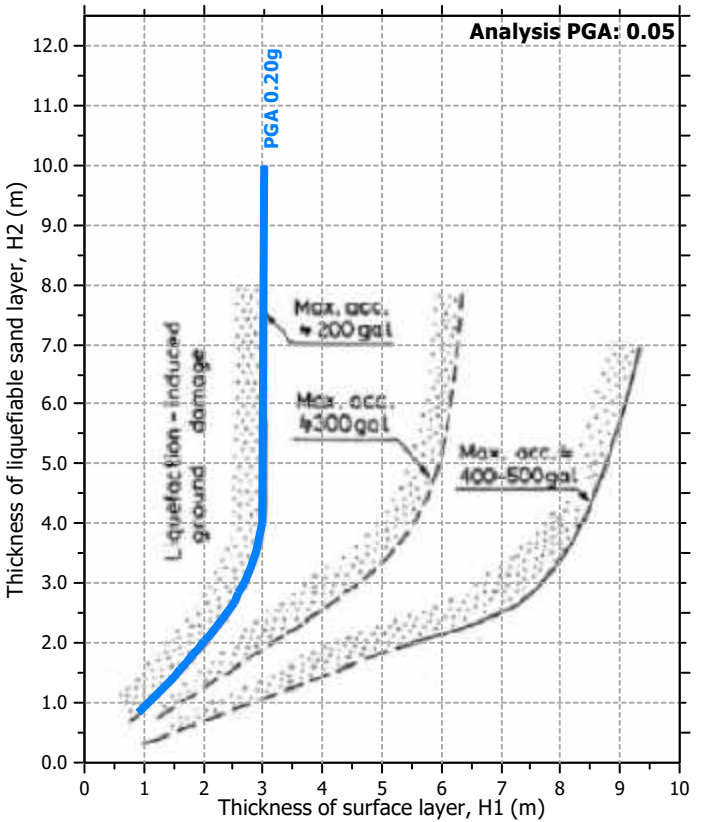
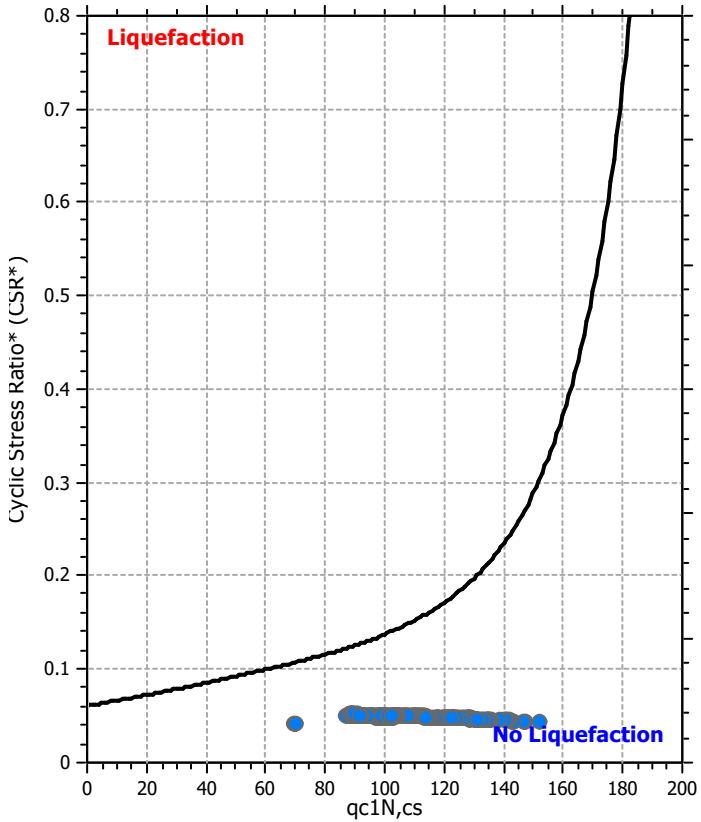
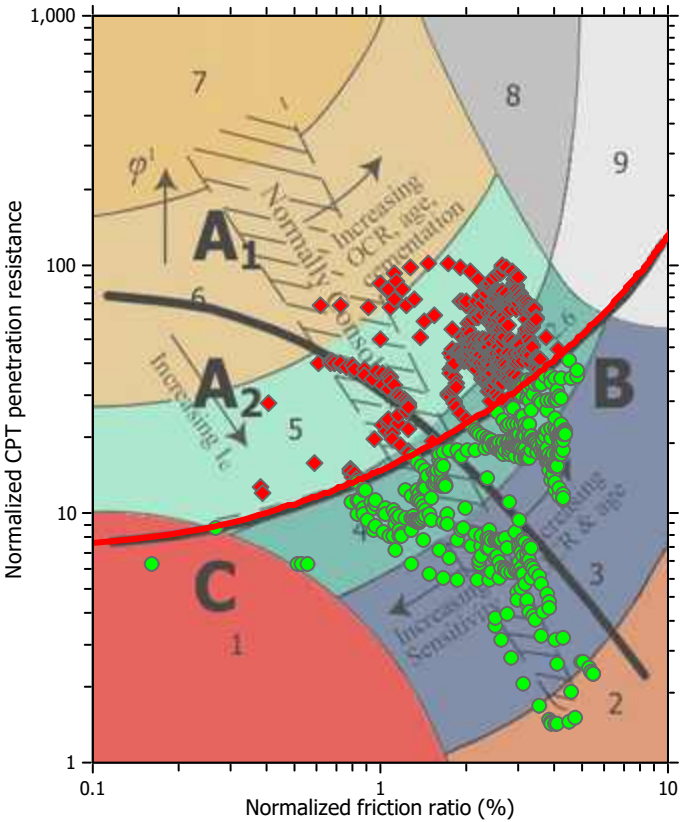
F.S. color scheme

- 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

LPI color scheme

- Very high risk
- High risk
- Low risk

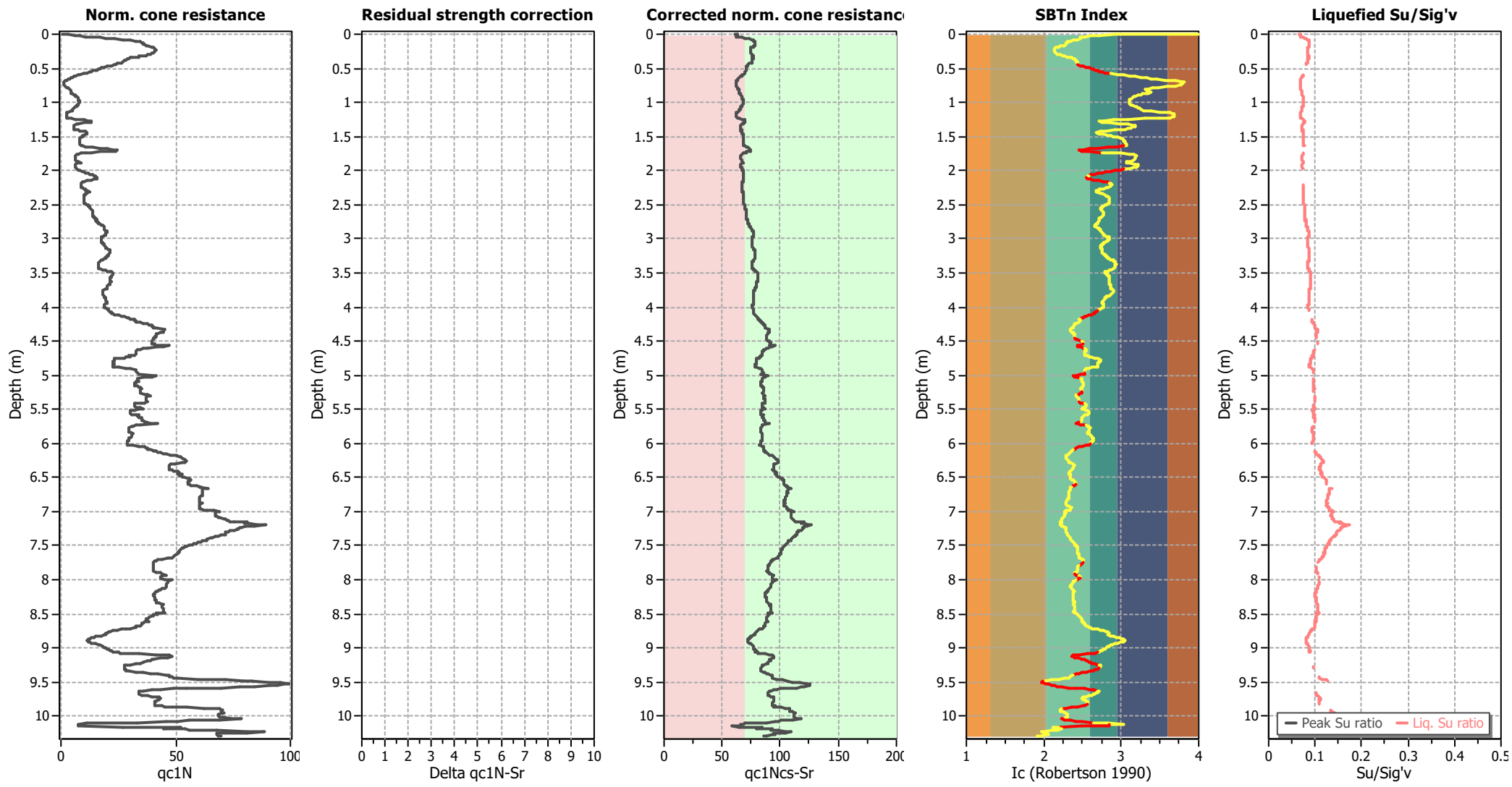
Liquefaction analysis summary plots



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: | Yes        |
| Points to test:                | Based on Ic value | Ic cut-off value:         | 2.60         | $K_0$ applied:              | Yes        |
| Earthquake magnitude $M_w$ :   | 6.50              | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration:      | 0.05              | Use fill:                 | No           | Limit depth applied:        | Yes        |
| Depth to water table (insitu): | 1.00 m            | Fill height:              | N/A          | Limit depth:                | 10.00 m    |

Check for strength loss plots (Idriss & Boulanger (2008))



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: | Yes        |
| Points to test:                       | Based on Ic value | Ic cut-off value:         | 2.60         | K <sub>o</sub> applied:     | Yes        |
| Earthquake magnitude M <sub>w</sub> : | 6.50              | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration:             | 0.05              | Use fill:                 | No           | Limit depth applied:        | Yes        |
| Depth to water table (insitu):        | 1.00 m            | Fill height:              | N/A          | Limit depth:                | 10.00 m    |

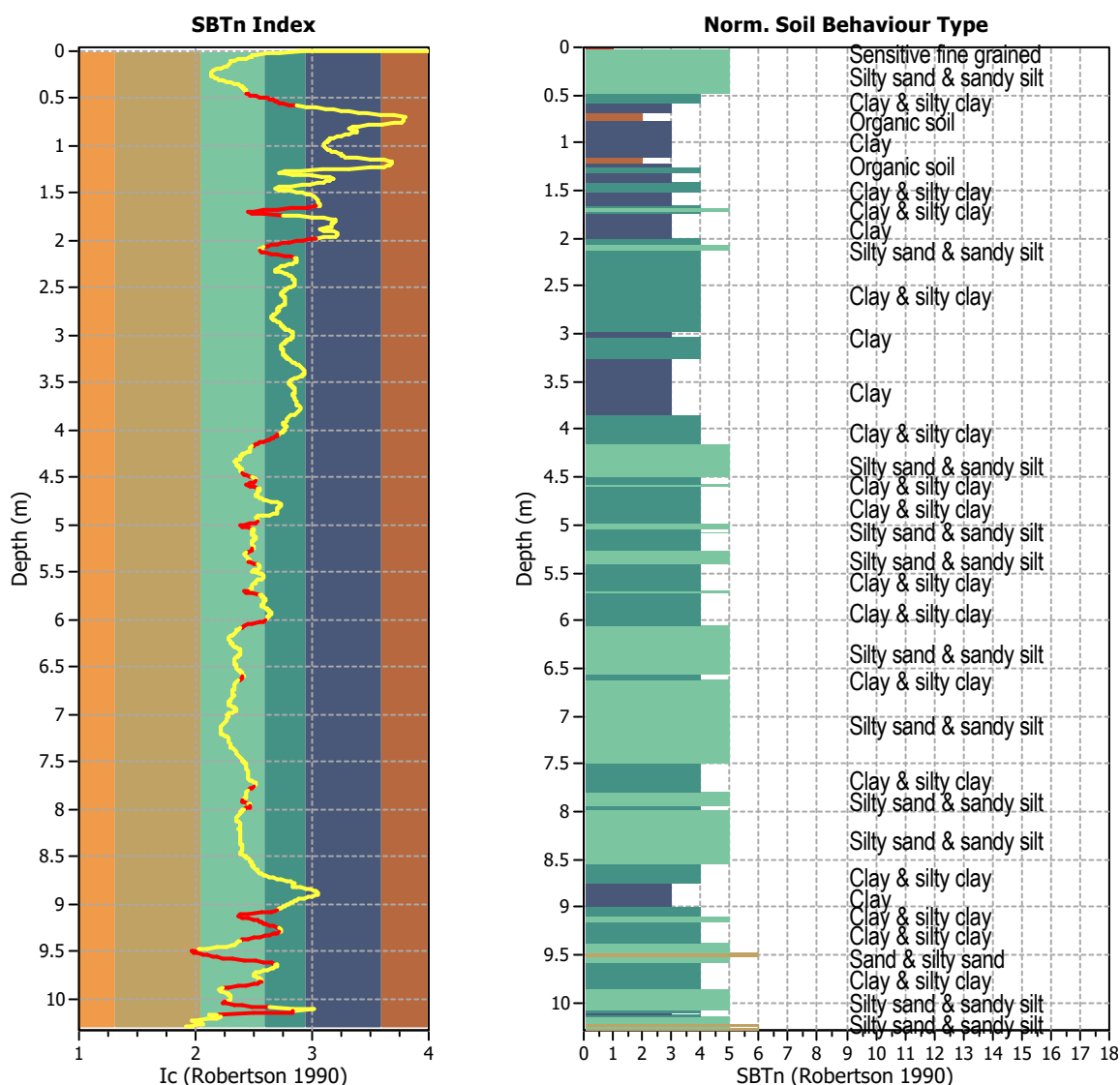
## TRANSITION LAYER DETECTION ALGORITHM REPORT

### Summary Details & Plots

#### Short description

The software will delete data when the cone is in transition from either clay to sand or vice-versa. To do this the software requires a range of  $I_c$  values over which the transition will be defined (typically somewhere between  $1.80 < I_c < 3.0$ ) and a rate of change of  $I_c$ . Transitions typically occur when the rate of change of  $I_c$  is fast (i.e.  $\Delta I_c$  is small).

The  $SBT_n$  plot below, displays in red the detected transition layers based on the parameters listed below the graphs.

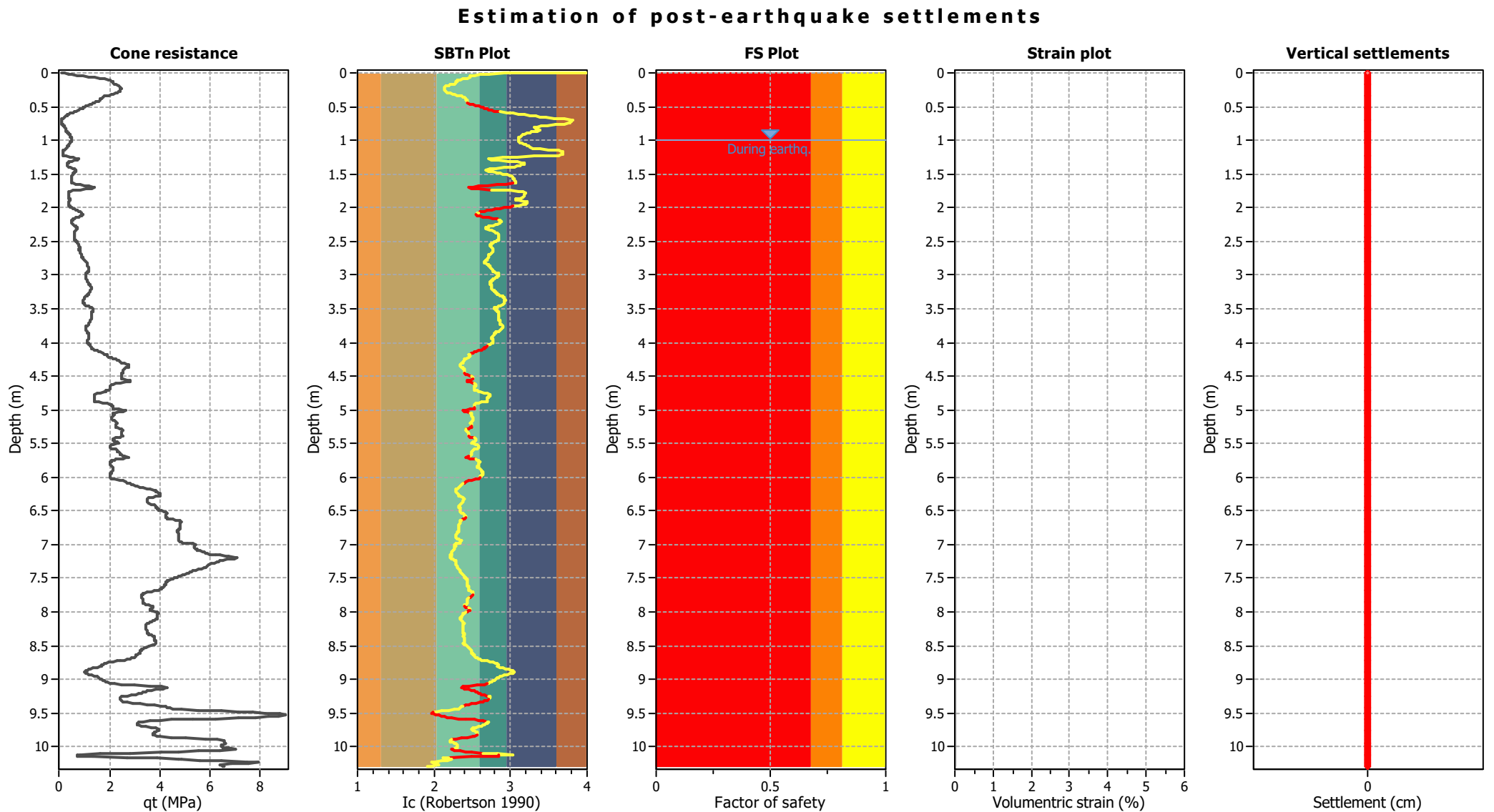


#### Transition layer algorithm properties

$I_c$  minimum check value: 1.70  
 $I_c$  maximum check value: 3.00  
 $I_c$  change ratio value: 0.0100  
 Minimum number of points in layer: 4

#### General statistics

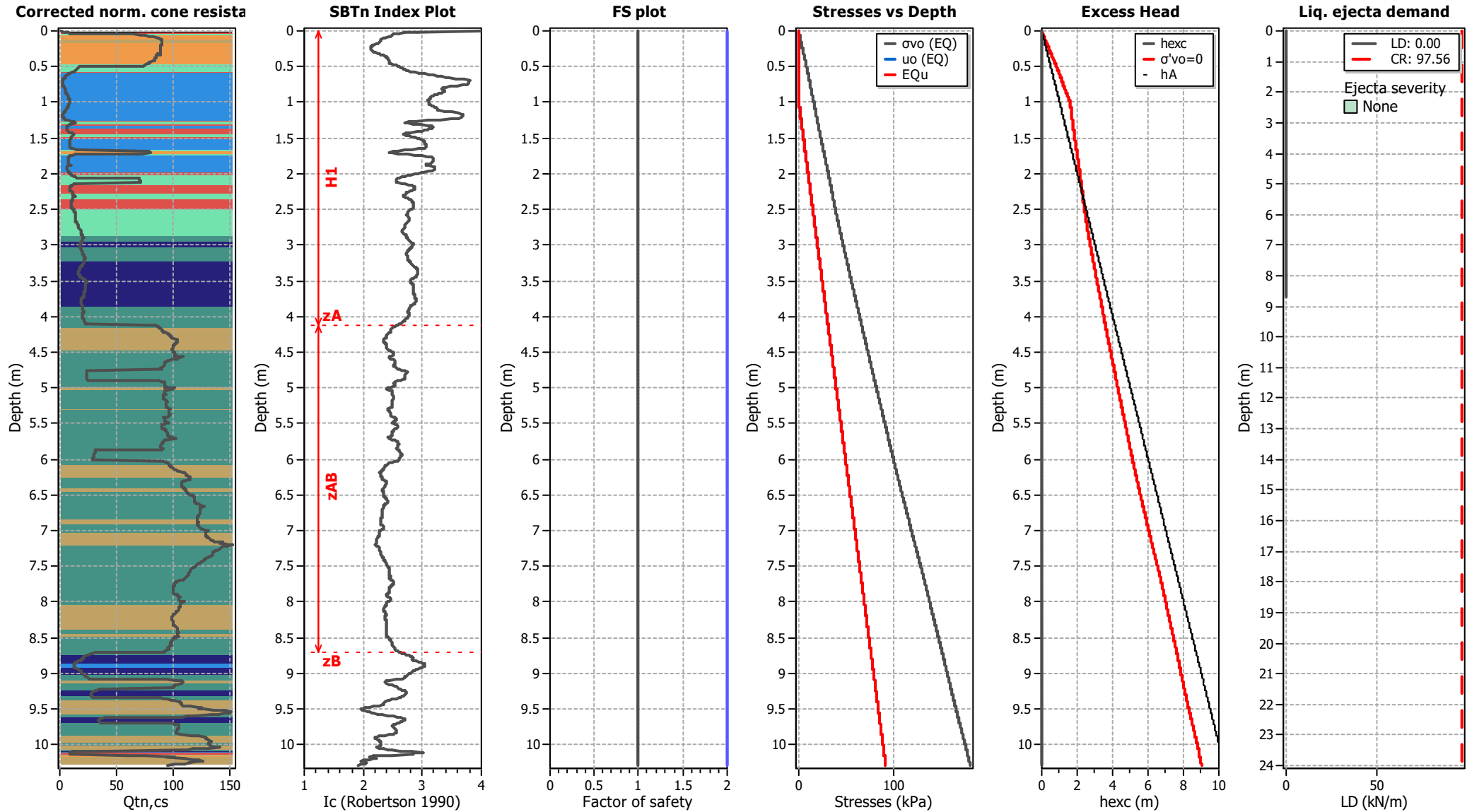
Total points in CPT file: 1030  
 Total points excluded: 190  
 Exclusion percentage: 18.45%  
 Number of layers detected: 26



**Abbreviations**

- $q_c$ : Total cone resistance (cone resistance  $q_c$  corrected for pore water effects)
- $I_c$ : Soil Behaviour Type Index
- FS: Calculated Factor of Safety against liquefaction
- Volumetric strain: Post-liquefaction volumetric strain

## Ejecta Severity Estimation



## LIQUEFACTION ANALYSIS REPORT

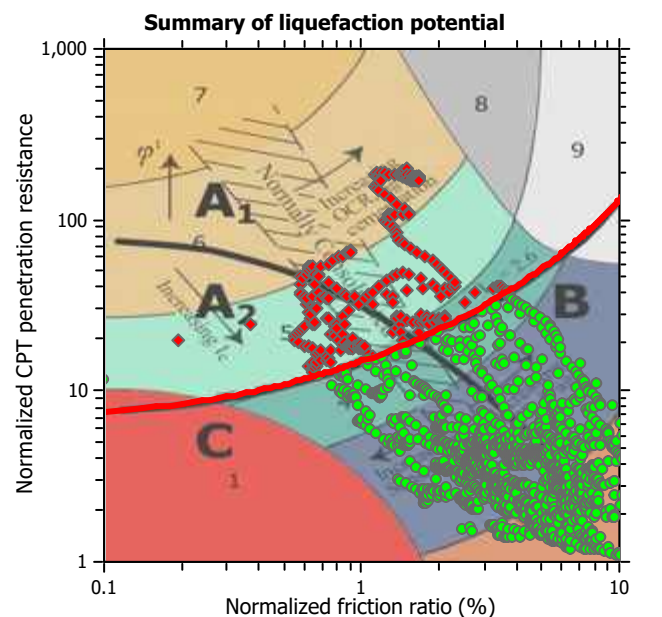
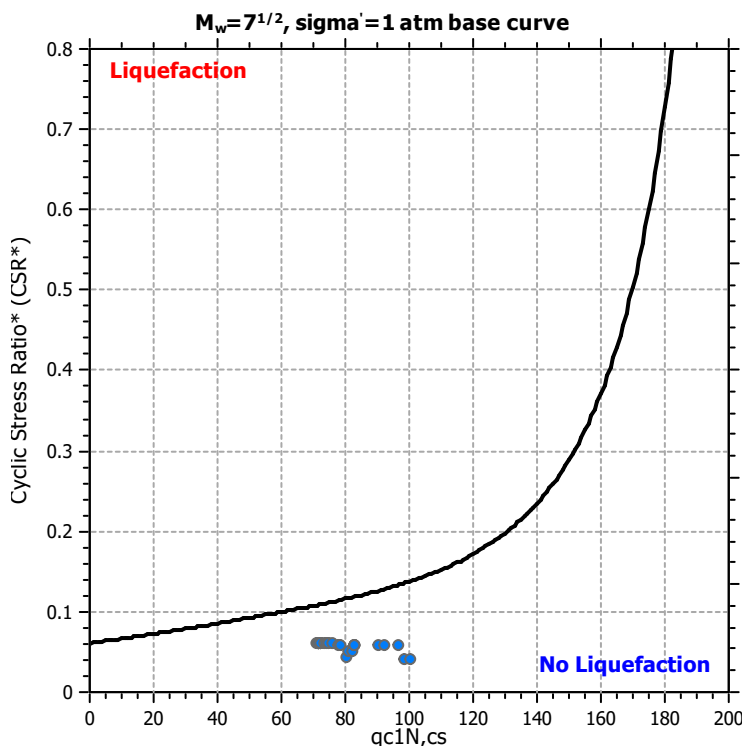
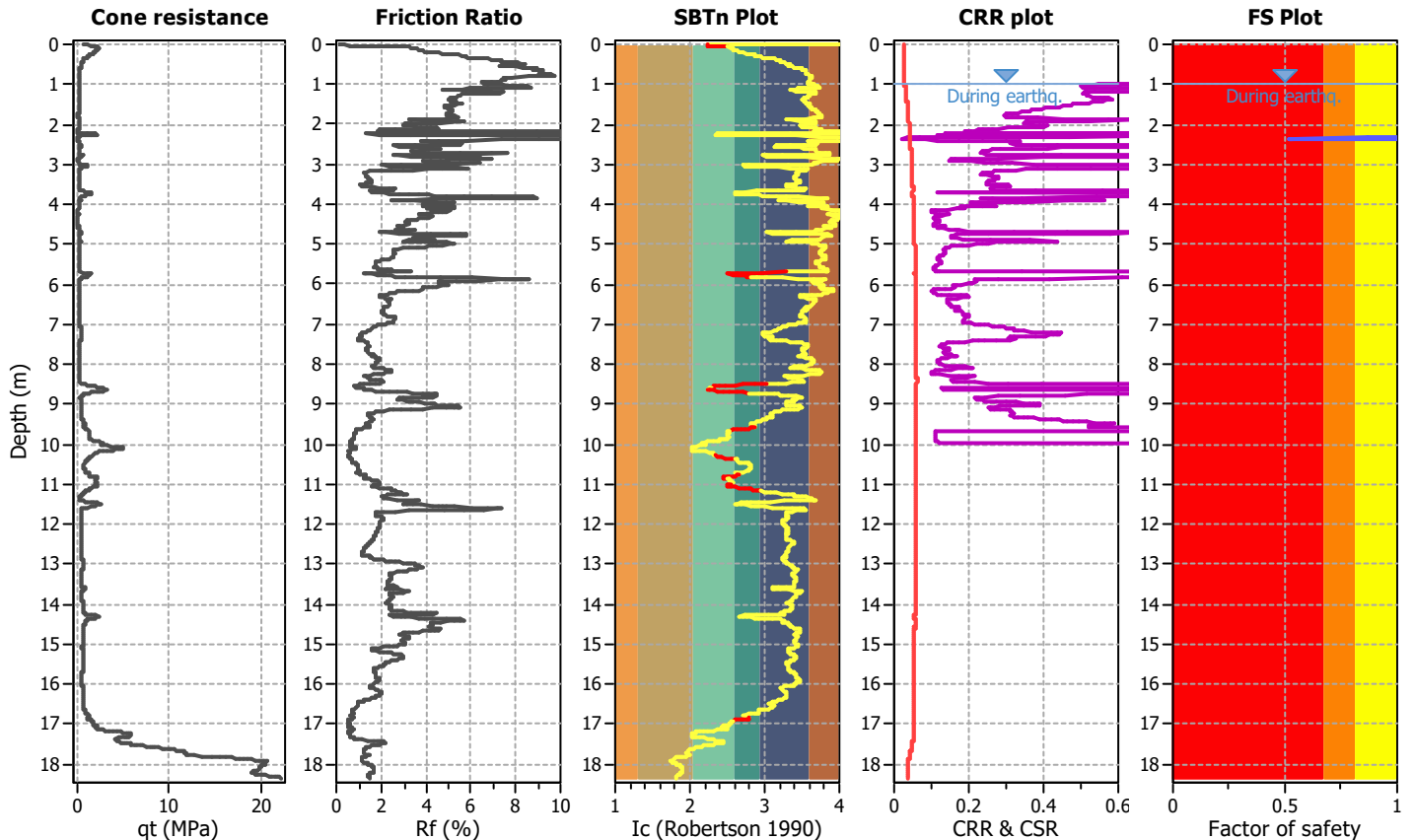
**Project title :**

**Location :**

**CPT file : CPT21A**

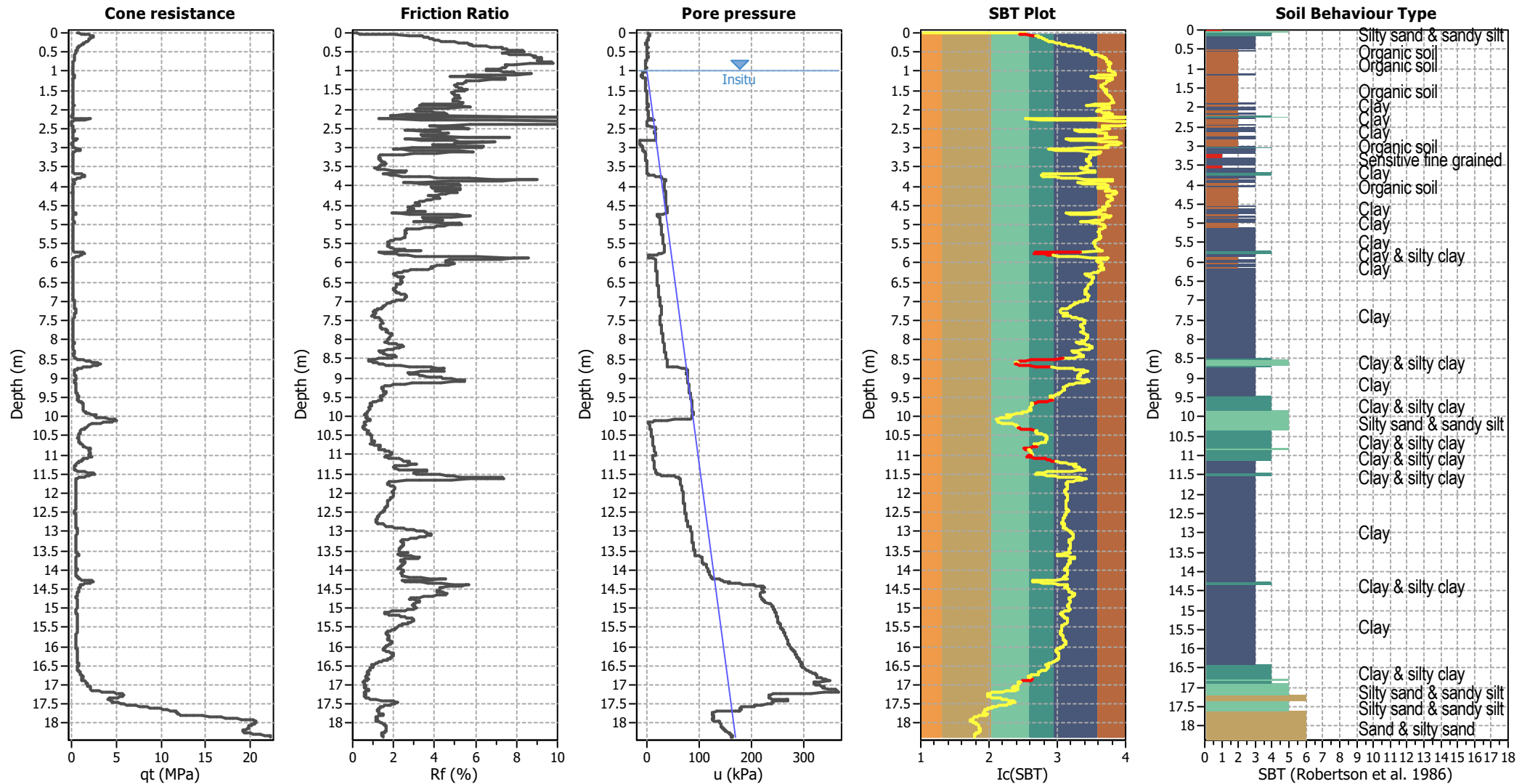
### Input parameters and analysis data

|                              |                   |                           |              |                         |     |                             |              |
|------------------------------|-------------------|---------------------------|--------------|-------------------------|-----|-----------------------------|--------------|
| Analysis method:             | B&I (2014)        | G.W.T. (in-situ):         | 1.00 m       | Use fill:               | No  | Clay like behavior applied: | Sand & Clay  |
| Fines correction method:     | B&I (2014)        | G.W.T. (earthq.):         | 1.00 m       | Fill height:            | N/A | Limit depth applied:        | Yes          |
| Points to test:              | Based on Ic value | Average results interval: | 3            | Fill weight:            | N/A | Limit depth:                | 10.00 m      |
| Earthquake magnitude $M_w$ : | 6.50              | Ic cut-off value:         | 2.60         | Trans. detect. applied: | Yes | MSF method:                 | Method based |
| Peak ground acceleration:    | 0.05              | Unit weight calculation:  | Based on SBT | $K_\sigma$ applied:     | Yes |                             |              |



Zone A<sub>1</sub>: Cyclic liquefaction likely depending on size and duration of cyclic loading  
Zone A<sub>2</sub>: Cyclic liquefaction and strength loss likely depending on loading and ground geometry  
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening  
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

## CPT basic interpretation plots



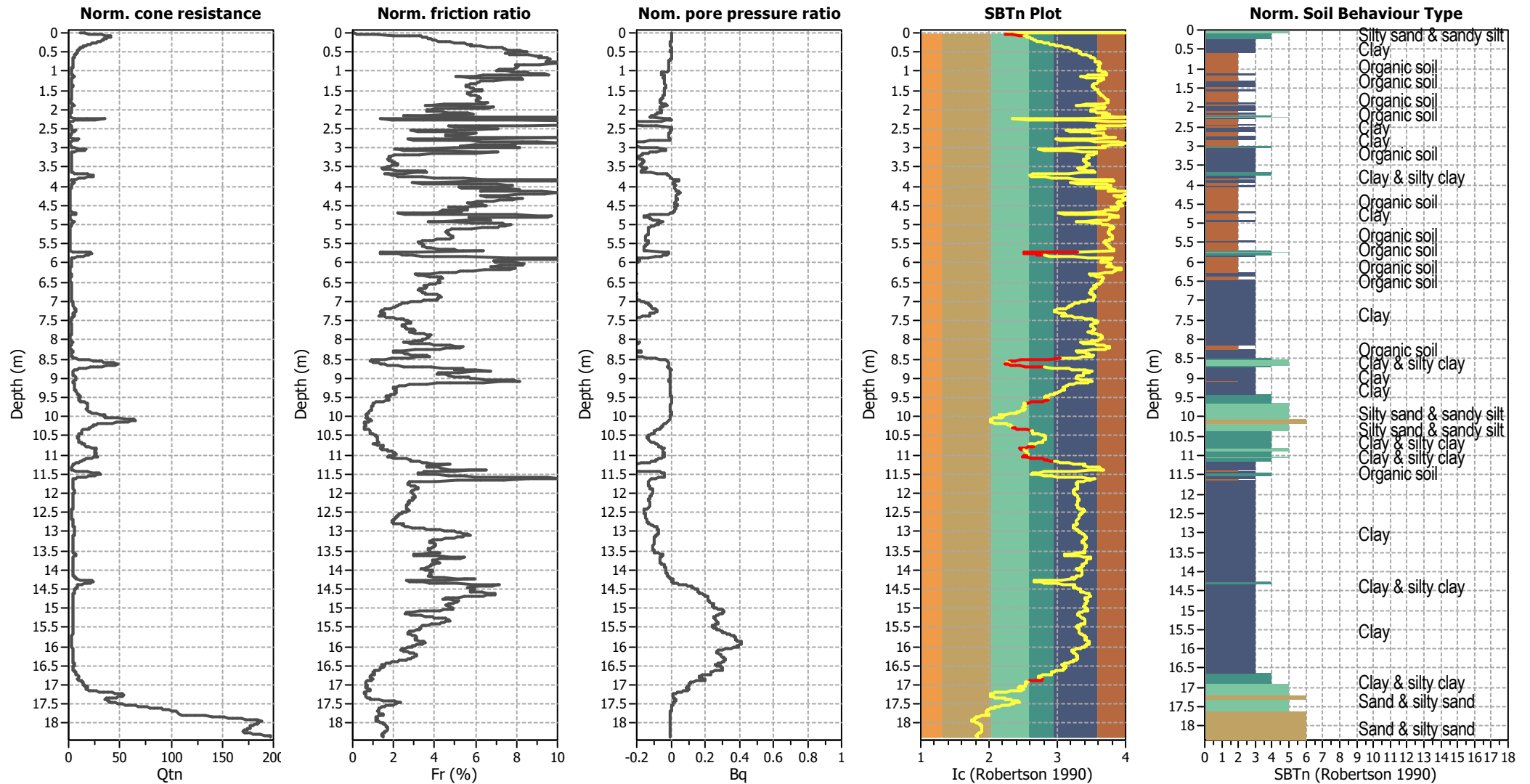
## Input parameters and analysis data

|                                |                      |                           |              |                             |             |
|--------------------------------|----------------------|---------------------------|--------------|-----------------------------|-------------|
| 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: | Yes         |
| Points to test:                | Based on $I_c$ value | $I_c$ cut-off value:      | 2.60         | $K_0$ applied:              | Yes         |
| Earthquake magnitude $M_w$ :   | 6.50                 | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sand & Clay |
| Peak ground acceleration:      | 0.05                 | 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 (normalized)



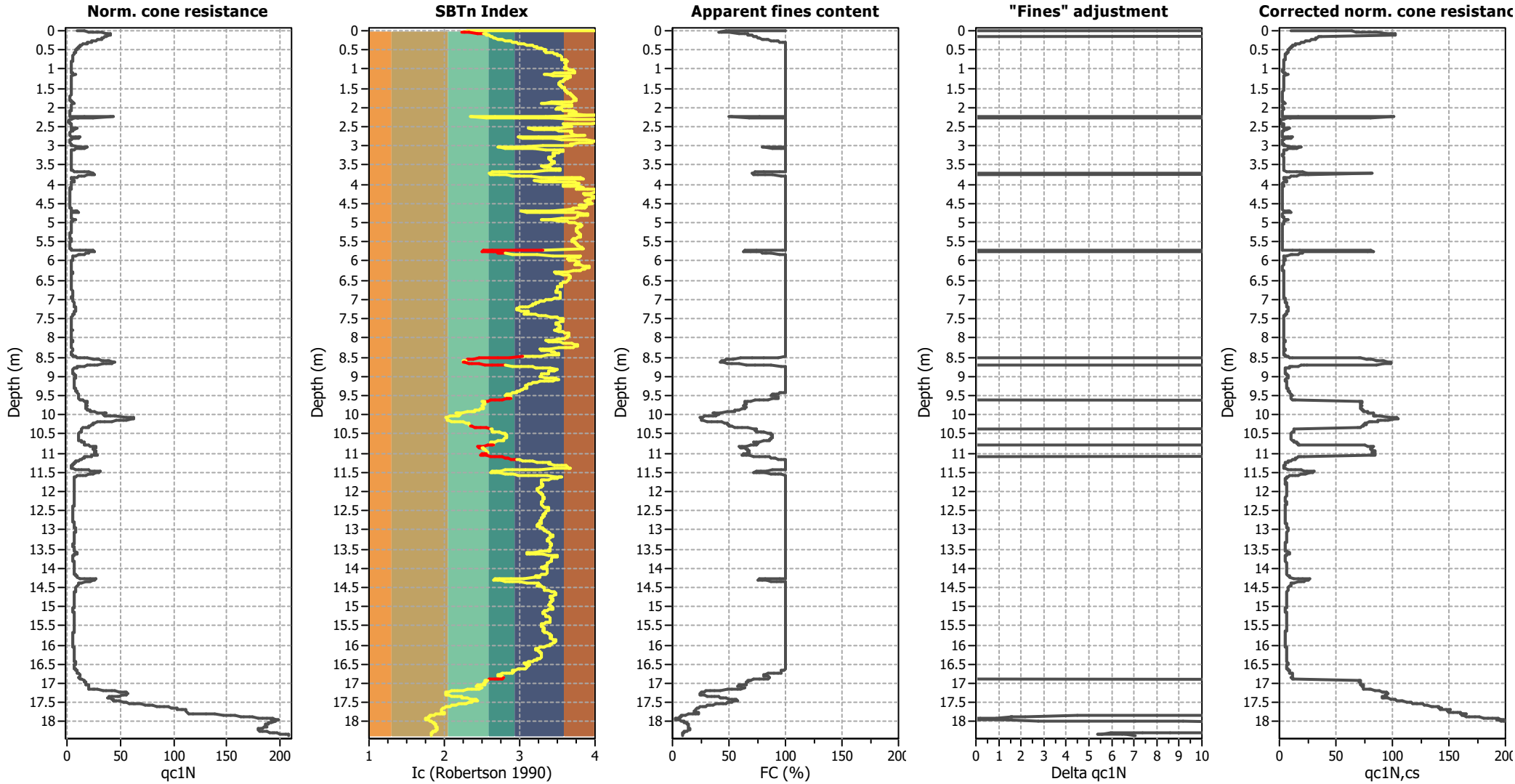
#### Input parameters and analysis data

|                                |                      |                           |              |                             |             |
|--------------------------------|----------------------|---------------------------|--------------|-----------------------------|-------------|
| 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: | Yes         |
| Points to test:                | Based on $I_c$ value | $I_c$ cut-off value:      | 2.60         | $K_o$ applied:              | Yes         |
| Earthquake magnitude $M_w$ :   | 6.50                 | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sand & Clay |
| Peak ground acceleration:      | 0.05                 | Use fill:                 | No           | Limit depth applied:        | Yes         |
| Depth to water table (insitu): | 1.00 m               | Fill height:              | N/A          | Limit depth:                | 10.00 m     |

#### SBTn legend

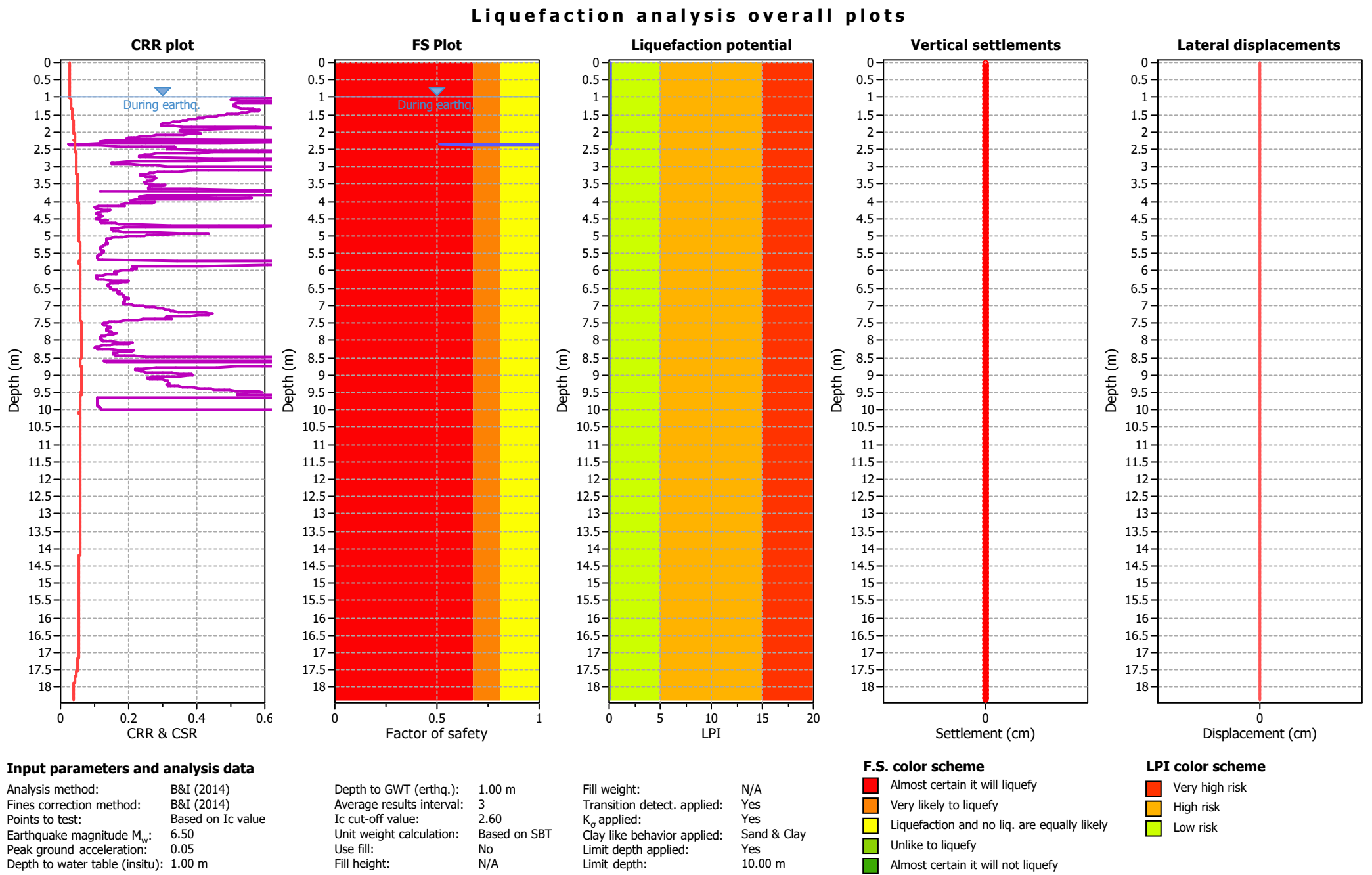
|                           |                             |                            |
|---------------------------|-----------------------------|----------------------------|
| 1. Sensitive fine grained | 4. Clayey silt to silty     | 7. Gravely sand to sand    |
| 2. Organic material       | 5. Silty 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 |

Liquefaction analysis overall plots (intermediate results)

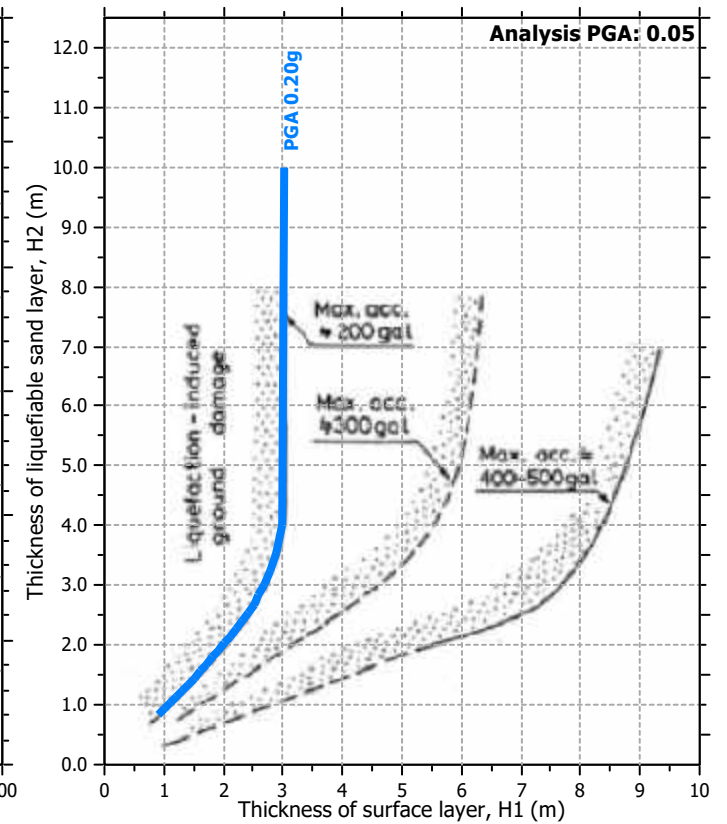
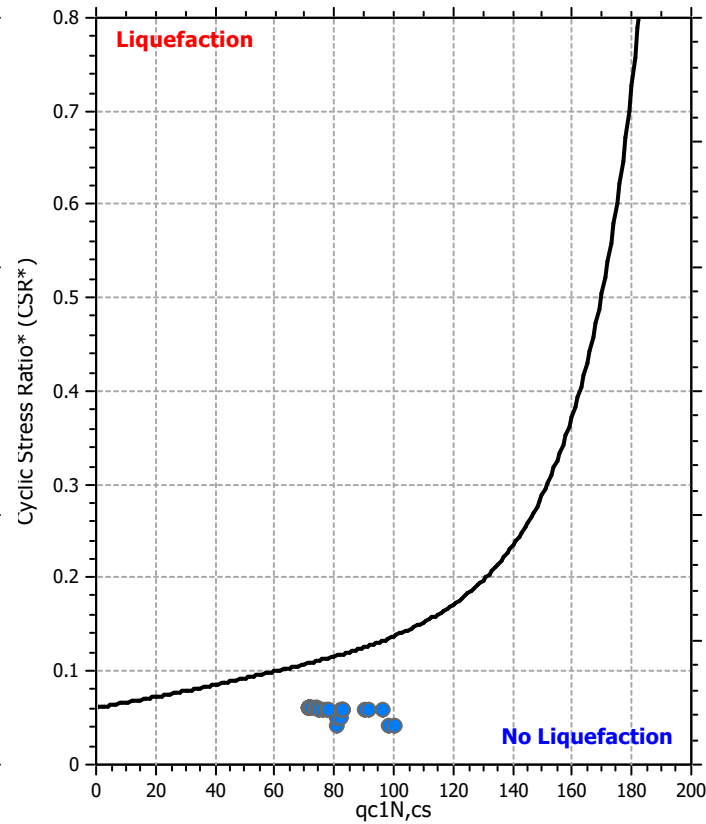
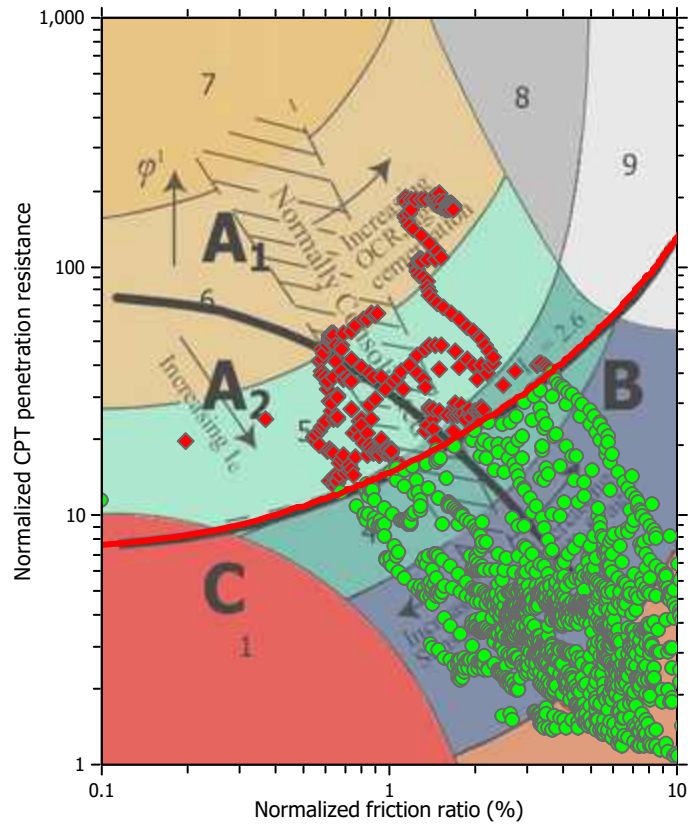


Input parameters and analysis data

|                                       |                   |                           |              |                             |             |
|---------------------------------------|-------------------|---------------------------|--------------|-----------------------------|-------------|
| 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: | Yes         |
| 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> : | 6.50              | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sand & Clay |
| Peak ground acceleration:             | 0.05              | Use fill:                 | No           | Limit depth applied:        | Yes         |
| Depth to water table (insitu):        | 1.00 m            | Fill height:              | N/A          | Limit depth:                | 10.00 m     |



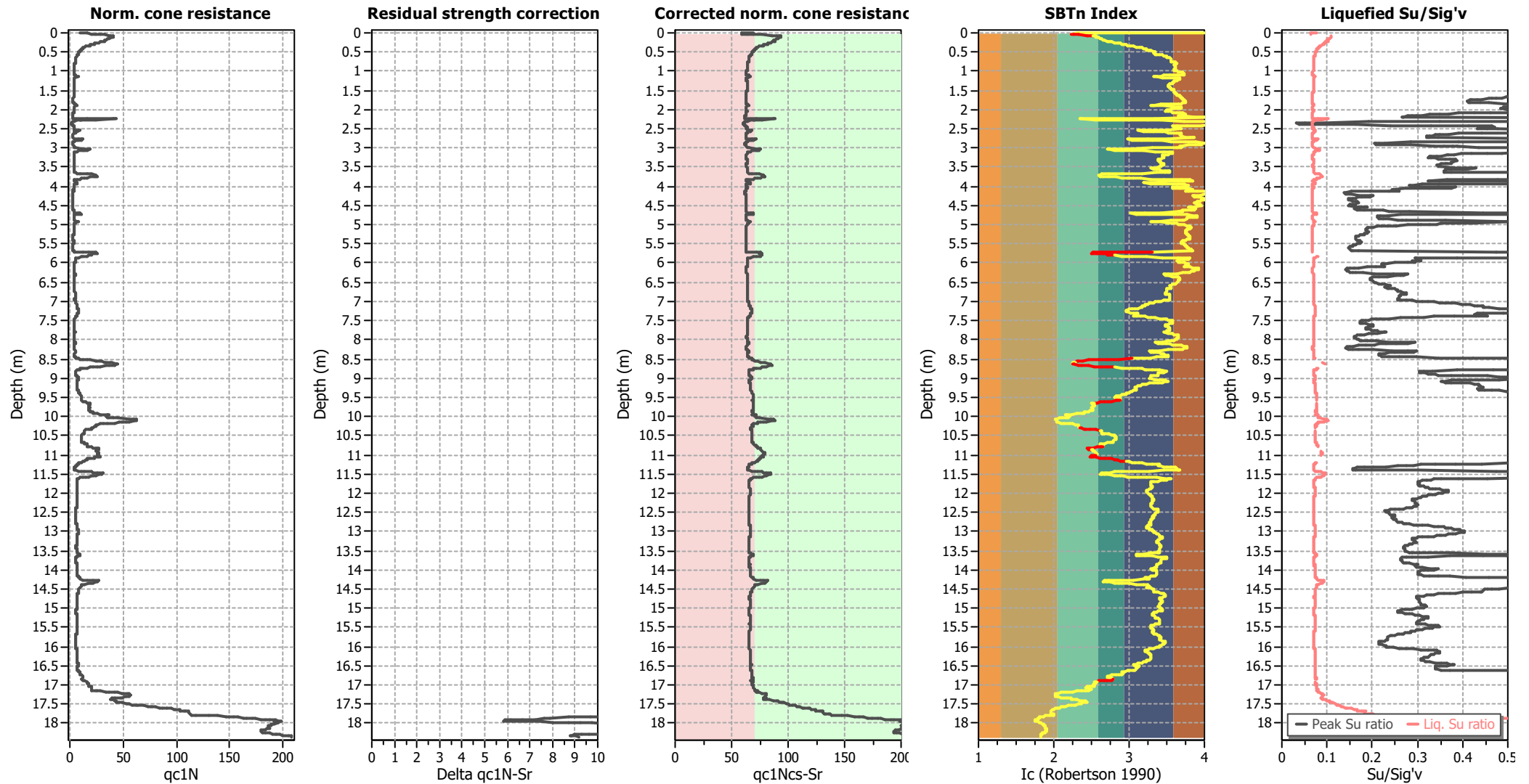
## Liquefaction analysis summary plots



### 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: | Yes         |
| 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> : | 6.50              | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sand & Clay |
| Peak ground acceleration:             | 0.05              | Use fill:                 | No           | Limit depth applied:        | Yes         |
| Depth to water table (insitu):        | 1.00 m            | Fill height:              | N/A          | Limit depth:                | 10.00 m     |

## Check for strength loss plots (Idriss & Boulanger (2008))



### 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: | Yes         |
| Points to test:                | Based on Ic value | Ic cut-off value:         | 2.60         | $K_{\sigma}$ applied:       | Yes         |
| Earthquake magnitude $M_w$ :   | 6.50              | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sand & Clay |
| Peak ground acceleration:      | 0.05              | Use fill:                 | No           | Limit depth applied:        | Yes         |
| Depth to water table (insitu): | 1.00 m            | Fill height:              | N/A          | Limit depth:                | 10.00 m     |

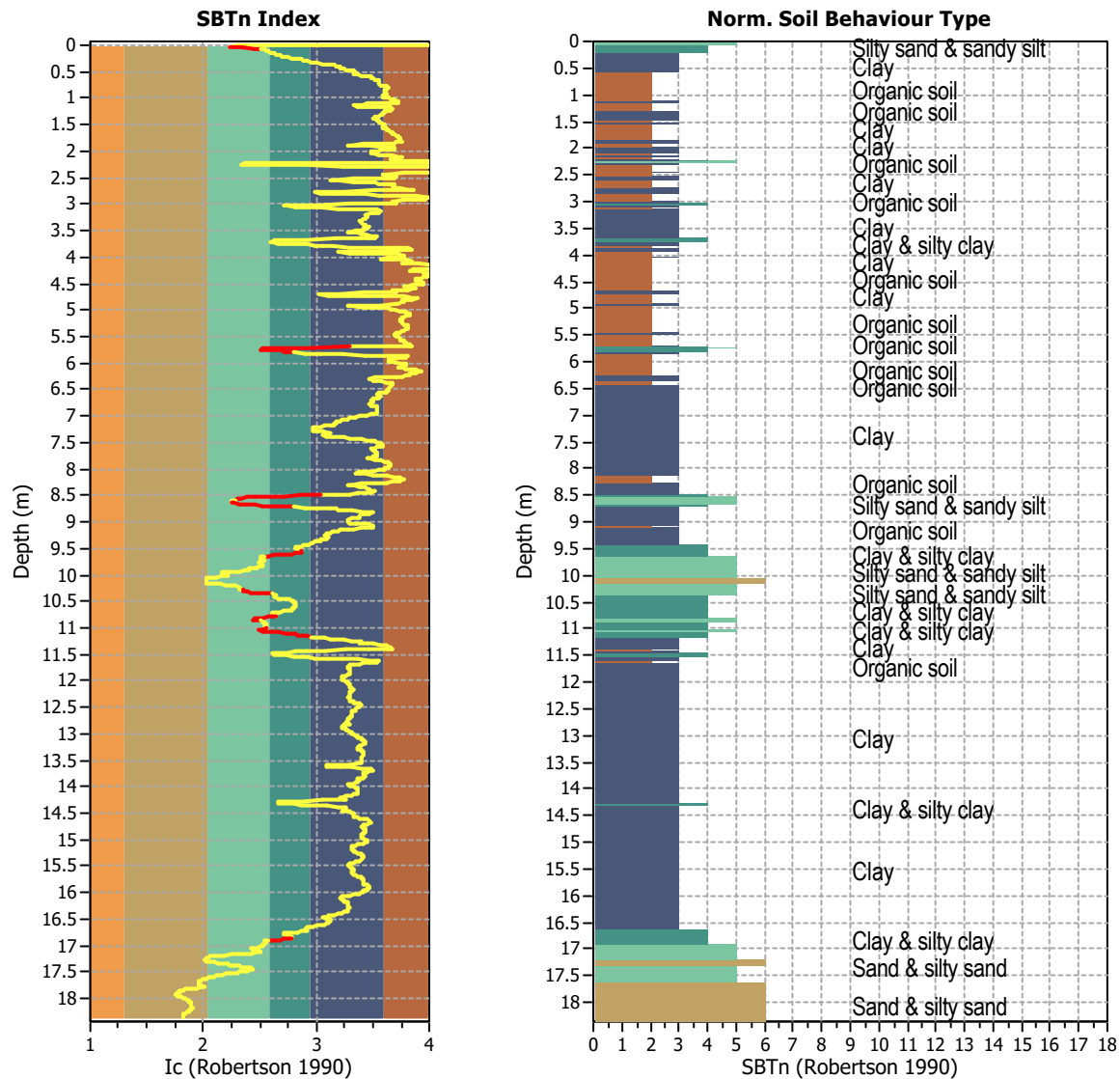
TRANSITION LAYER DETECTION ALGORITHM REPORT

Summary Details & Plots

Short description

The software will delete data when the cone is in transition from either clay to sand or vice-versa. To do this the software requires a range of  $I_c$  values over which the transition will be defined (typically somewhere between  $1.80 < I_c < 3.0$ ) and a rate of change of  $I_c$ . Transitions typically occur when the rate of change of  $I_c$  is fast (i.e.  $\Delta I_c$  is small).

The  $SBT_n$  plot below, displays in red the detected transition layers based on the parameters listed below the graphs.

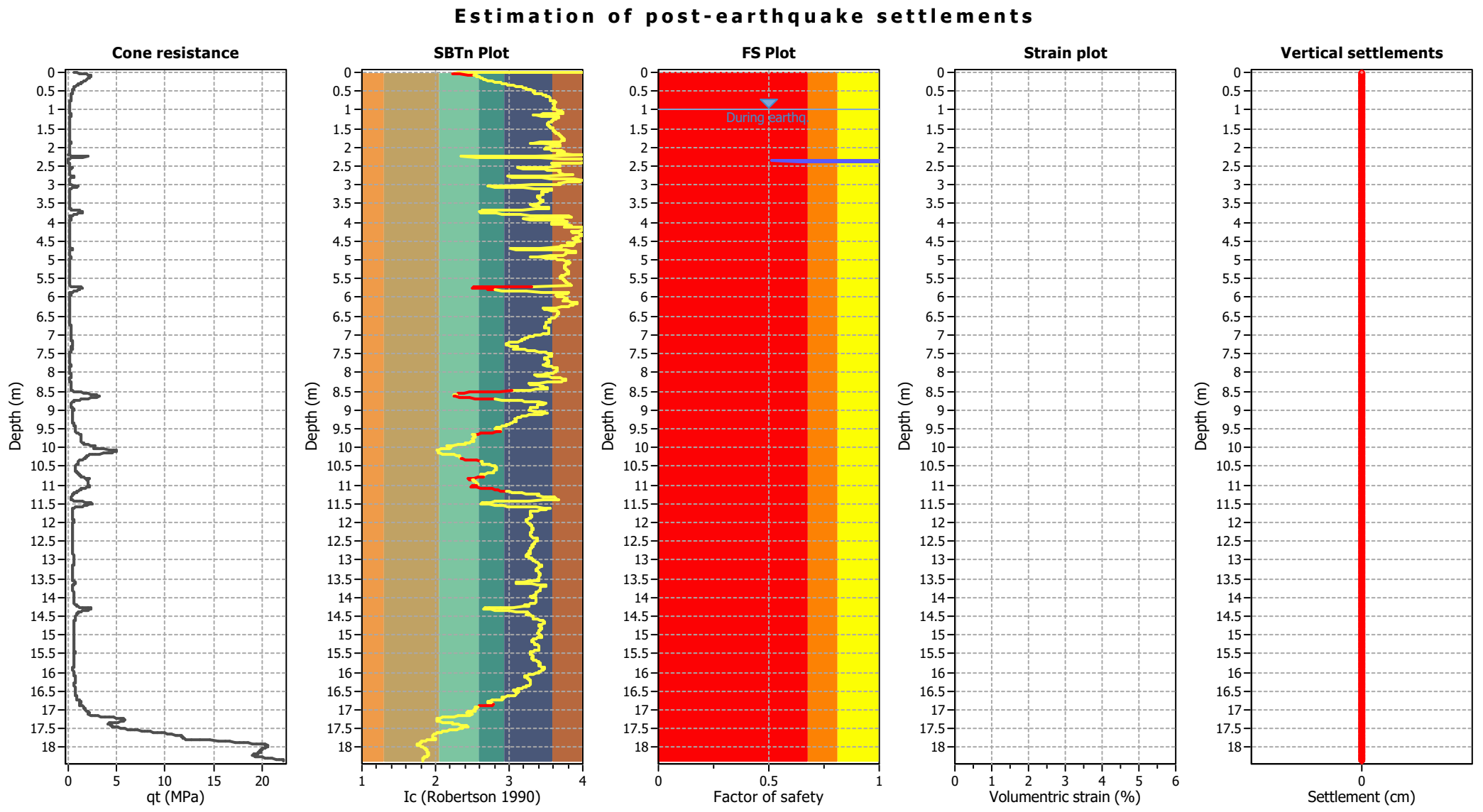


Transition layer algorithm properties

$I_c$  minimum check value: 1.70  
 $I_c$  maximum check value: 3.00  
 $I_c$  change ratio value: 0.0100  
Minimum number of points in layer: 4

General statistics

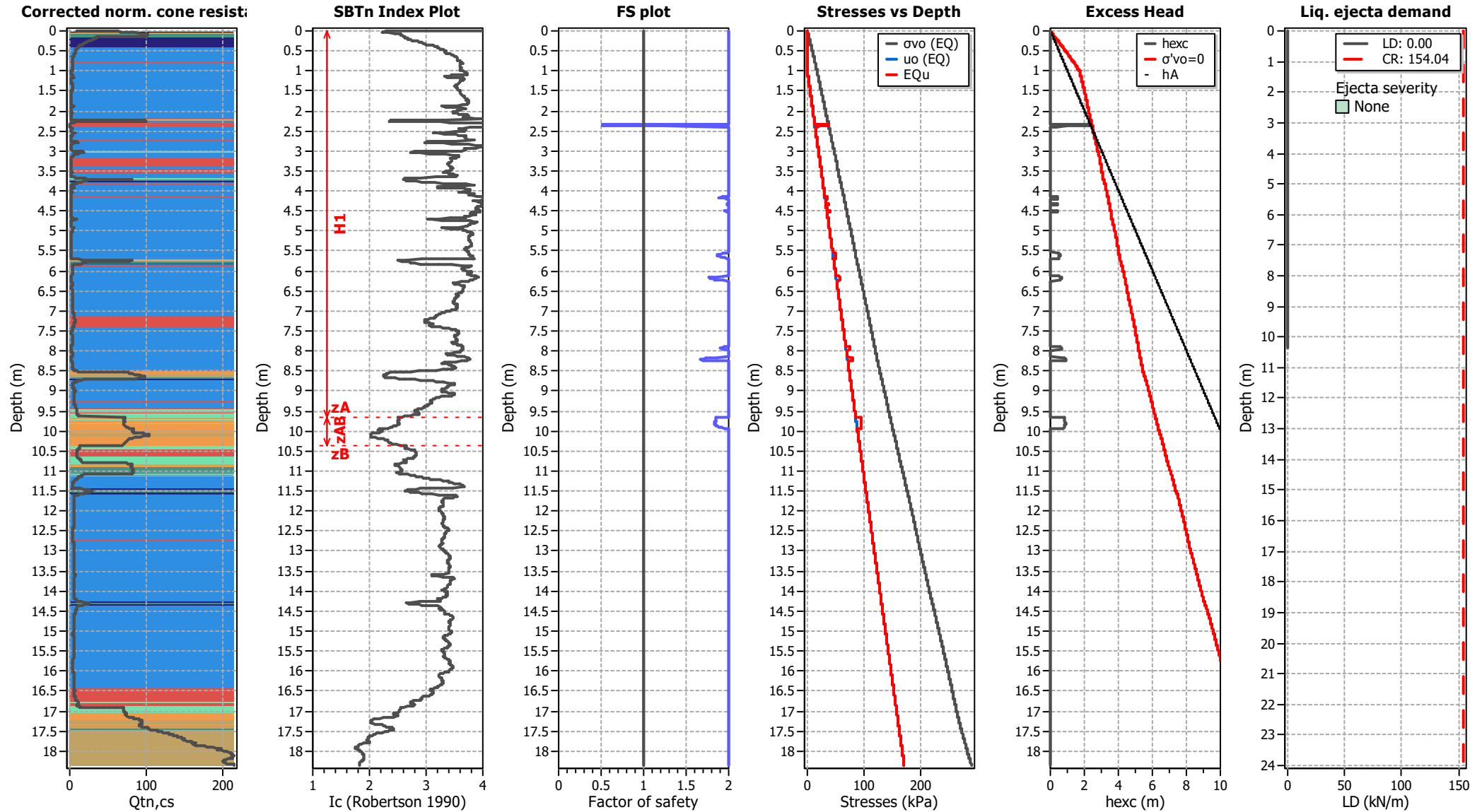
Total points in CPT file: 1837  
Total points excluded: 95  
Exclusion percentage: 5.17%  
Number of layers detected: 12



Abbreviations

- q<sub>c</sub>: Total cone resistance (cone resistance q<sub>c</sub> corrected for pore water effects)
- I<sub>c</sub>: Soil Behaviour Type Index
- FS: Calculated Factor of Safety against liquefaction
- Volumetric strain: Post-liquefaction volumetric strain

## Ejecta Severity Estimation



## LIQUEFACTION ANALYSIS REPORT

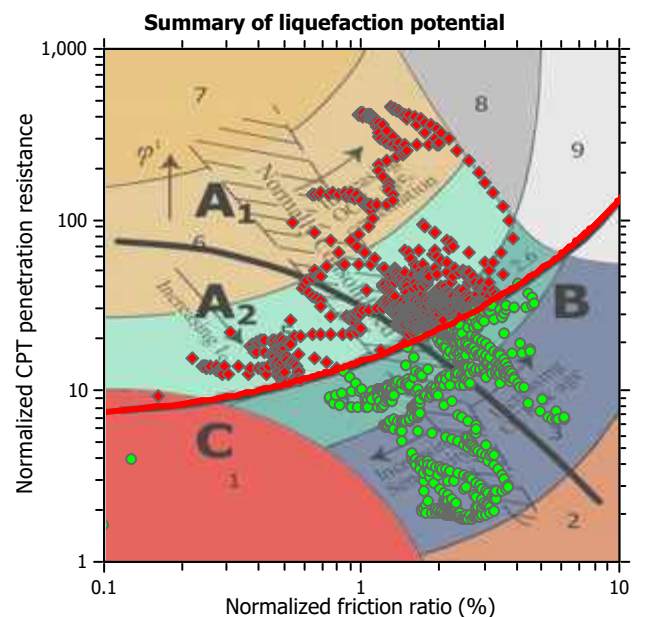
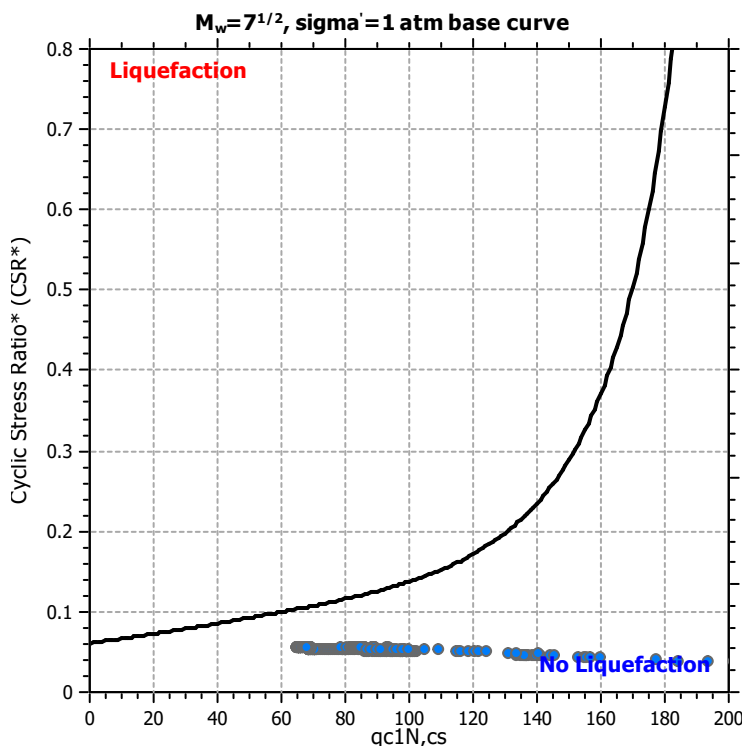
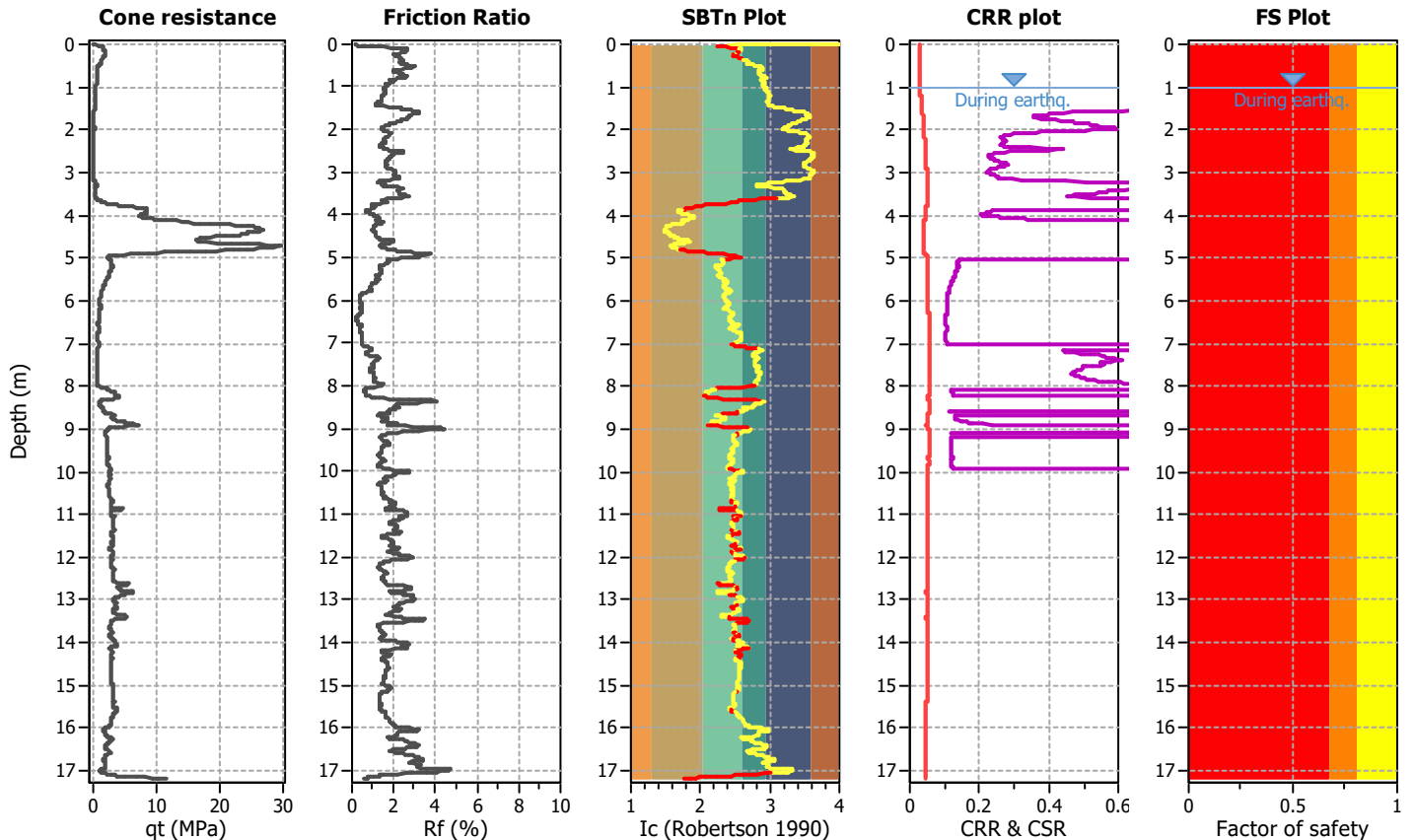
**Project title :**

**Location :**

**CPT file : CPT22**

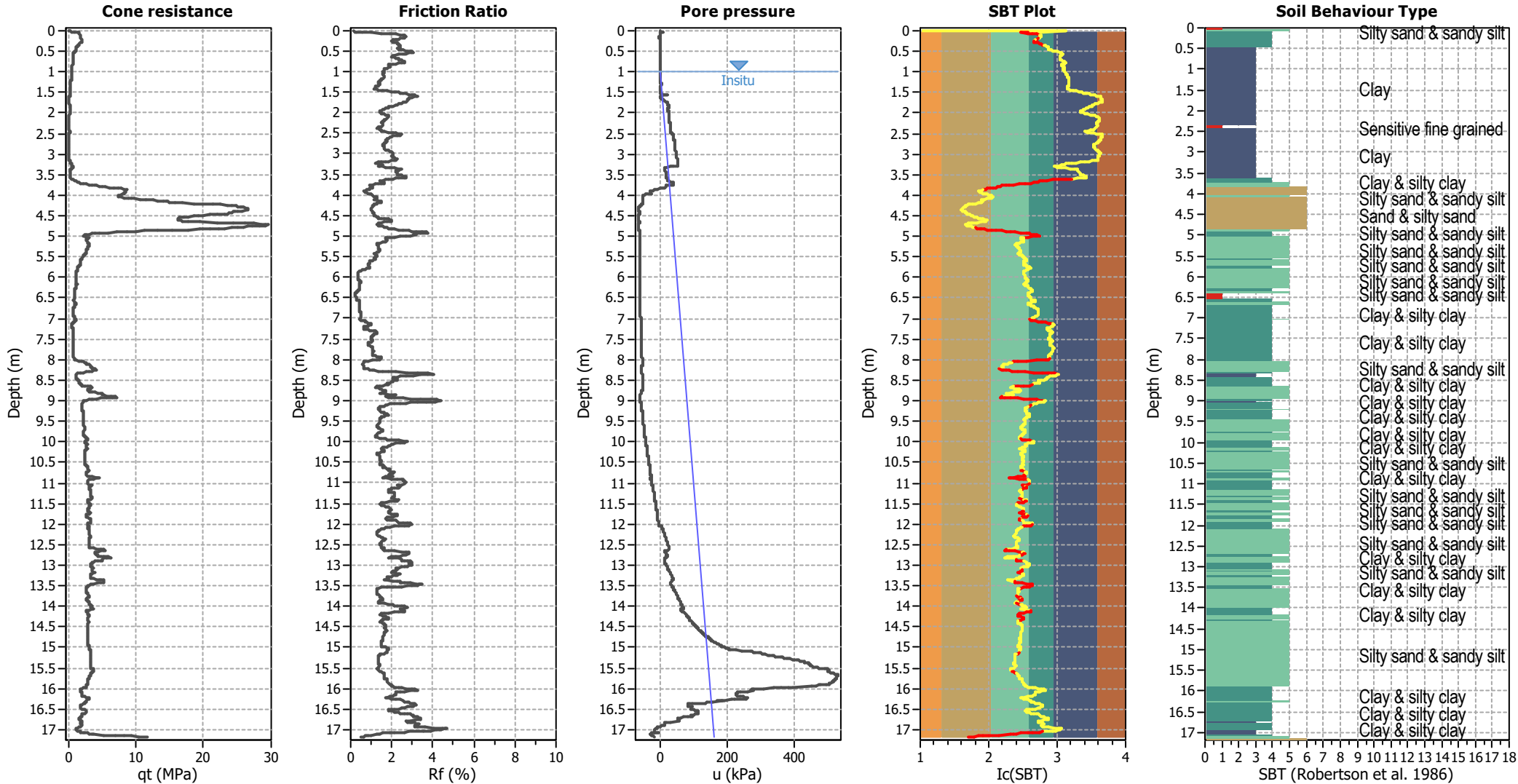
### Input parameters and analysis data

|                              |                   |                           |              |                         |     |                      |              |
|------------------------------|-------------------|---------------------------|--------------|-------------------------|-----|----------------------|--------------|
| Analysis method:             | B&I (2014)        | G.W.T. (in-situ):         | 1.00 m       | Use fill:               | No  | Clay like behavior   |              |
| Fines correction method:     | B&I (2014)        | G.W.T. (earthq.):         | 1.00 m       | Fill height:            | N/A | applied:             | Sand & Clay  |
| Points to test:              | Based on Ic value | Average results interval: | 3            | Fill weight:            | N/A | Limit depth applied: | Yes          |
| Earthquake magnitude $M_w$ : | 6.50              | Ic cut-off value:         | 2.60         | Trans. detect. applied: | Yes | Limit depth:         | 10.00 m      |
| Peak ground acceleration:    | 0.05              | Unit weight calculation:  | Based on SBT | $K_\sigma$ applied:     | Yes | MSF method:          | Method based |



Zone A<sub>1</sub>: Cyclic liquefaction likely depending on size and duration of cyclic loading  
Zone A<sub>2</sub>: Cyclic liquefaction and strength loss likely depending on loading and ground geometry  
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening  
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

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: | Yes         |
| 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> : | 6.50              | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sand & Clay |
| Peak ground acceleration:             | 0.05              | Use fill:                 | No           | Limit depth applied:        | Yes         |
| Depth to water table (insitu):        | 1.00 m            | Fill height:              | N/A          | Limit depth:                | 10.00 m     |

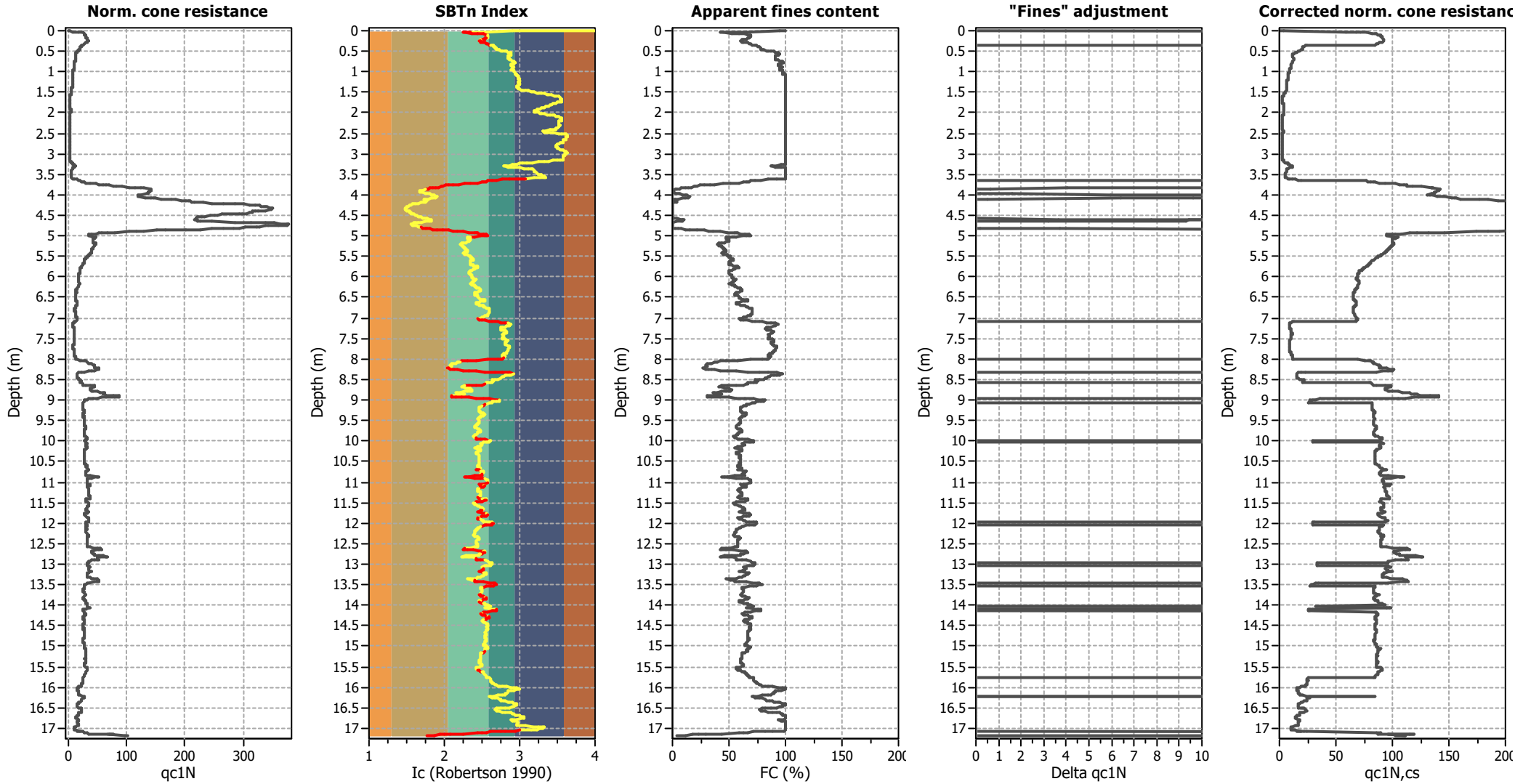
SBT legend

|                           |                             |                            |
|---------------------------|-----------------------------|----------------------------|
| 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 |

|                                       |                   |                           |              |                             |             |
|---------------------------------------|-------------------|---------------------------|--------------|-----------------------------|-------------|
| 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: | Yes         |
| Points to test:                       | Based on Ic value | Ic cut-off value:         | 2.60         | K <sub>o</sub> applied:     | Yes         |
| Earthquake magnitude M <sub>w</sub> : | 6.50              | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sand & Clay |
| Peak ground acceleration:             | 0.05              | Use fill:                 | No           | Limit depth applied:        | Yes         |
| Depth to water table (insitu):        | 1.00 m            | Fill height:              | N/A          | Limit depth:                | 10.00 m     |

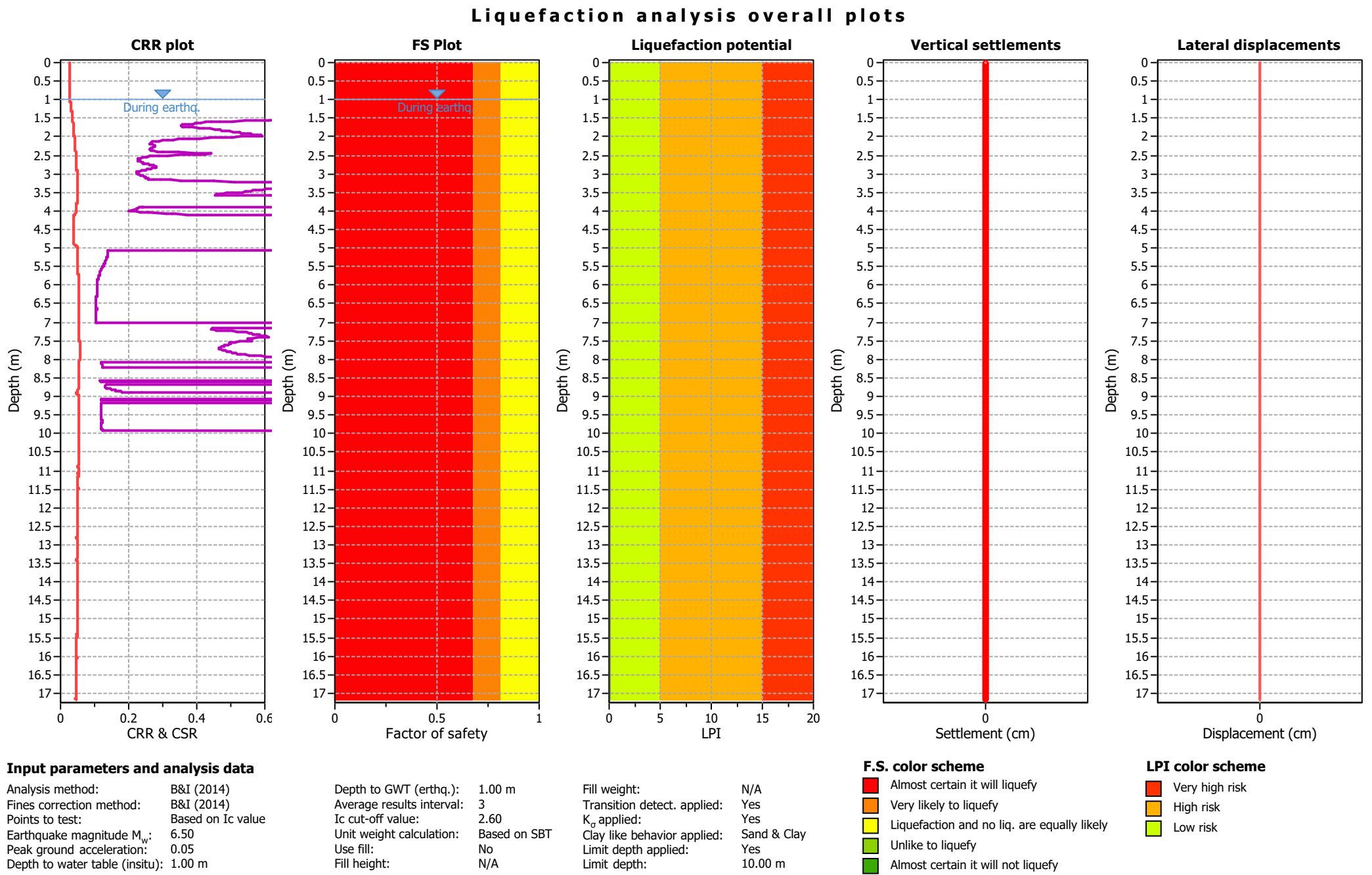
|                                                                                       |                           |                                                                                       |                             |                                                                                       |                            |
|---------------------------------------------------------------------------------------|---------------------------|---------------------------------------------------------------------------------------|-----------------------------|---------------------------------------------------------------------------------------|----------------------------|
|  | 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 |

Liquefaction analysis overall plots (intermediate results)

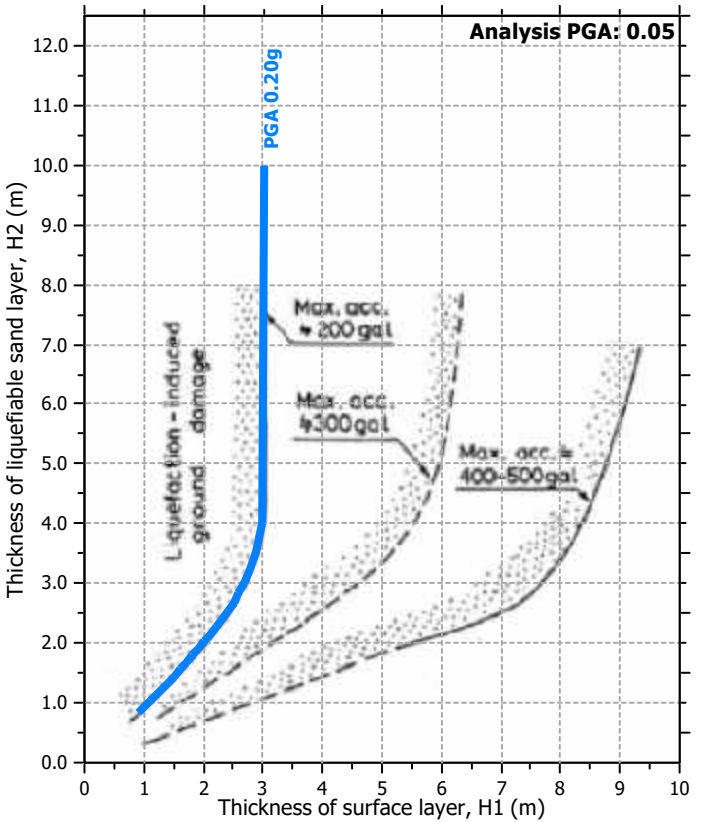
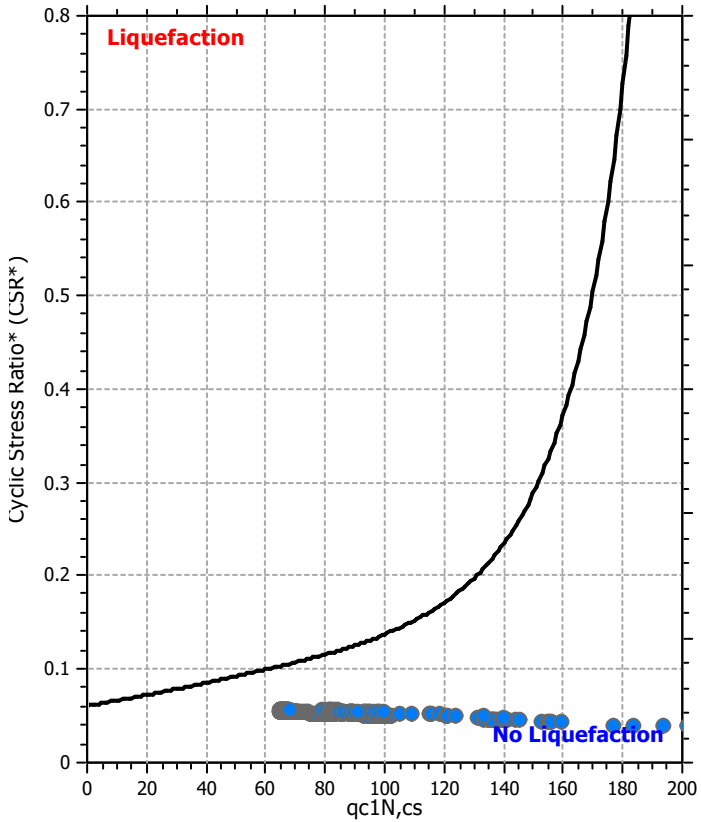
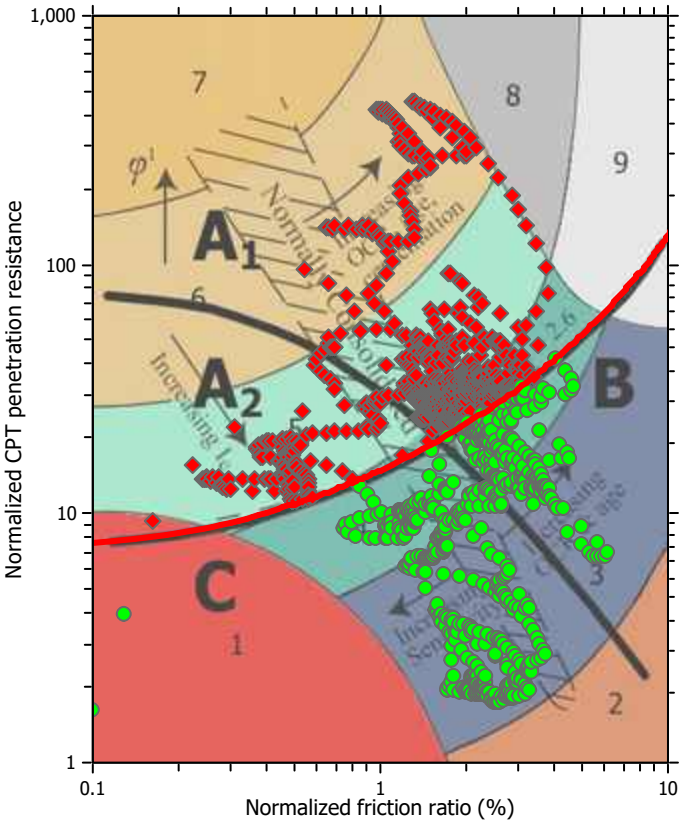


Input parameters and analysis data

|                                       |                   |                           |              |                             |             |
|---------------------------------------|-------------------|---------------------------|--------------|-----------------------------|-------------|
| 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: | Yes         |
| Points to test:                       | Based on Ic value | Ic cut-off value:         | 2.60         | K <sub>o</sub> applied:     | Yes         |
| Earthquake magnitude M <sub>w</sub> : | 6.50              | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sand & Clay |
| Peak ground acceleration:             | 0.05              | Use fill:                 | No           | Limit depth applied:        | Yes         |
| Depth to water table (insitu):        | 1.00 m            | Fill height:              | N/A          | Limit depth:                | 10.00 m     |



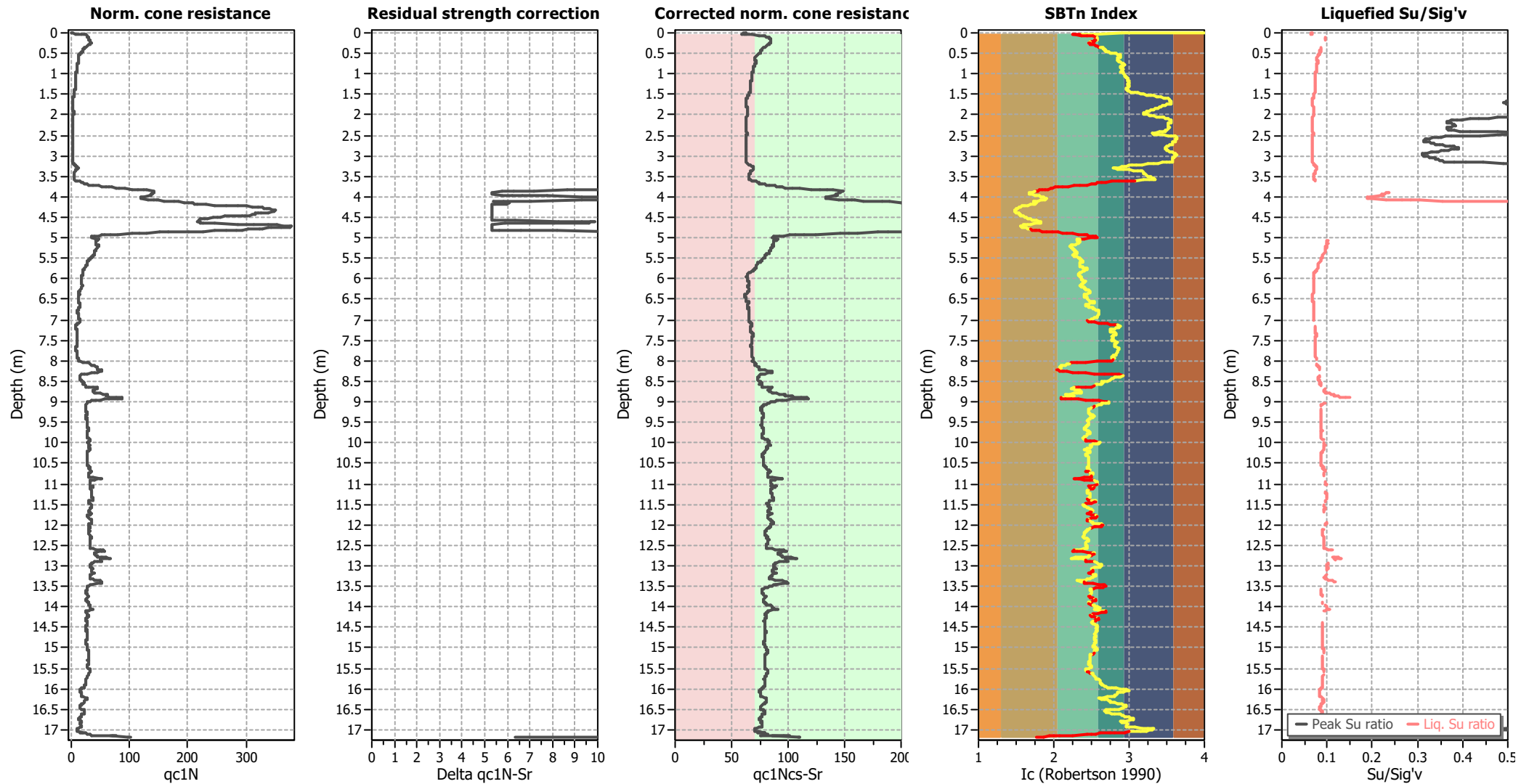
Liquefaction analysis summary plots



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: | Yes         |
| Points to test:                | Based on Ic value | Ic cut-off value:         | 2.60         | $K_0$ applied:              | Yes         |
| Earthquake magnitude $M_w$ :   | 6.50              | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sand & Clay |
| Peak ground acceleration:      | 0.05              | Use fill:                 | No           | Limit depth applied:        | Yes         |
| Depth to water table (insitu): | 1.00 m            | Fill height:              | N/A          | Limit depth:                | 10.00 m     |

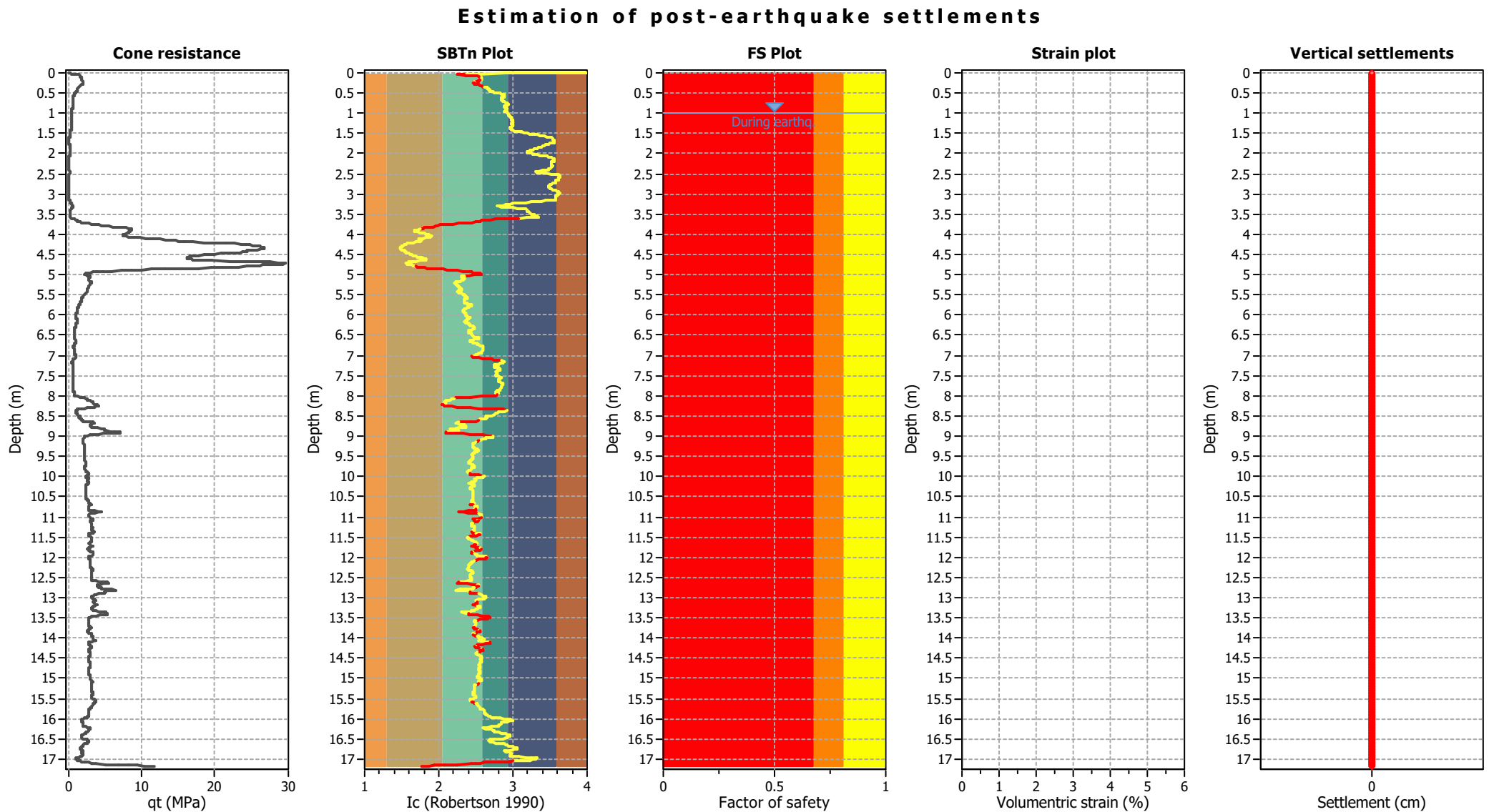
## Check for strength loss plots (Idriss & Boulanger (2008))



### 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: | Yes         |
| Points to test:                       | Based on Ic value | Ic cut-off value:         | 2.60         | K <sub>o</sub> applied:     | Yes         |
| Earthquake magnitude M <sub>w</sub> : | 6.50              | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sand & Clay |
| Peak ground acceleration:             | 0.05              | Use fill:                 | No           | Limit depth applied:        | Yes         |
| Depth to water table (insitu):        | 1.00 m            | Fill height:              | N/A          | Limit depth:                | 10.00 m     |

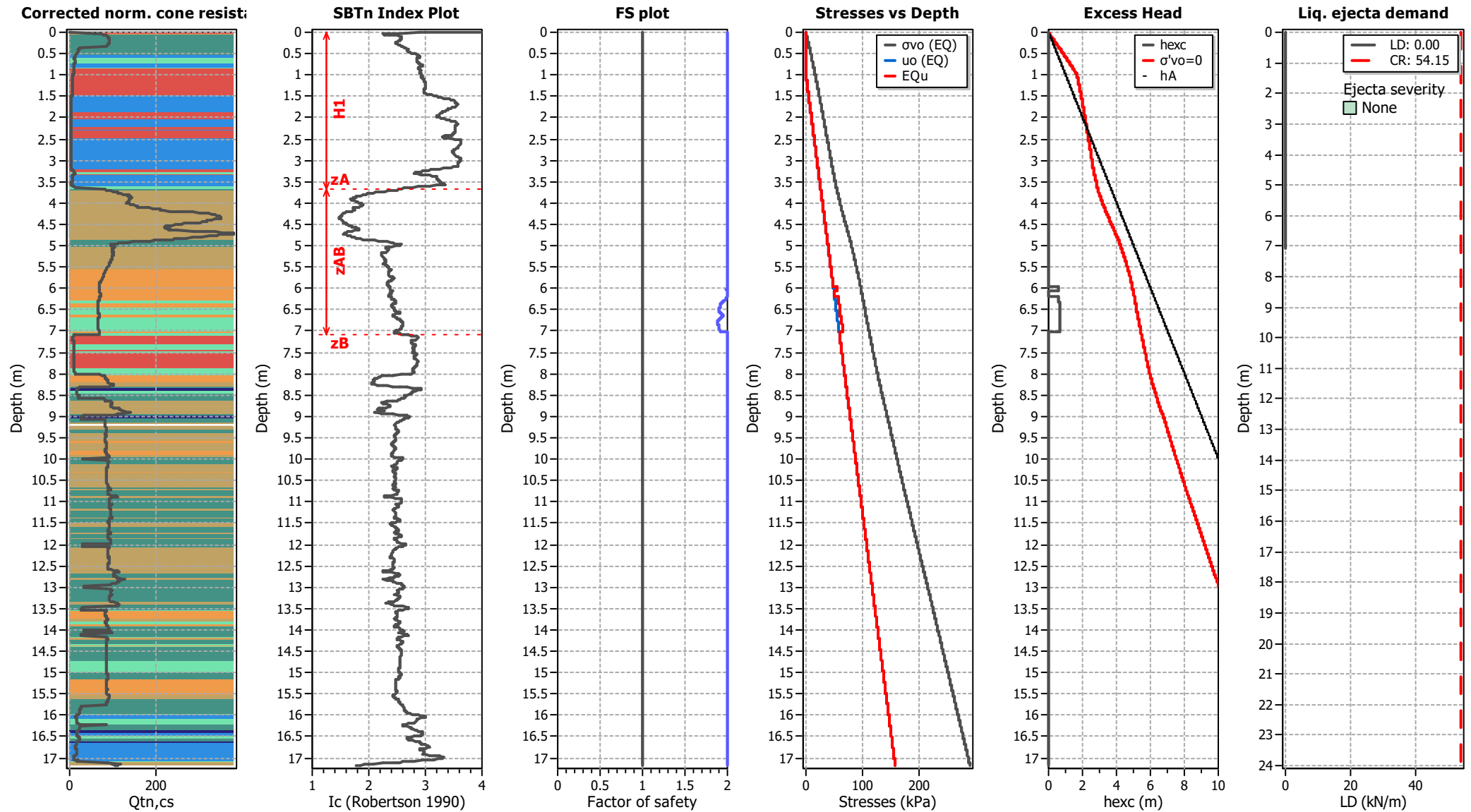




Abbreviations

- $q_t$ : Total cone resistance (cone resistance  $q_c$  corrected for pore water effects)
- $I_c$ : Soil Behaviour Type Index
- FS: Calculated Factor of Safety against liquefaction
- Volumetric strain: Post-liquefaction volumetric strain

## Ejecta Severity Estimation



## LIQUEFACTION ANALYSIS REPORT

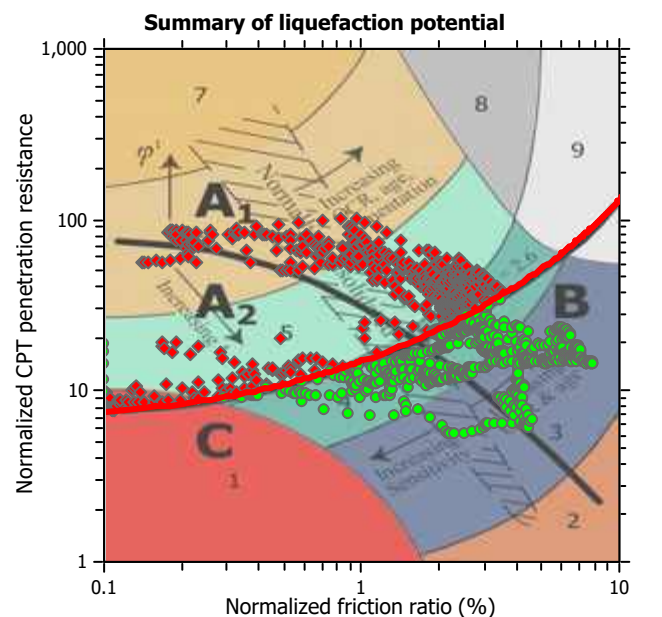
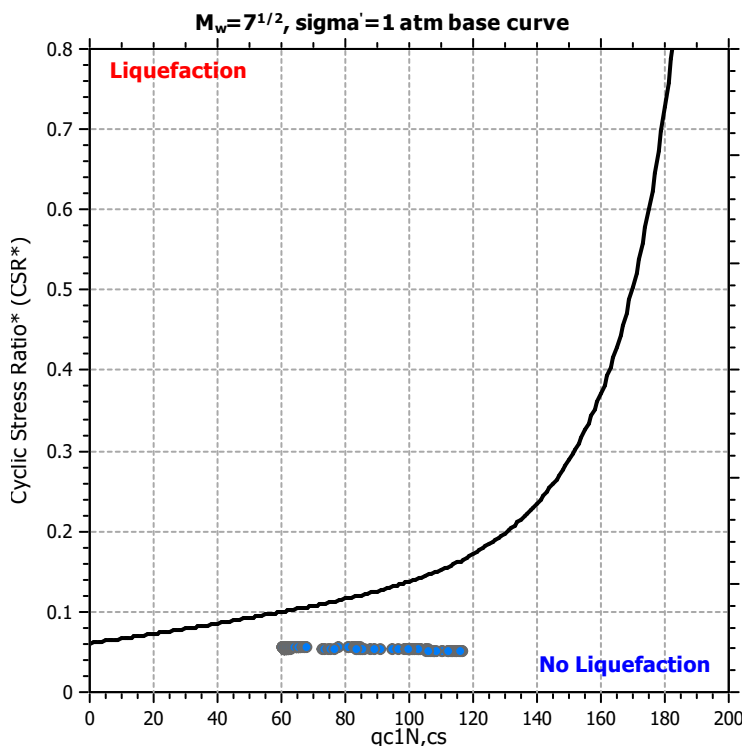
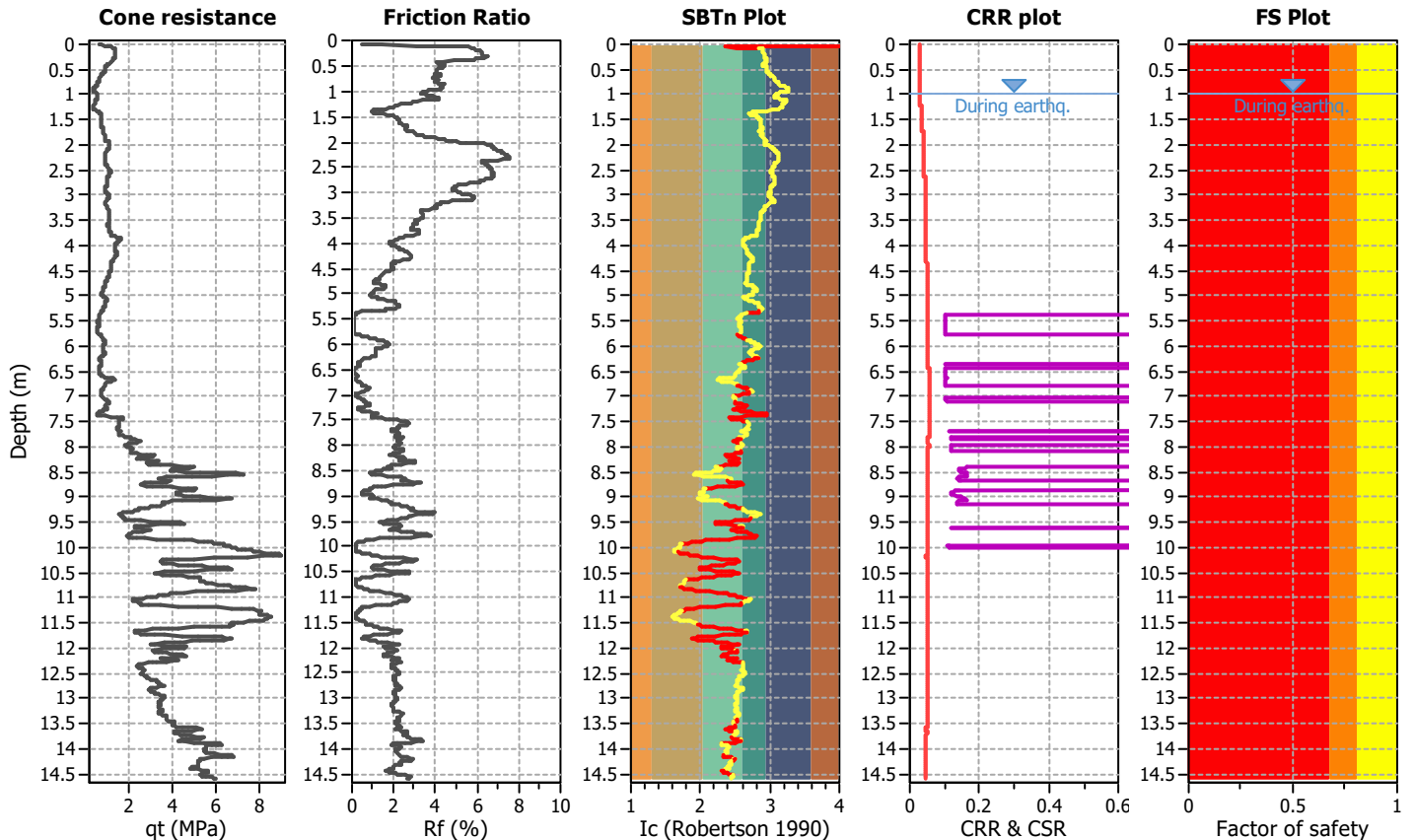
**Project title :**

**Location :**

**CPT file : CPT401**

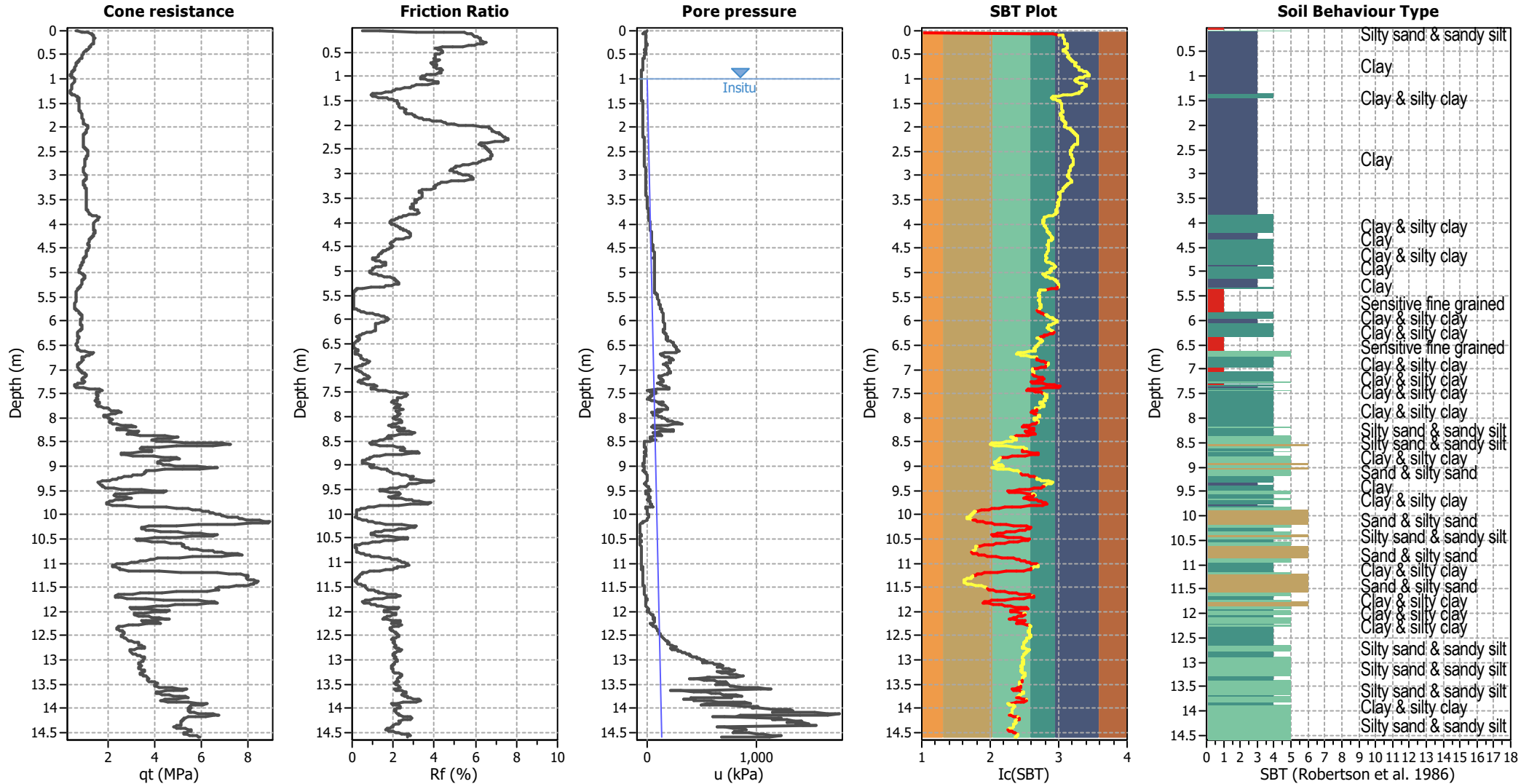
### Input parameters and analysis data

|                              |                   |                           |              |                         |     |                      |              |
|------------------------------|-------------------|---------------------------|--------------|-------------------------|-----|----------------------|--------------|
| Analysis method:             | B&I (2014)        | G.W.T. (in-situ):         | 1.00 m       | Use fill:               | No  | Clay like behavior   |              |
| Fines correction method:     | B&I (2014)        | G.W.T. (earthq.):         | 1.00 m       | Fill height:            | N/A | applied:             | Sands only   |
| Points to test:              | Based on Ic value | Average results interval: | 3            | Fill weight:            | N/A | Limit depth applied: | Yes          |
| Earthquake magnitude $M_w$ : | 6.50              | Ic cut-off value:         | 2.60         | Trans. detect. applied: | Yes | Limit depth:         | 10.00 m      |
| Peak ground acceleration:    | 0.05              | Unit weight calculation:  | Based on SBT | $K_\sigma$ applied:     | Yes | MSF method:          | Method based |



Zone A1: Cyclic liquefaction likely depending on size and duration of cyclic loading  
Zone A2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry  
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening  
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

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: | Yes        |
| 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> : | 6.50              | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration:             | 0.05              | 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

2. Organic material

3. Clay to silty clay

4. Clayey silt to silty

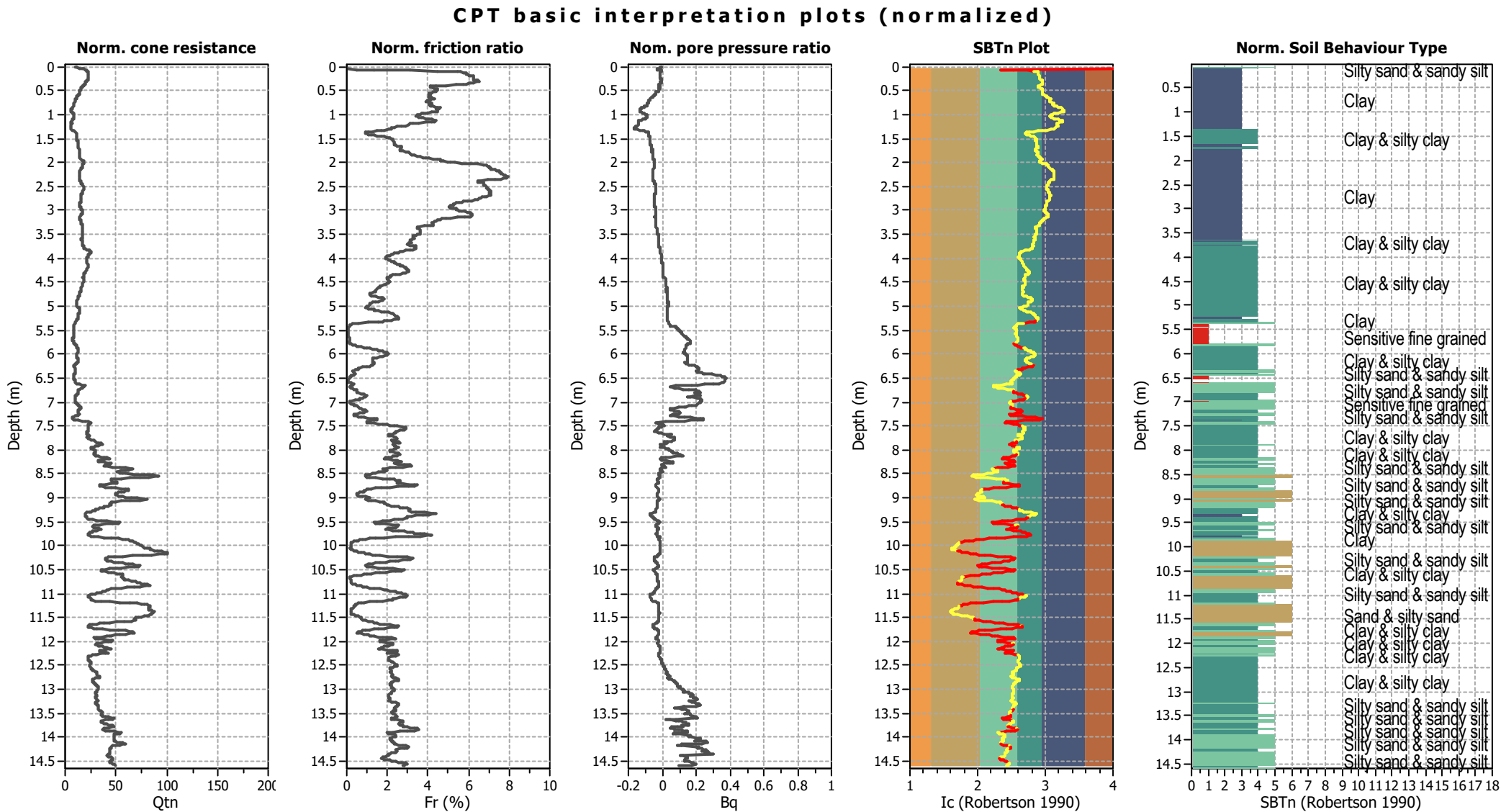
5. Silty sand to sandy silt

6. Clean sand to silty sand

7. Gravely sand to sand

8. Very stiff sand to

9. Very stiff fine grained

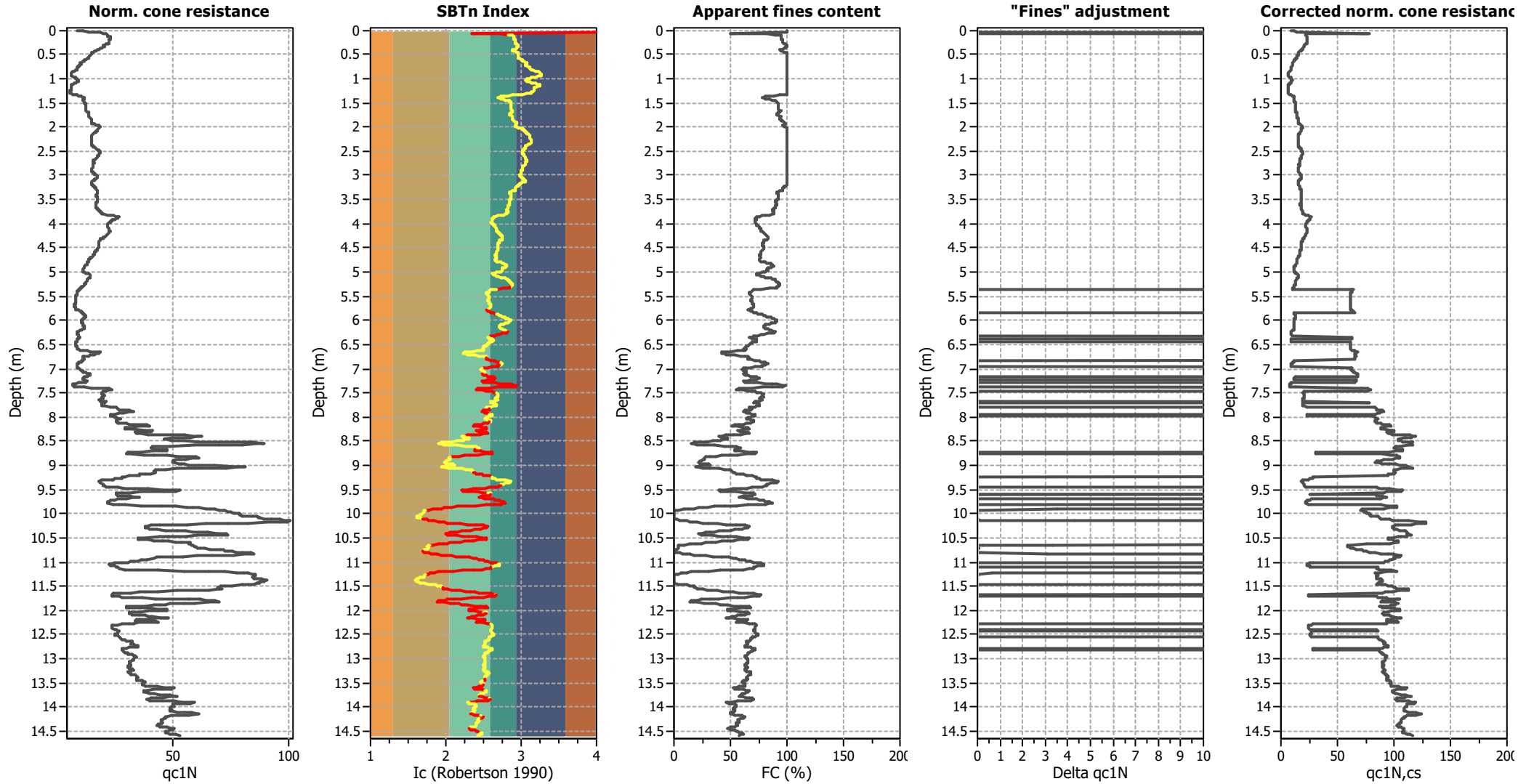


Input parameters and analysis data

|                                       |                   |                           |              |                             |            |
|---------------------------------------|-------------------|---------------------------|--------------|-----------------------------|------------|
| 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: | Yes        |
| Points to test:                       | Based on Ic value | Ic cut-off value:         | 2.60         | K <sub>o</sub> applied:     | Yes        |
| Earthquake magnitude M <sub>w</sub> : | 6.50              | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration:             | 0.05              | Use fill:                 | No           | Limit depth applied:        | Yes        |
| Depth to water table (insitu):        | 1.00 m            | Fill height:              | N/A          | Limit depth:                | 10.00 m    |

| SBTn 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 |

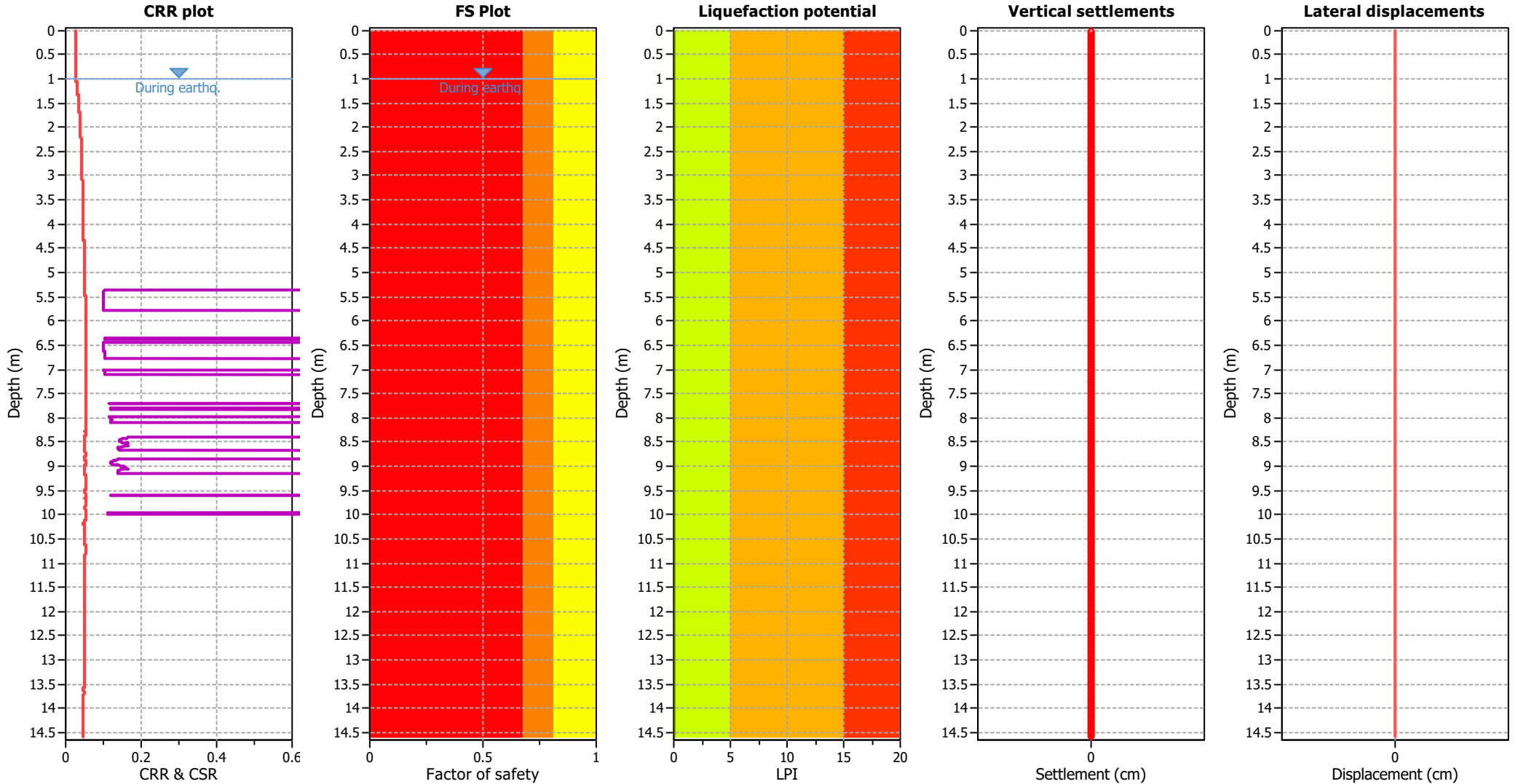
Liquefaction analysis overall plots (intermediate results)



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: | Yes        |
| Points to test:                       | Based on Ic value | Ic cut-off value:         | 2.60         | K <sub>o</sub> applied:     | Yes        |
| Earthquake magnitude M <sub>w</sub> : | 6.50              | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration:             | 0.05              | Use fill:                 | No           | Limit depth applied:        | Yes        |
| Depth to water table (insitu):        | 1.00 m            | Fill height:              | N/A          | Limit depth:                | 10.00 m    |

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: | Yes        |
| Points to test:                | Based on Ic value | Ic cut-off value:         | 2.60         | $K_0$ applied:              | Yes        |
| Earthquake magnitude $M_w$ :   | 6.50              | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration:      | 0.05              | Use fill:                 | No           | Limit depth applied:        | Yes        |
| Depth to water table (insitu): | 1.00 m            | Fill height:              | N/A          | Limit depth:                | 10.00 m    |

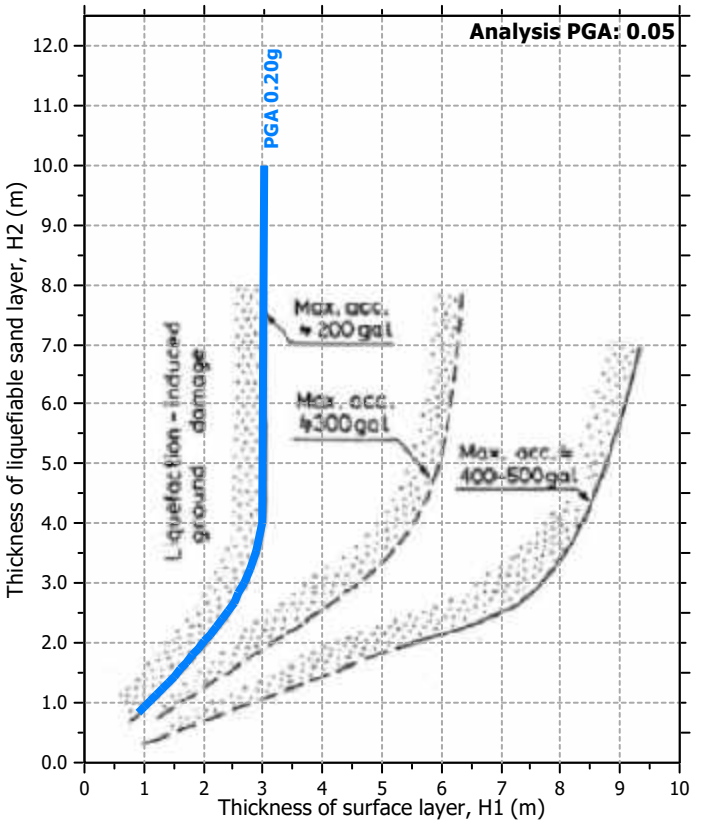
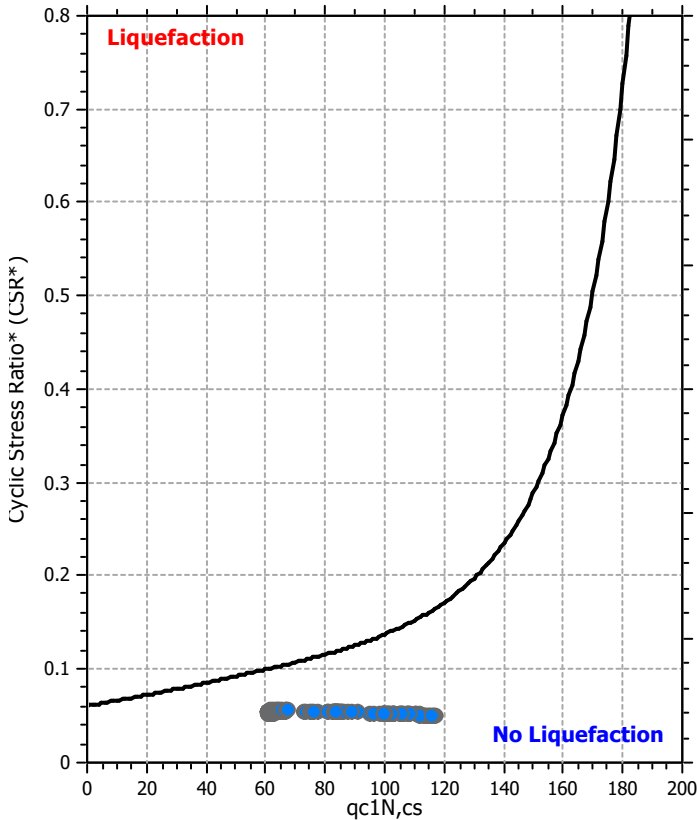
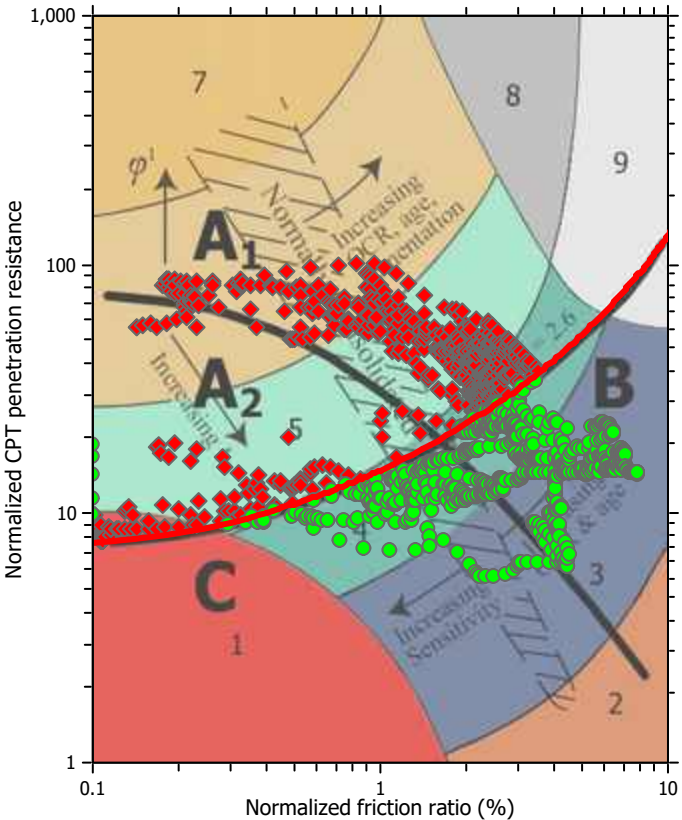
F.S. color scheme

|             |                                             |
|-------------|---------------------------------------------|
| Red         | Almost certain it will liquefy              |
| Orange      | Very likely to liquefy                      |
| Yellow      | Liquefaction and no liq. are equally likely |
| Light Green | Unlike to liquefy                           |
| Dark Green  | Almost certain it will not liquefy          |

LPI color scheme

|        |                |
|--------|----------------|
| Red    | Very high risk |
| Orange | High risk      |
| Yellow | Low risk       |

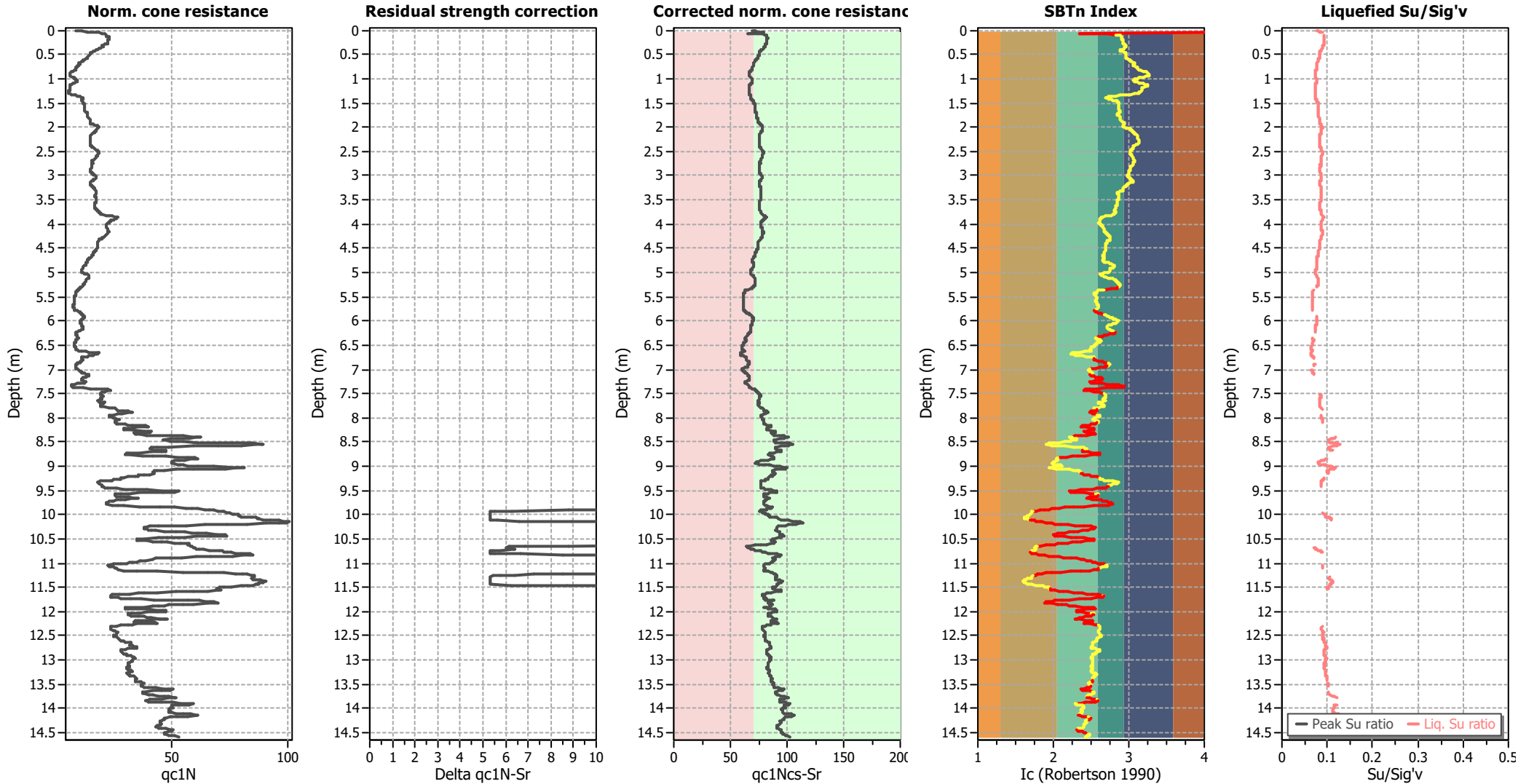
Liquefaction analysis summary plots



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: | Yes        |
| Points to test:                       | Based on Ic value | Ic cut-off value:         | 2.60         | K <sub>o</sub> applied:     | Yes        |
| Earthquake magnitude M <sub>w</sub> : | 6.50              | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration:             | 0.05              | Use fill:                 | No           | Limit depth applied:        | Yes        |
| Depth to water table (insitu):        | 1.00 m            | Fill height:              | N/A          | Limit depth:                | 10.00 m    |

Check for strength loss plots (Idriss & Boulanger (2008))



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: | Yes        |
| Points to test:                       | Based on Ic value | Ic cut-off value:         | 2.60         | K <sub>o</sub> applied:     | Yes        |
| Earthquake magnitude M <sub>w</sub> : | 6.50              | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration:             | 0.05              | Use fill:                 | No           | Limit depth applied:        | Yes        |
| Depth to water table (insitu):        | 1.00 m            | Fill height:              | N/A          | Limit depth:                | 10.00 m    |

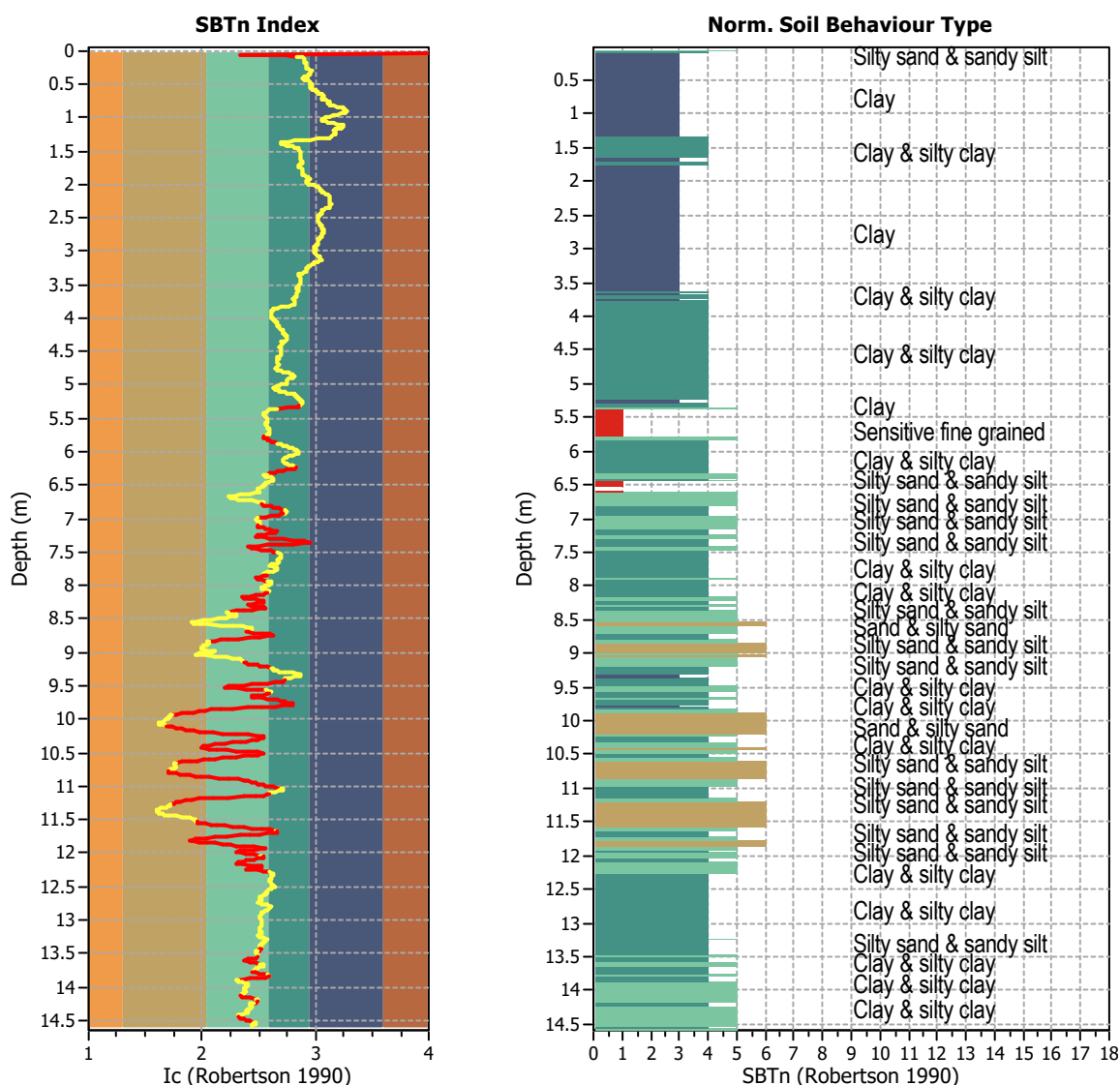
## TRANSITION LAYER DETECTION ALGORITHM REPORT

### Summary Details & Plots

#### Short description

The software will delete data when the cone is in transition from either clay to sand or vice-versa. To do this the software requires a range of  $I_c$  values over which the transition will be defined (typically somewhere between  $1.80 < I_c < 3.0$ ) and a rate of change of  $I_c$ . Transitions typically occur when the rate of change of  $I_c$  is fast (i.e.  $\Delta I_c$  is small).

The  $SBT_n$  plot below, displays in red the detected transition layers based on the parameters listed below the graphs.

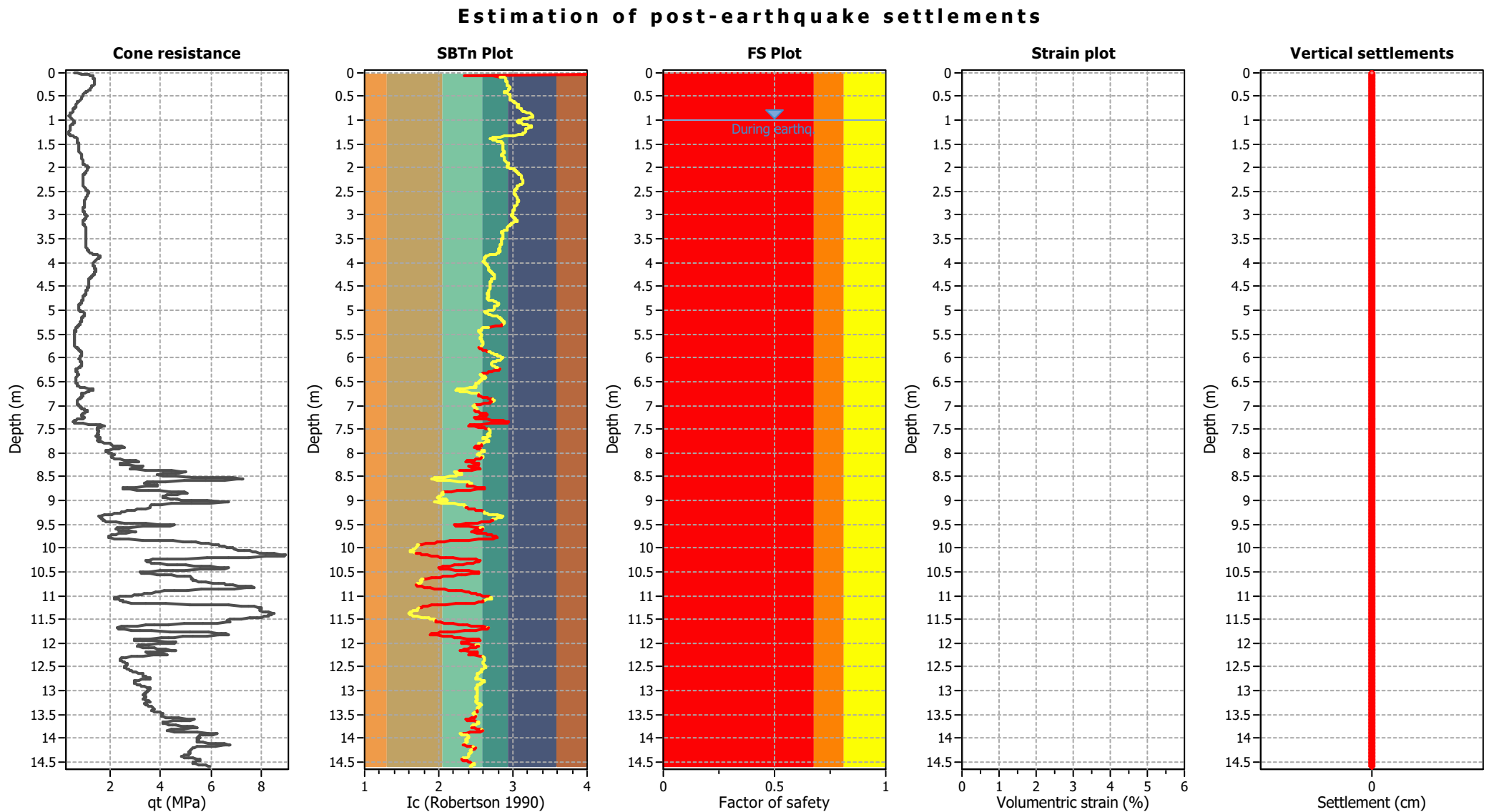


#### Transition layer algorithm properties

$I_c$  minimum check value: 1.70  
 $I_c$  maximum check value: 3.00  
 $I_c$  change ratio value: 0.0100  
 Minimum number of points in layer: 4

#### General statistics

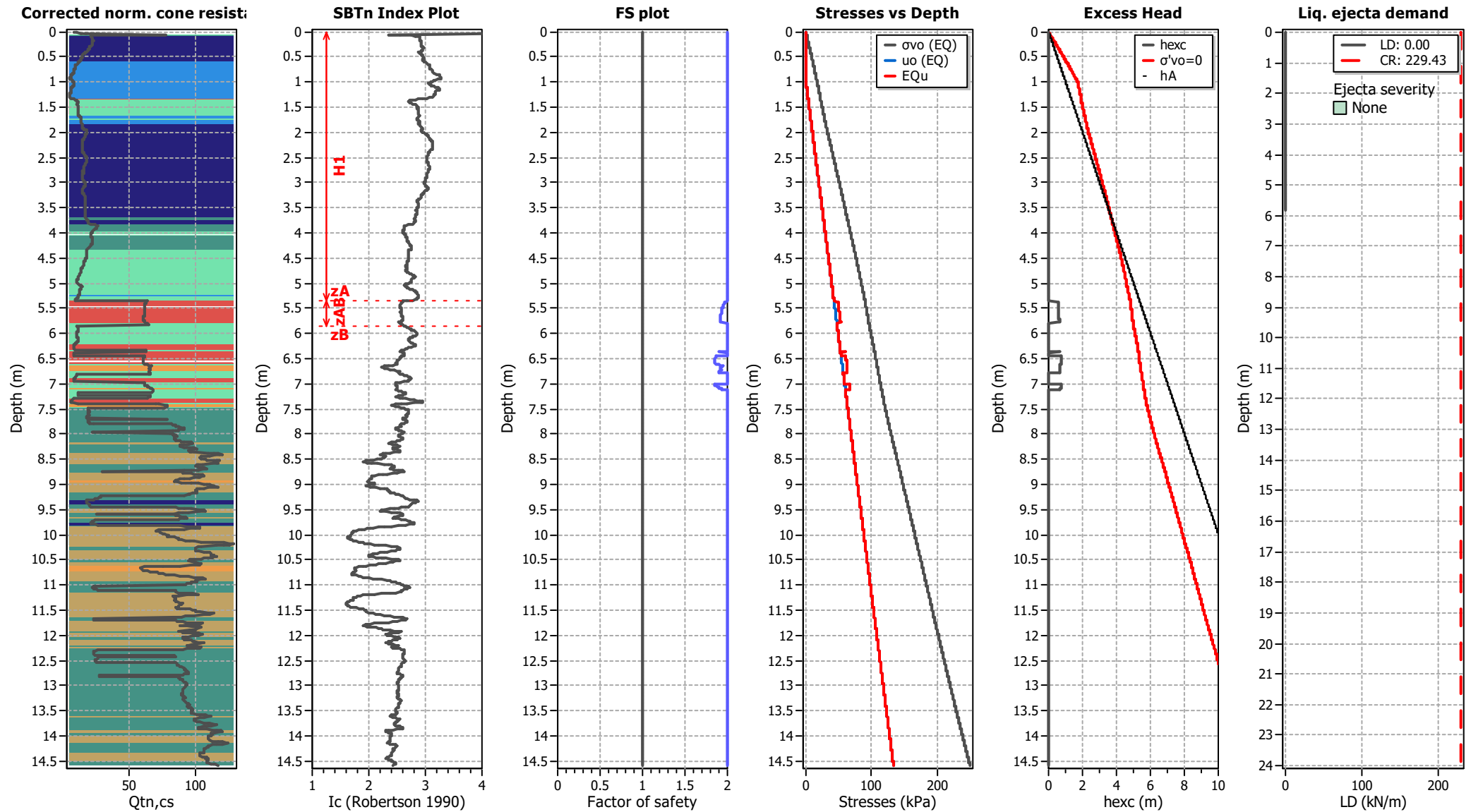
Total points in CPT file: 1459  
 Total points excluded: 439  
 Exclusion percentage: 30.09%  
 Number of layers detected: 49



Abbreviations

- q<sub>c</sub>: Total cone resistance (cone resistance q<sub>c</sub> corrected for pore water effects)
- I<sub>c</sub>: Soil Behaviour Type Index
- FS: Calculated Factor of Safety against liquefaction
- Volumetric strain: Post-liquefaction volumetric strain

## Ejecta Severity Estimation



## LIQUEFACTION ANALYSIS REPORT

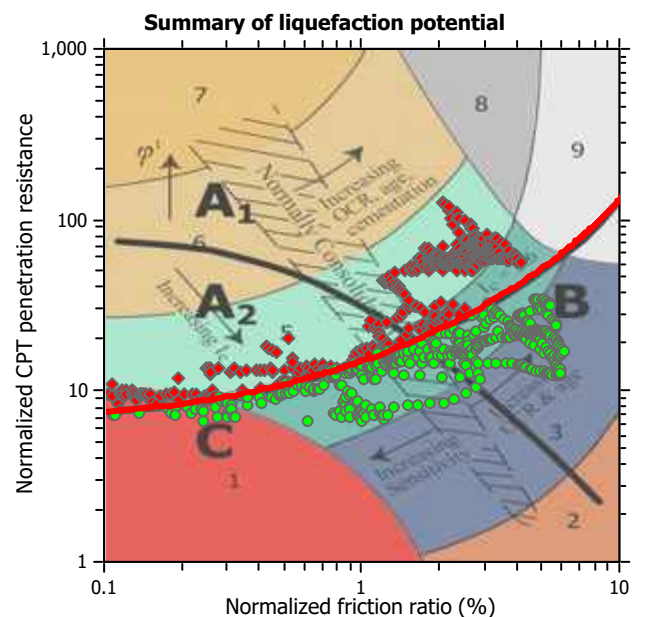
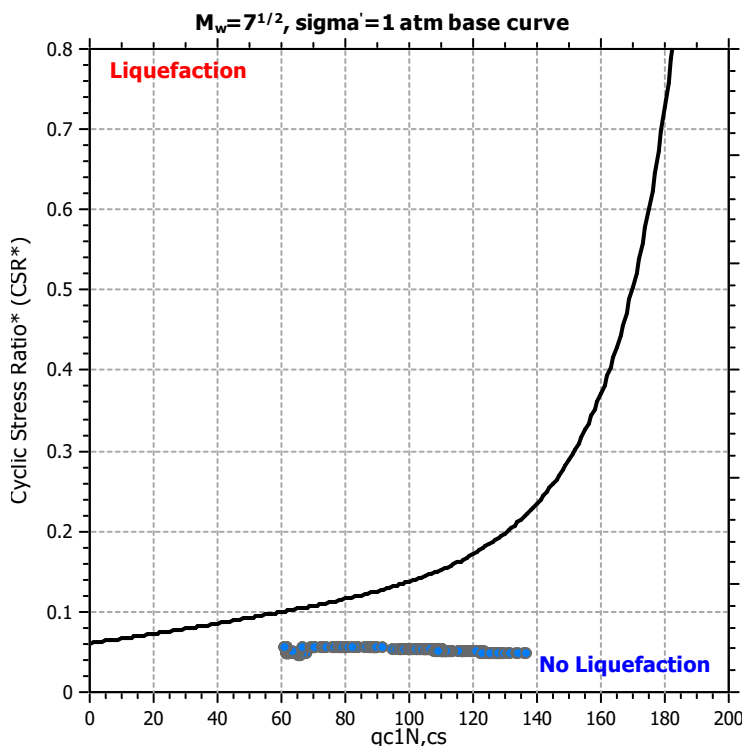
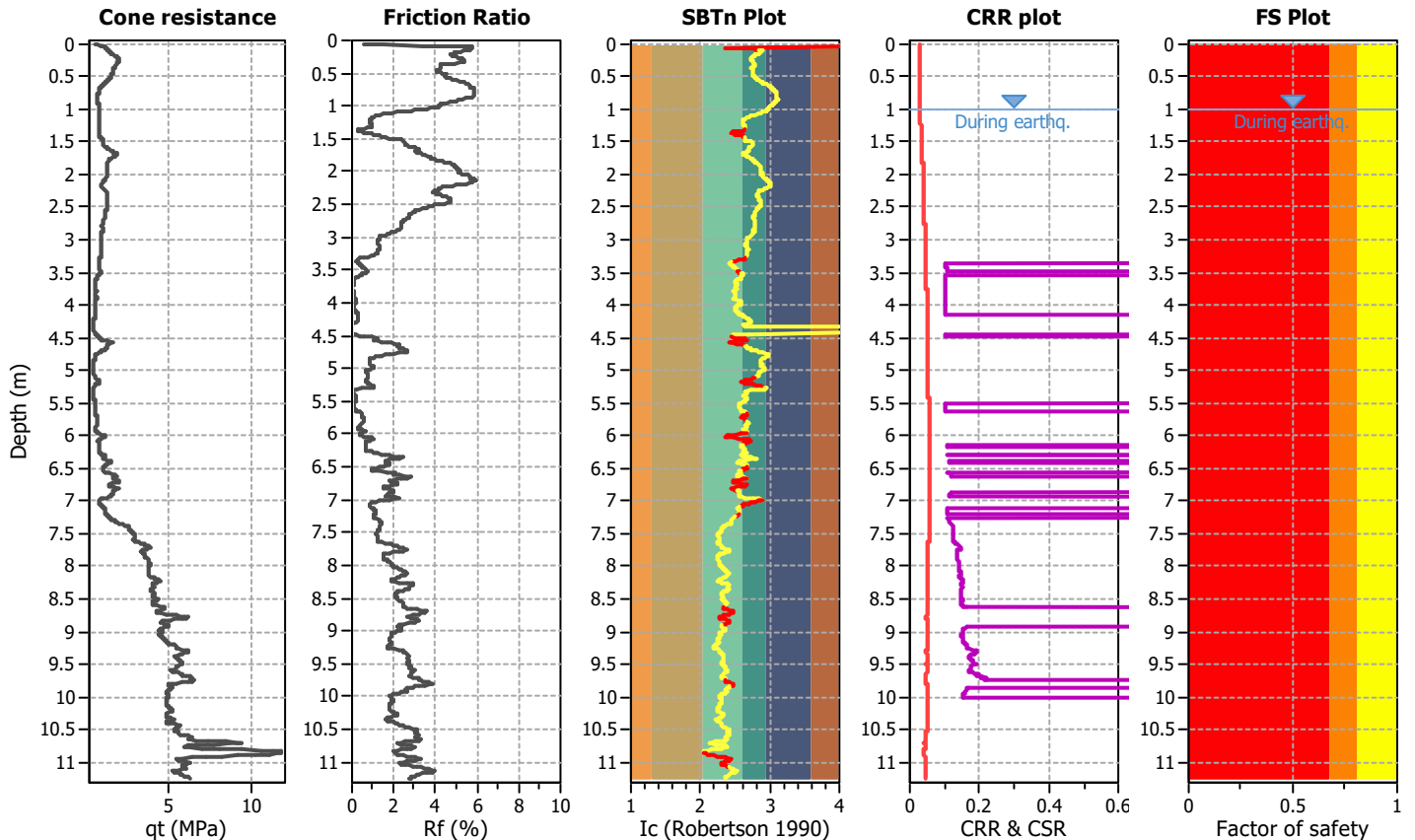
**Project title :**

**Location :**

**CPT file : CPT402**

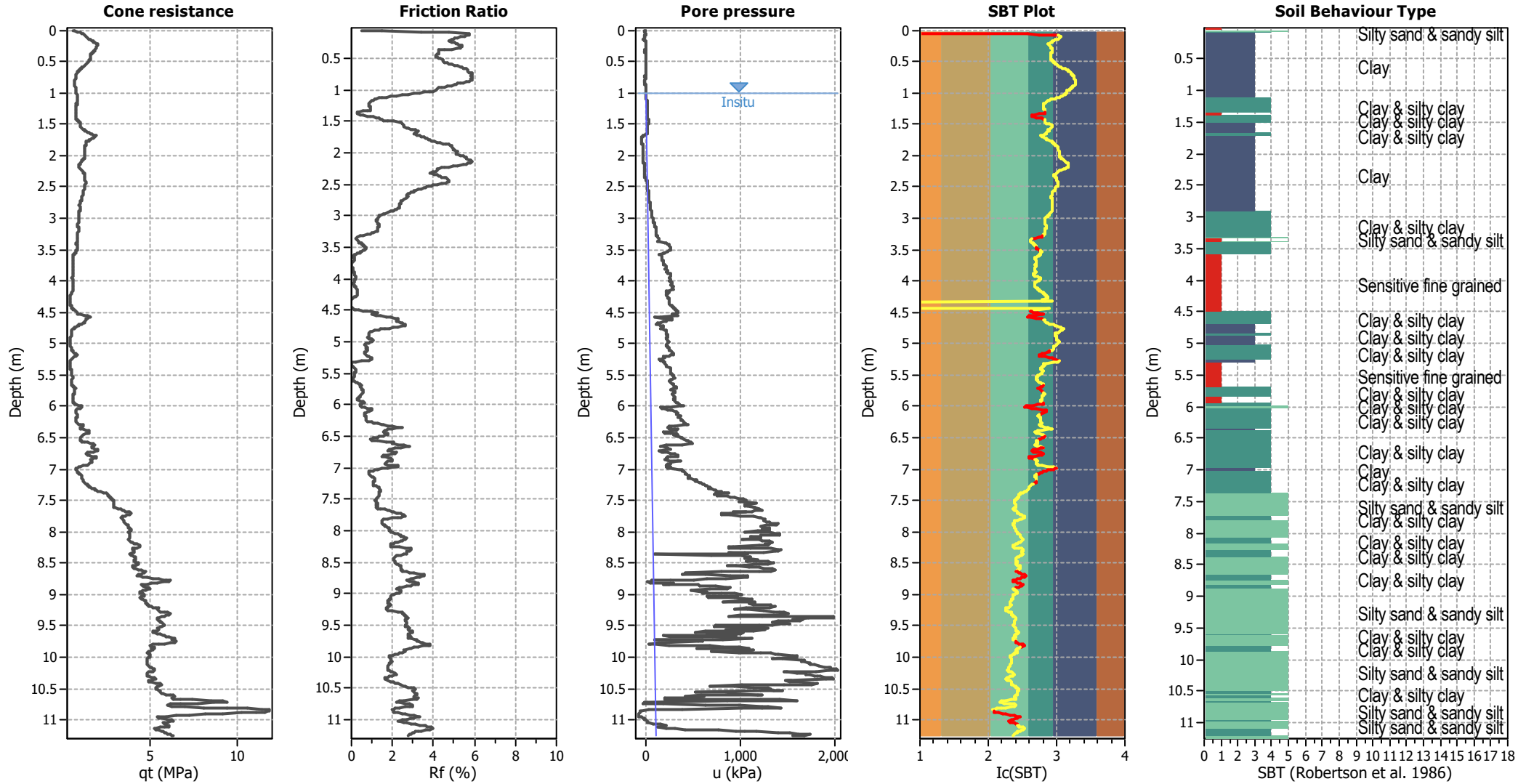
### Input parameters and analysis data

|                              |                   |                           |              |                         |     |                      |              |
|------------------------------|-------------------|---------------------------|--------------|-------------------------|-----|----------------------|--------------|
| Analysis method:             | B&I (2014)        | G.W.T. (in-situ):         | 1.00 m       | Use fill:               | No  | Clay like behavior   |              |
| Fines correction method:     | B&I (2014)        | G.W.T. (earthq.):         | 1.00 m       | Fill height:            | N/A | applied:             | Sands only   |
| Points to test:              | Based on Ic value | Average results interval: | 3            | Fill weight:            | N/A | Limit depth applied: | Yes          |
| Earthquake magnitude $M_w$ : | 6.50              | Ic cut-off value:         | 2.60         | Trans. detect. applied: | Yes | Limit depth:         | 10.00 m      |
| Peak ground acceleration:    | 0.05              | Unit weight calculation:  | Based on SBT | $K_\sigma$ applied:     | Yes | MSF method:          | Method based |



Zone A<sub>1</sub>: Cyclic liquefaction likely depending on size and duration of cyclic loading  
Zone A<sub>2</sub>: Cyclic liquefaction and strength loss likely depending on loading and ground geometry  
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening  
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots

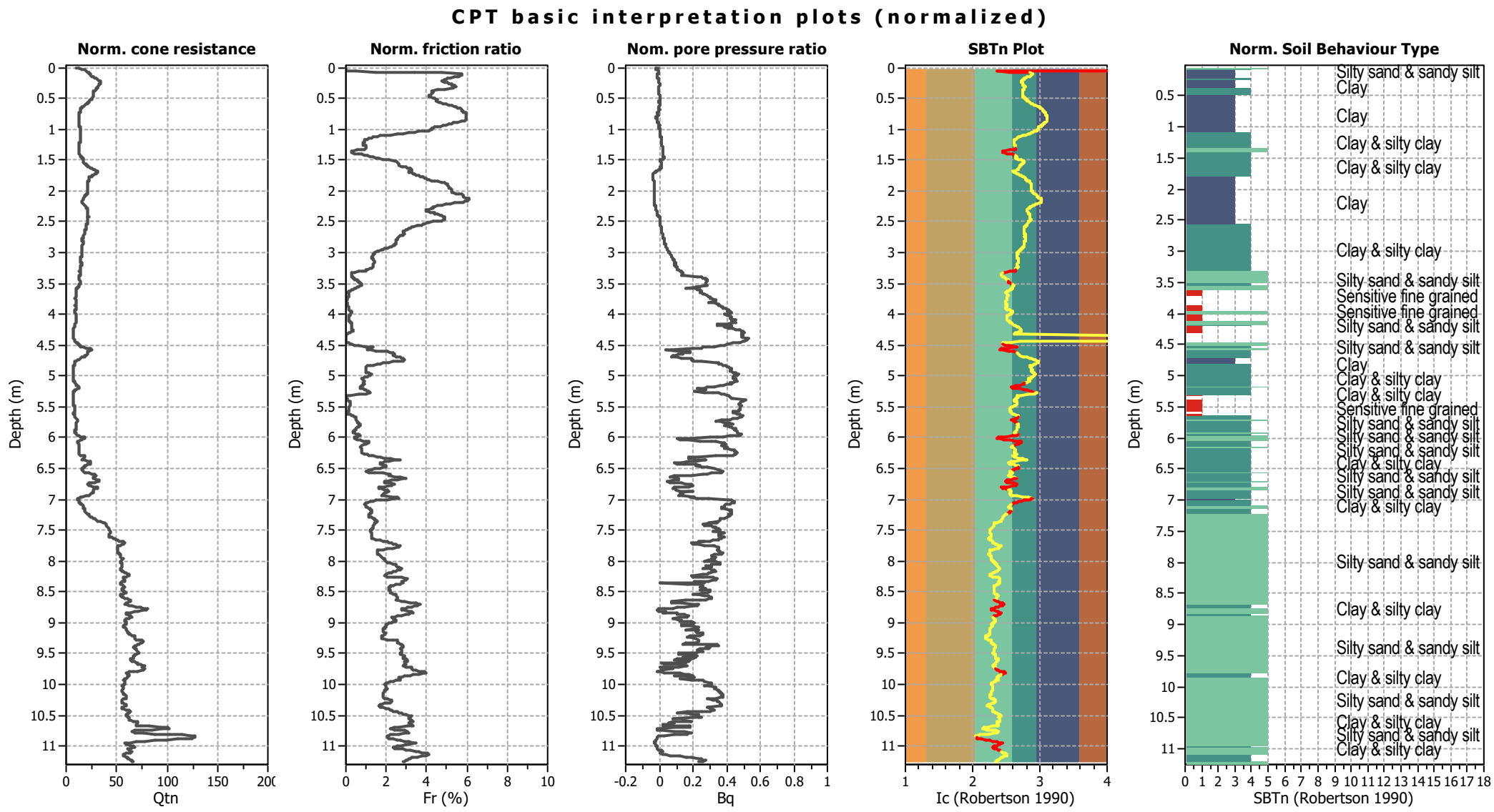


Input parameters and analysis data

|                                       |                   |                           |              |                             |            |
|---------------------------------------|-------------------|---------------------------|--------------|-----------------------------|------------|
| 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: | Yes        |
| 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> : | 6.50              | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration:             | 0.05              | 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 |



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: | Yes        |
| Points to test:                       | Based on Ic value | Ic cut-off value:         | 2.60         | K <sub>o</sub> applied:     | Yes        |
| Earthquake magnitude M <sub>w</sub> : | 6.50              | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration:             | 0.05              | Use fill:                 | No           | Limit depth applied:        | Yes        |
| Depth to water table (insitu):        | 1.00 m            | Fill height:              | N/A          | Limit depth:                | 10.00 m    |

SBTn legend

1. Sensitive fine grained

2. Organic material

3. Clay to silty clay

4. Clayey silt to silty

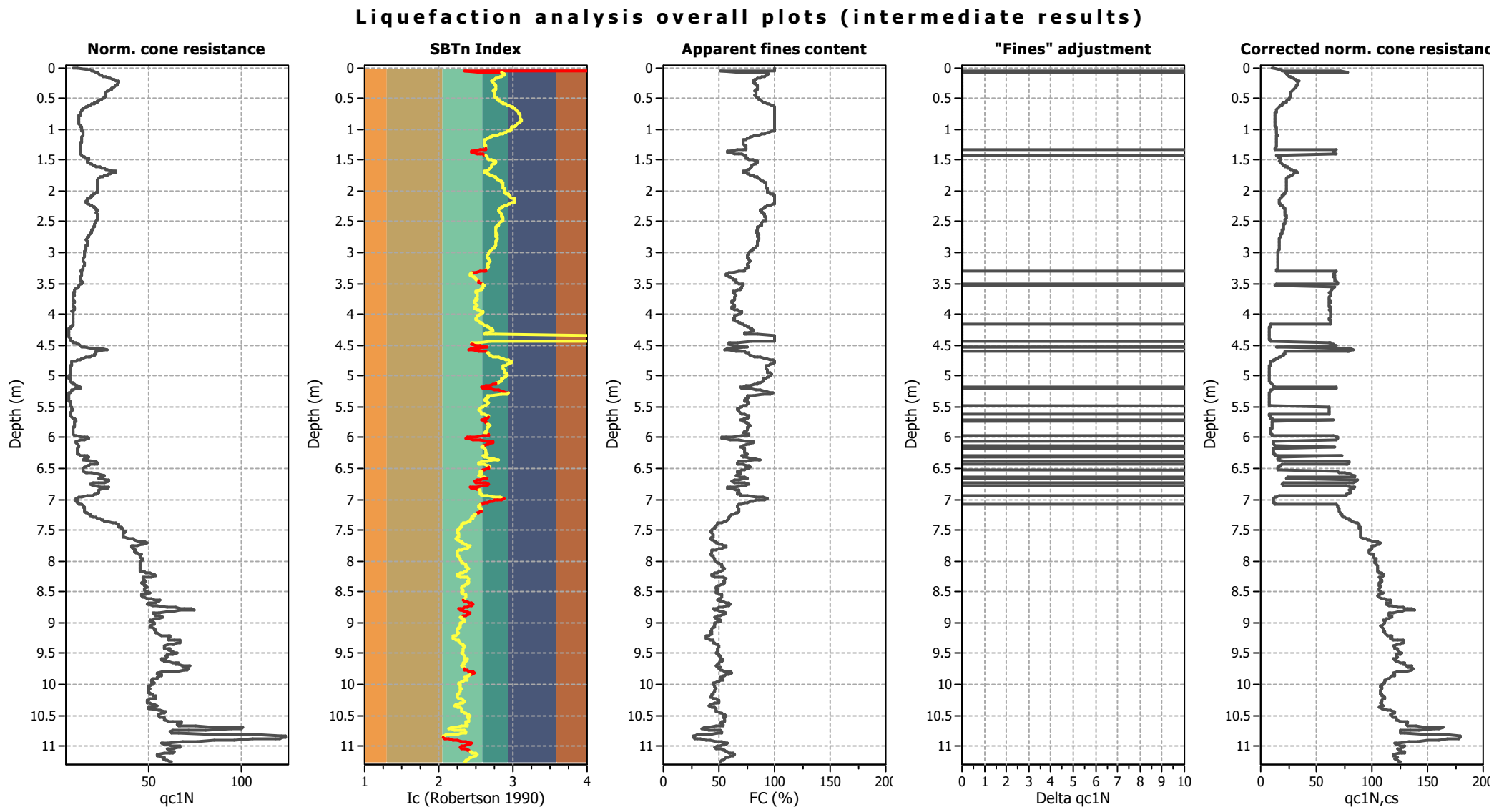
5. Silty sand to sandy silt

6. Clean sand to silty sand

7. Gravely sand to sand

8. Very stiff sand to

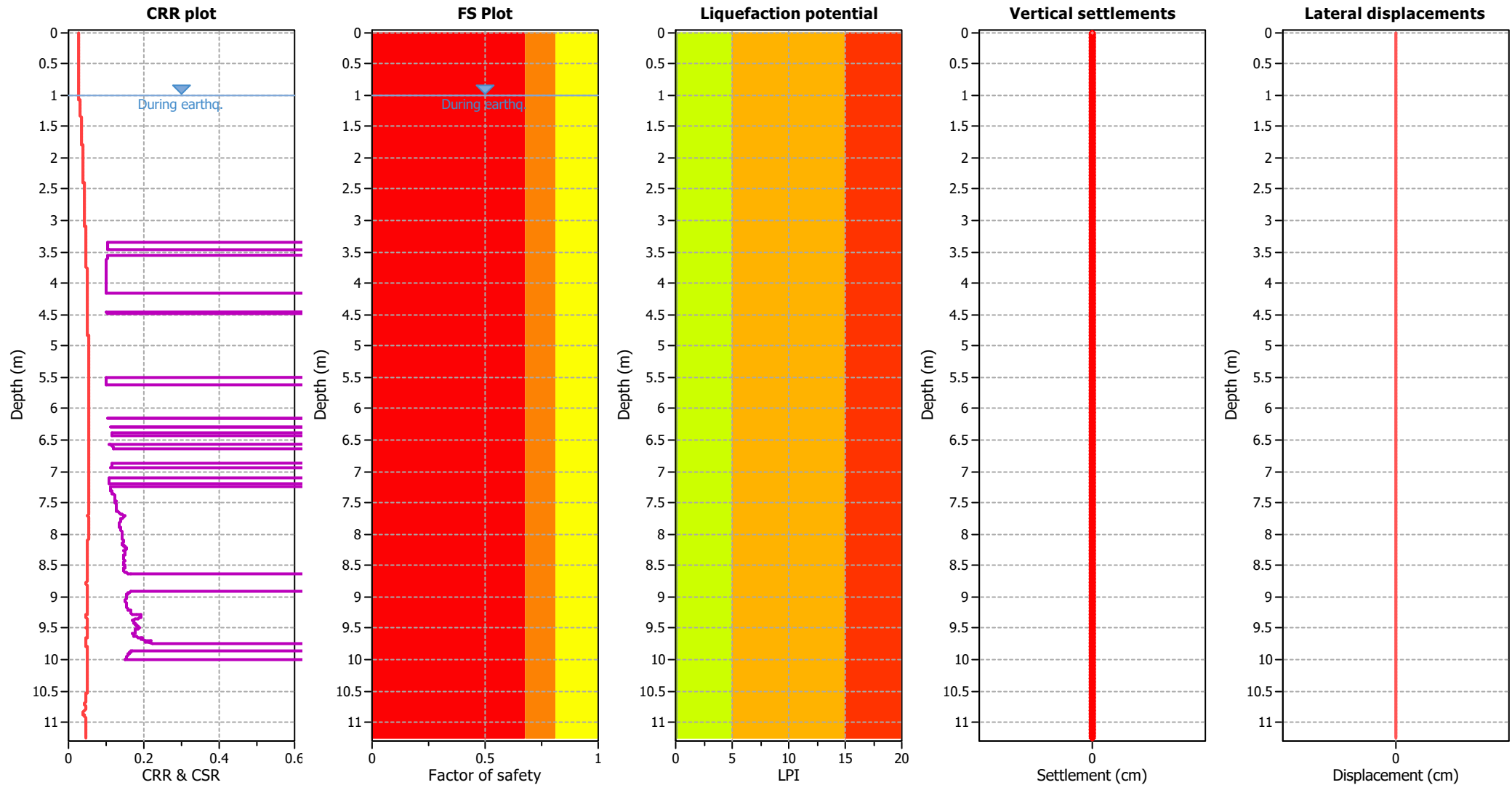
9. Very stiff fine grained



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: | Yes        |
| Points to test:                       | Based on Ic value | Ic cut-off value:         | 2.60         | K <sub>o</sub> applied:     | Yes        |
| Earthquake magnitude M <sub>w</sub> : | 6.50              | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration:             | 0.05              | Use fill:                 | No           | Limit depth applied:        | Yes        |
| Depth to water table (insitu):        | 1.00 m            | Fill height:              | N/A          | Limit depth:                | 10.00 m    |

## 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: | Yes        |
| Points to test:                | Based on Ic value | Ic cut-off value:         | 2.60         | $K_0$ applied:              | Yes        |
| Earthquake magnitude $M_w$ :   | 6.50              | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration:      | 0.05              | Use fill:                 | No           | Limit depth applied:        | Yes        |
| Depth to water table (insitu): | 1.00 m            | Fill height:              | N/A          | Limit depth:                | 10.00 m    |

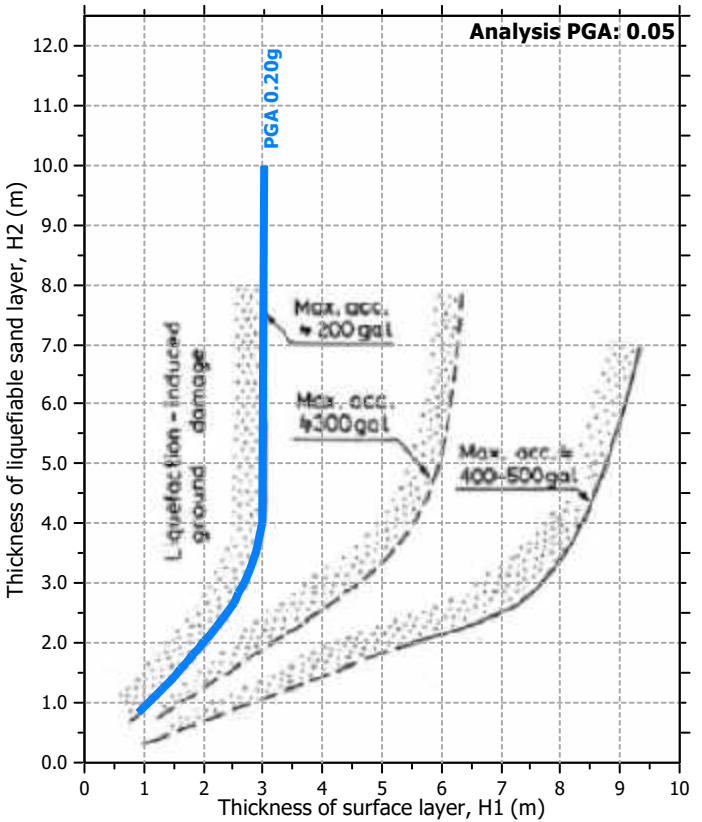
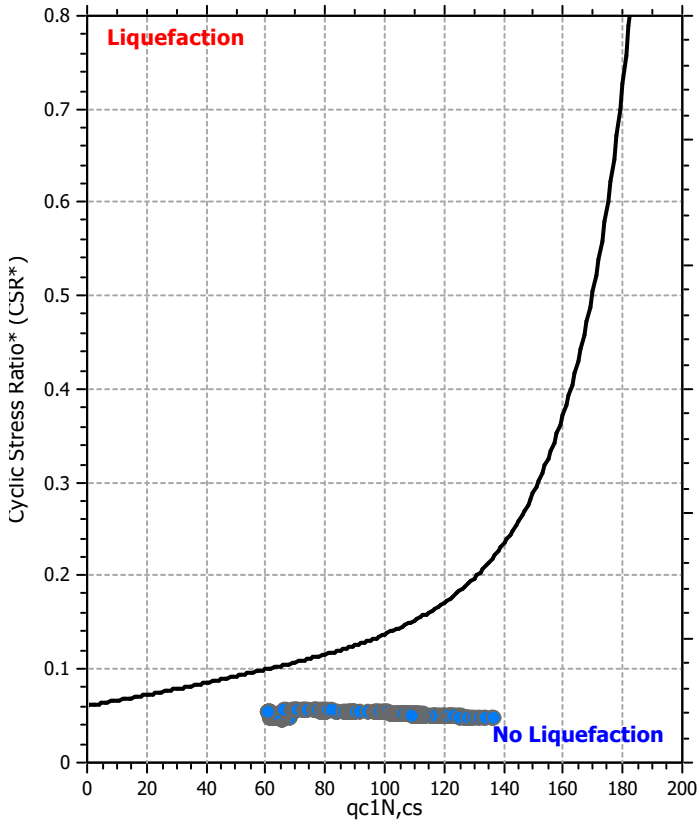
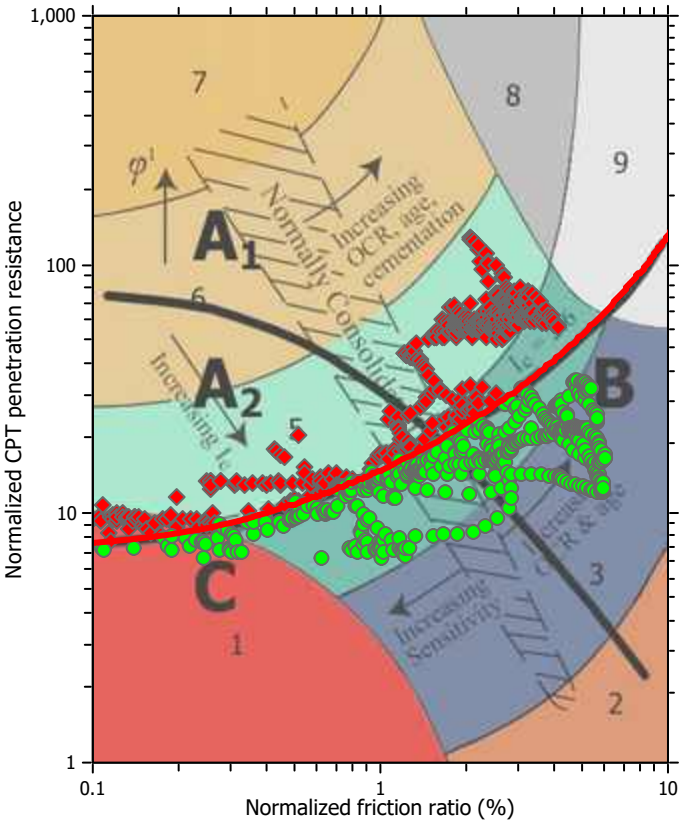
### F.S. color scheme

|                                           |                                             |
|-------------------------------------------|---------------------------------------------|
| <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          |

### LPI color scheme

|                                       |                |
|---------------------------------------|----------------|
| <span style="color: red;">■</span>    | Very high risk |
| <span style="color: orange;">■</span> | High risk      |
| <span style="color: yellow;">■</span> | Low risk       |

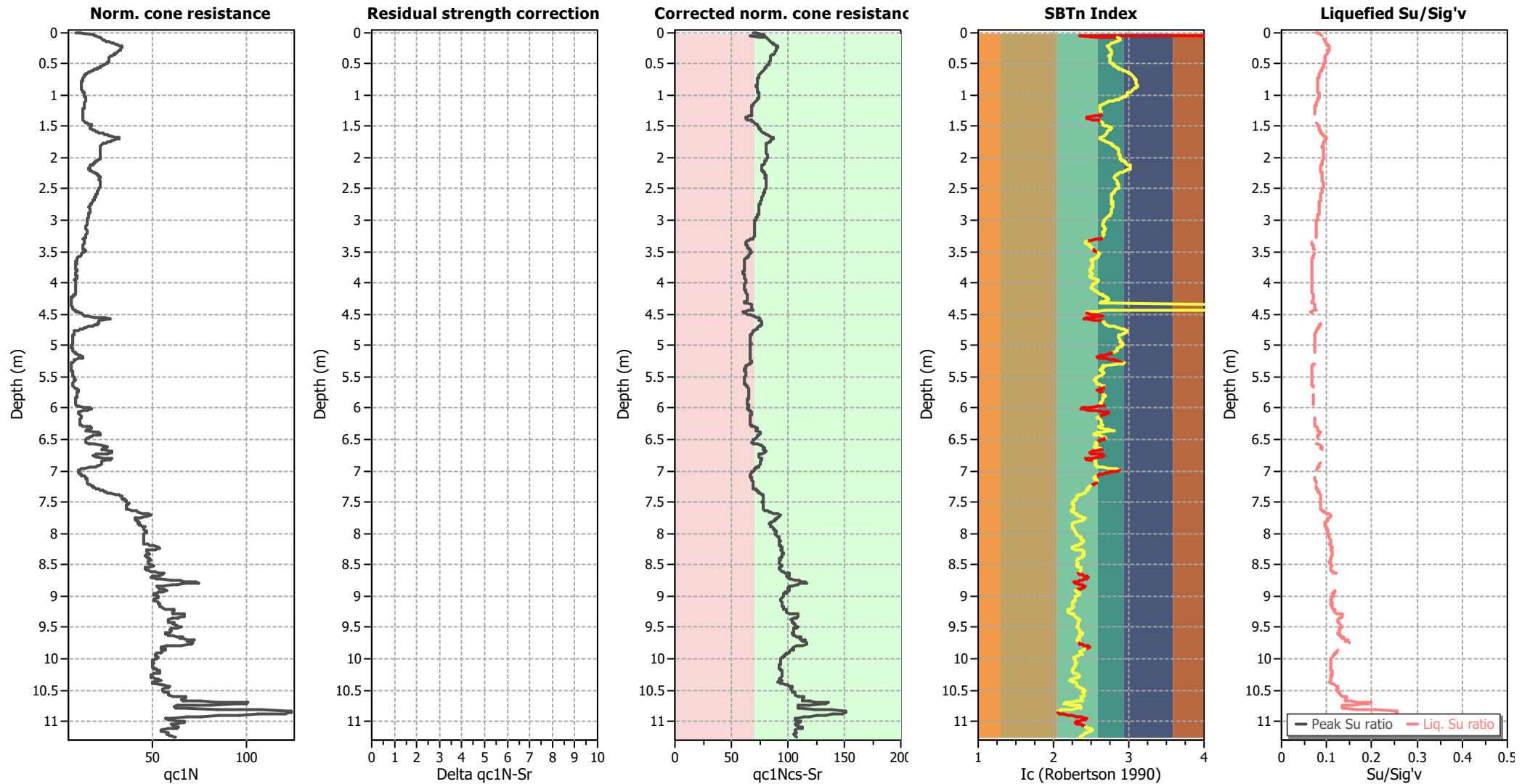
Liquefaction analysis summary plots



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: | Yes        |
| Points to test:                | Based on $I_c$ value | $I_c$ cut-off value:      | 2.60         | $K_0$ applied:              | Yes        |
| Earthquake magnitude $M_w$ :   | 6.50                 | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration:      | 0.05                 | Use fill:                 | No           | Limit depth applied:        | Yes        |
| Depth to water table (insitu): | 1.00 m               | Fill height:              | N/A          | Limit depth:                | 10.00 m    |

## Check for strength loss plots (Idriss & Boulanger (2008))



### 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: | Yes        |
| Points to test:                | Based on $I_c$ value | $I_c$ cut-off value:      | 2.60         | $K_\sigma$ applied:         | Yes        |
| Earthquake magnitude $M_w$ :   | 6.50                 | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration:      | 0.05                 | Use fill:                 | No           | Limit depth applied:        | Yes        |
| Depth to water table (insitu): | 1.00 m               | Fill height:              | N/A          | Limit depth:                | 10.00 m    |

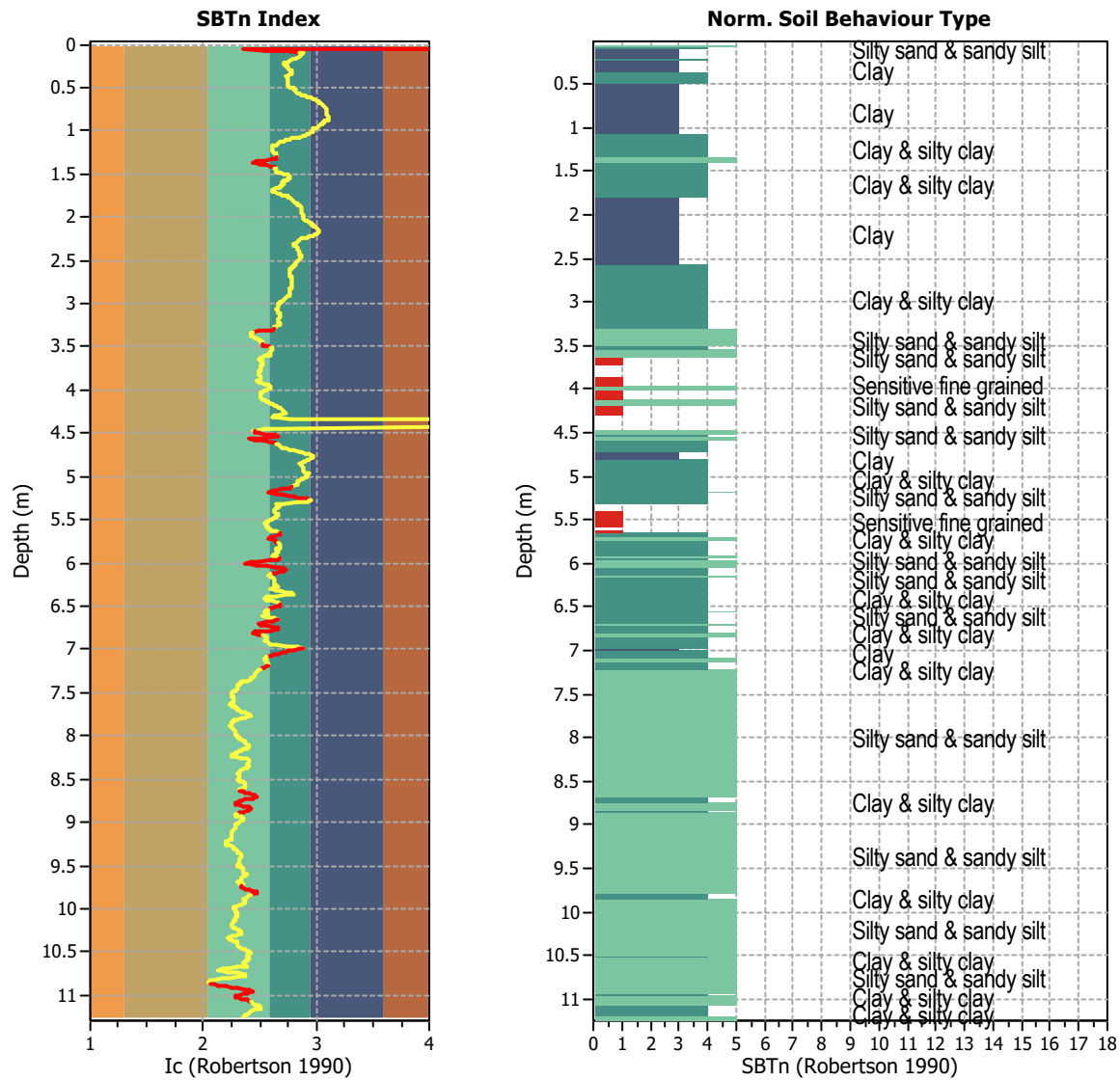
TRANSITION LAYER DETECTION ALGORITHM REPORT

Summary Details & Plots

Short description

The software will delete data when the cone is in transition from either clay to sand or vice-versa. To do this the software requires a range of  $I_c$  values over which the transition will be defined (typically somewhere between  $1.80 < I_c < 3.0$ ) and a rate of change of  $I_c$ . Transitions typically occur when the rate of change of  $I_c$  is fast (i.e.  $\Delta I_c$  is small).

The  $SBT_n$  plot below, displays in red the detected transition layers based on the parameters listed below the graphs.



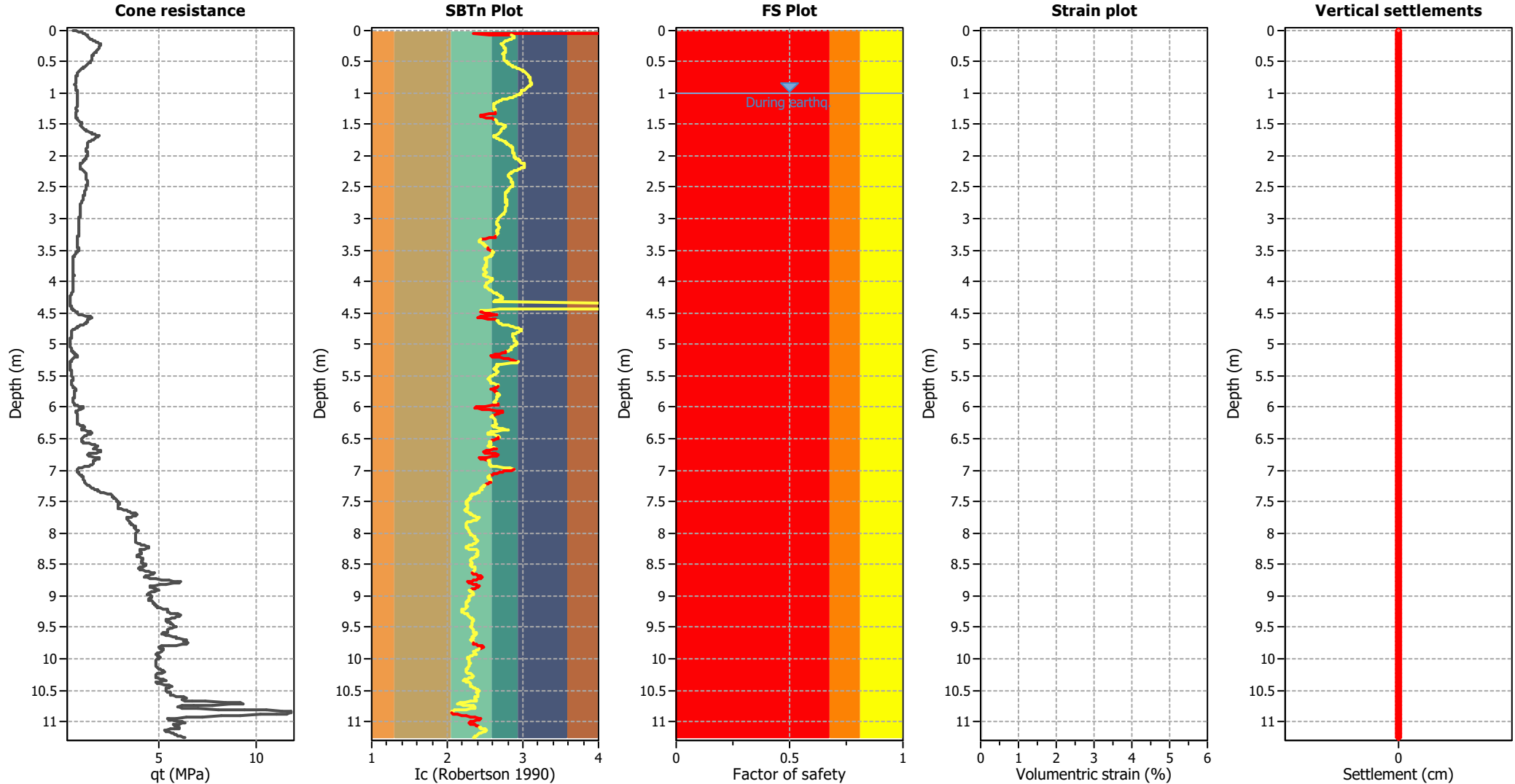
Transition layer algorithm properties

$I_c$  minimum check value: 1.70  
 $I_c$  maximum check value: 3.00  
 $I_c$  change ratio value: 0.0100  
Minimum number of points in layer: 4

General statistics

Total points in CPT file: 1125  
Total points excluded: 201  
Exclusion percentage: 17.87%  
Number of layers detected: 31

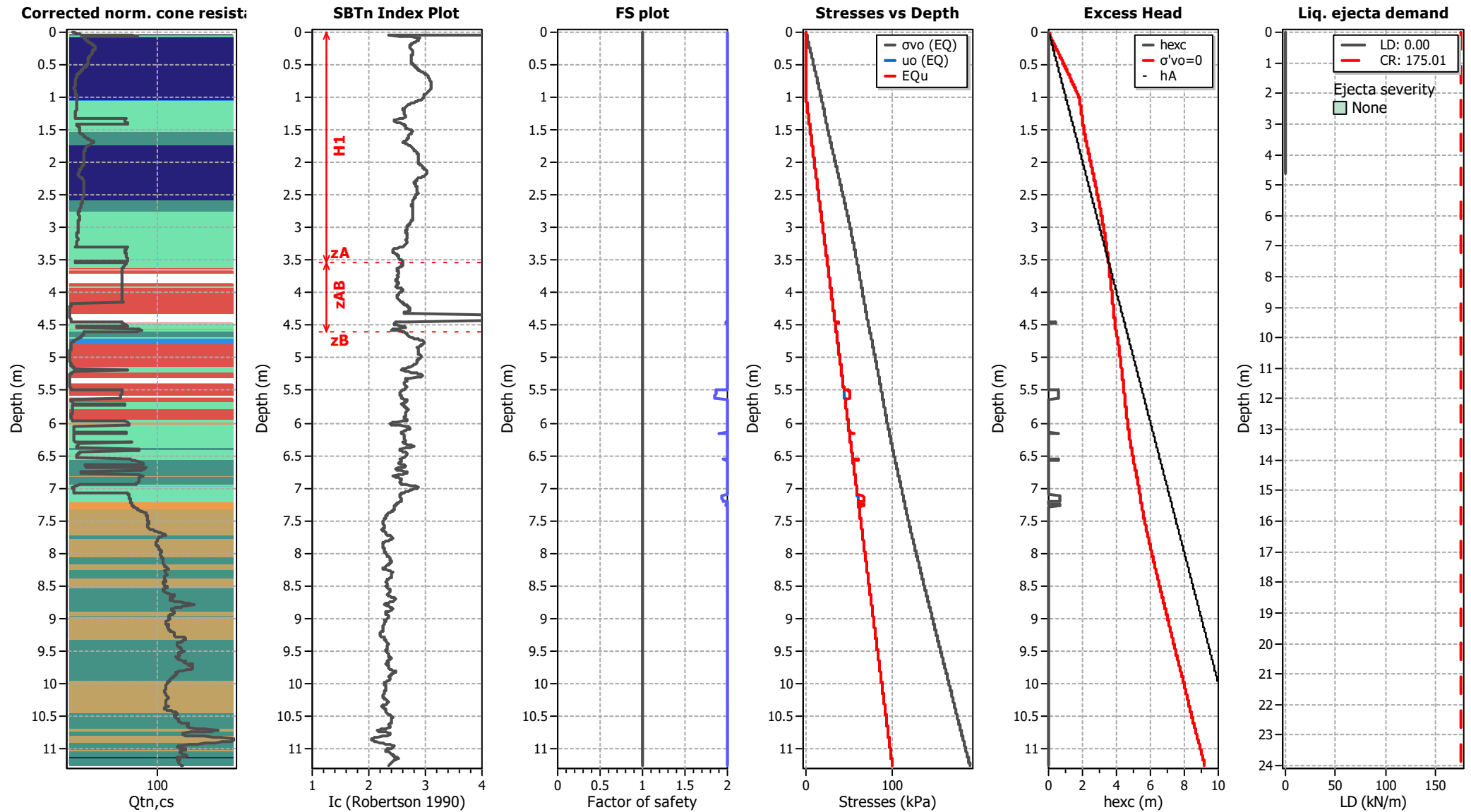
Estimation of post-earthquake settlements



Abbreviations

- q<sub>t</sub>: Total cone resistance (cone resistance q<sub>c</sub> corrected for pore water effects)
- I<sub>c</sub>: Soil Behaviour Type Index
- FS: Calculated Factor of Safety against liquefaction
- Volumetric strain: Post-liquefaction volumetric strain

## Ejecta Severity Estimation



## LIQUEFACTION ANALYSIS REPORT

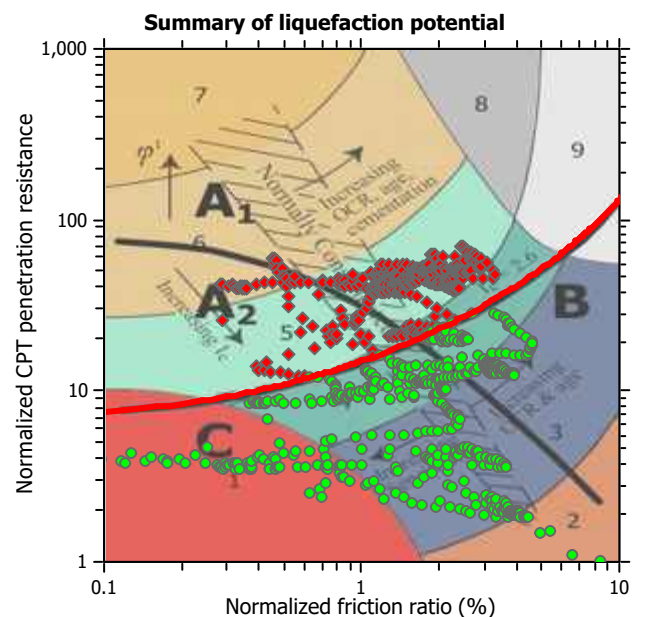
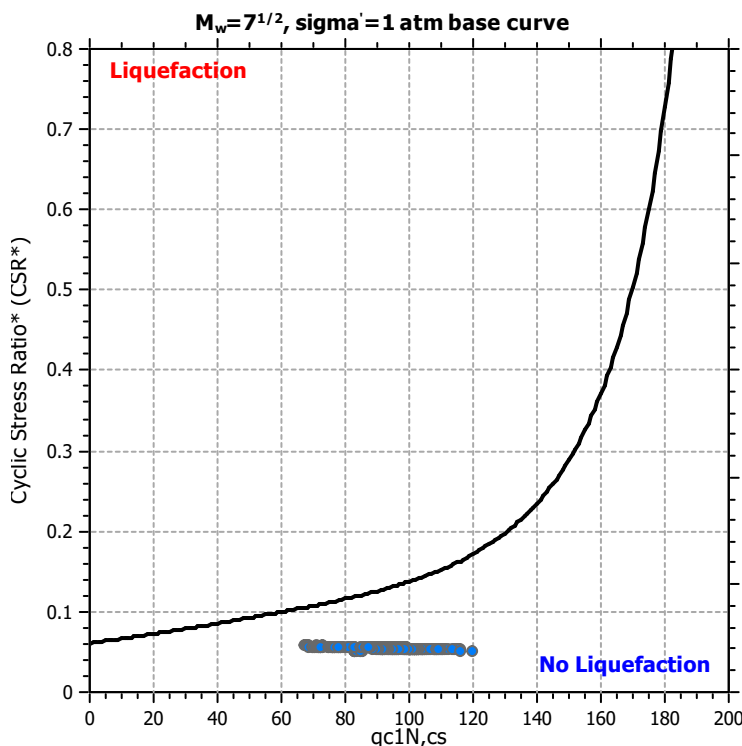
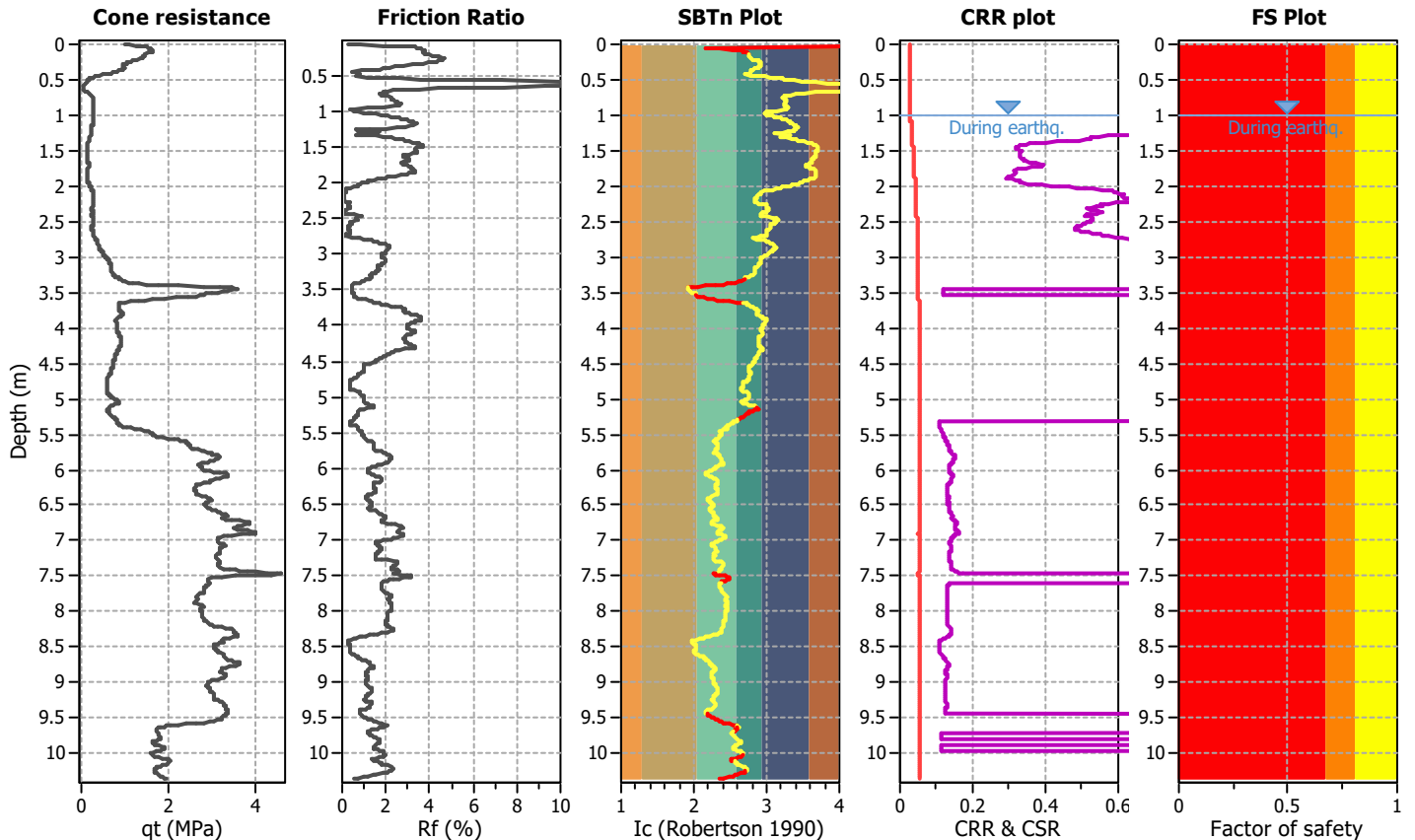
**Project title :**

**Location :**

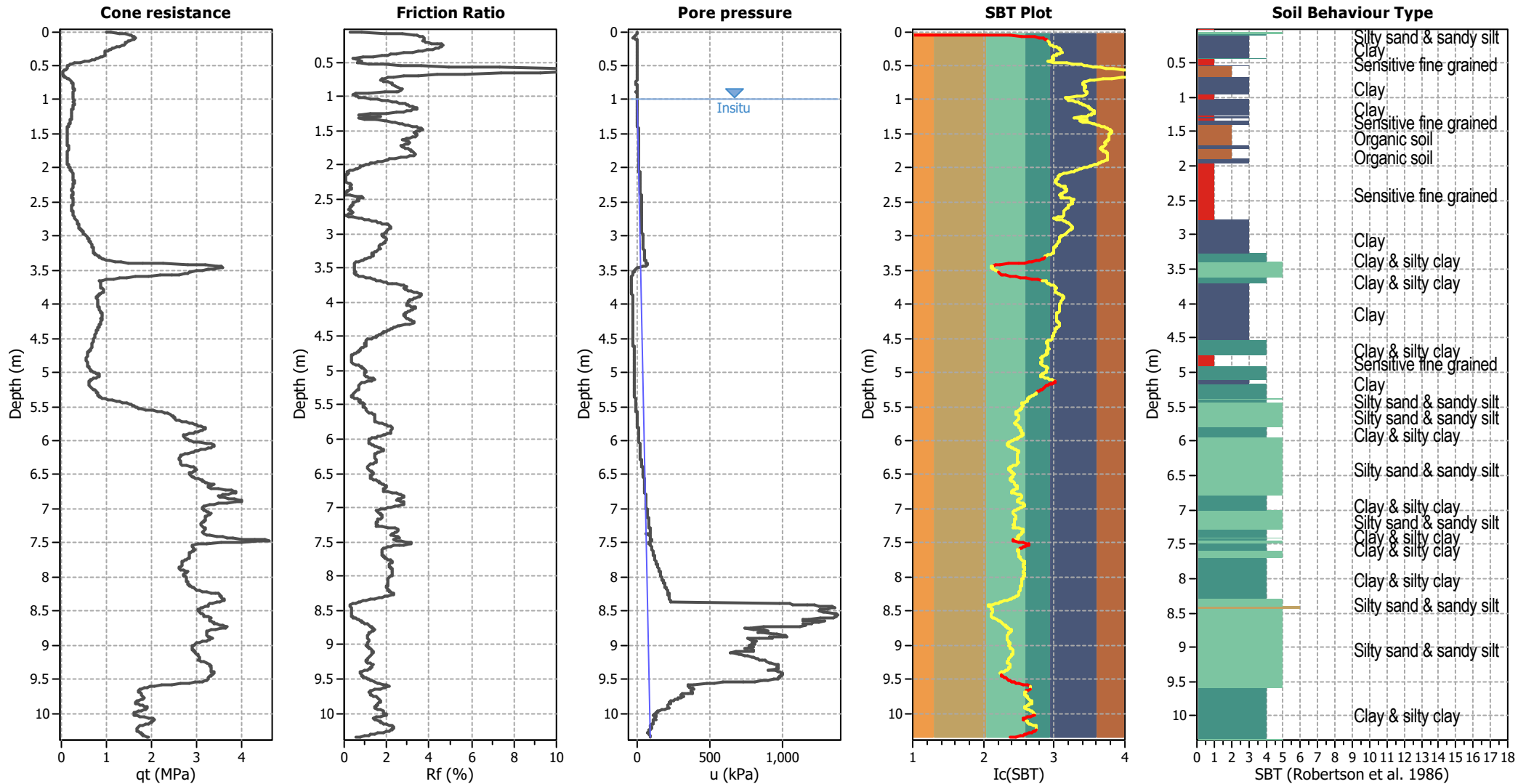
**CPT file : CPT403**

### Input parameters and analysis data

|                              |                   |                           |              |                         |     |                      |              |
|------------------------------|-------------------|---------------------------|--------------|-------------------------|-----|----------------------|--------------|
| Analysis method:             | B&I (2014)        | G.W.T. (in-situ):         | 1.00 m       | Use fill:               | No  | Clay like behavior   |              |
| Fines correction method:     | B&I (2014)        | G.W.T. (earthq.):         | 1.00 m       | Fill height:            | N/A | applied:             | Sand & Clay  |
| Points to test:              | Based on Ic value | Average results interval: | 3            | Fill weight:            | N/A | Limit depth applied: | Yes          |
| Earthquake magnitude $M_w$ : | 6.50              | Ic cut-off value:         | 2.60         | Trans. detect. applied: | Yes | Limit depth:         | 10.00 m      |
| Peak ground acceleration:    | 0.05              | Unit weight calculation:  | Based on SBT | $K_\sigma$ applied:     | Yes | MSF method:          | Method based |



CPT basic interpretation plots



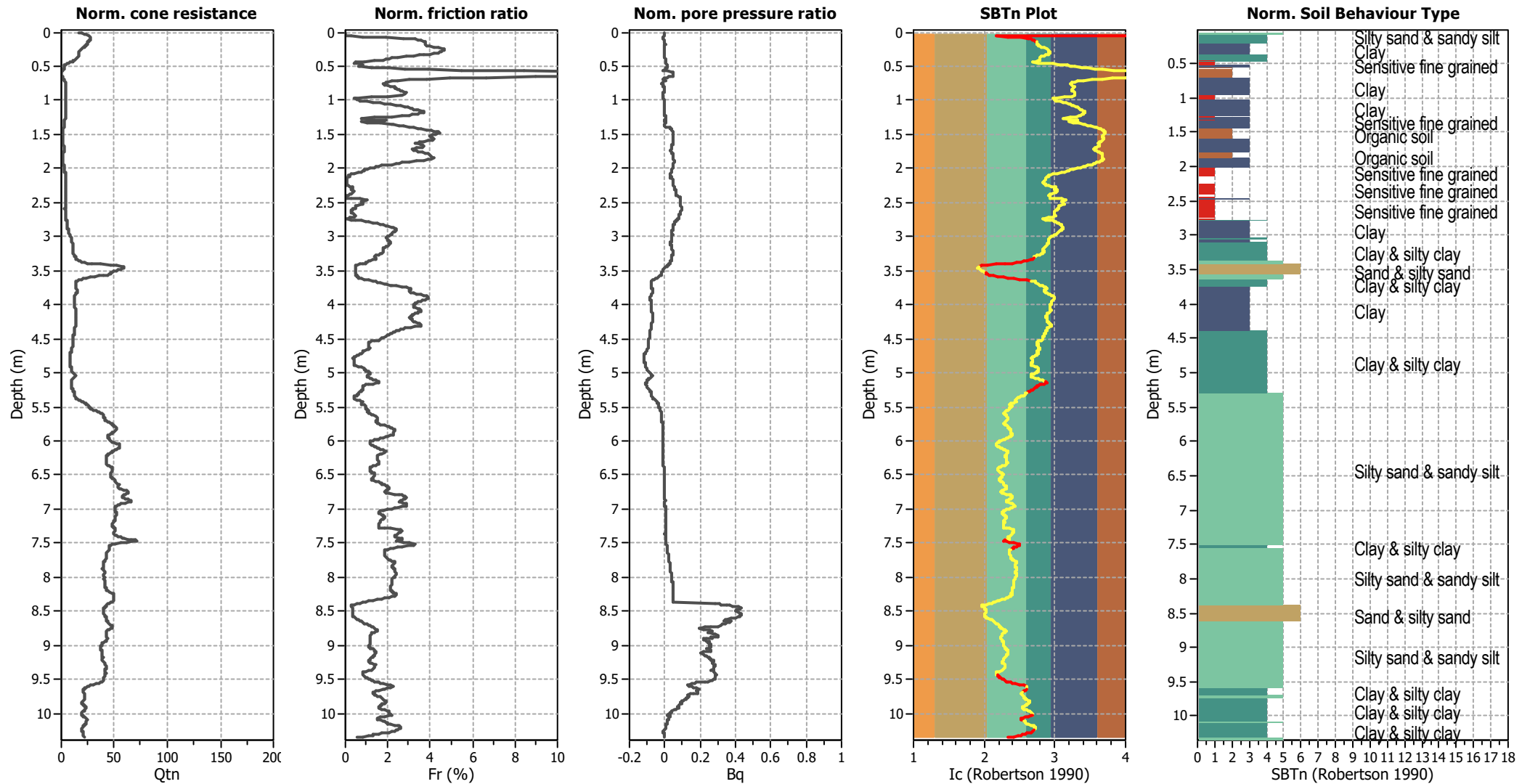
Input parameters and analysis data

|                                       |                   |                           |              |                             |             |
|---------------------------------------|-------------------|---------------------------|--------------|-----------------------------|-------------|
| 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: | Yes         |
| 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> : | 6.50              | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sand & Clay |
| Peak ground acceleration:             | 0.05              | 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 (normalized)



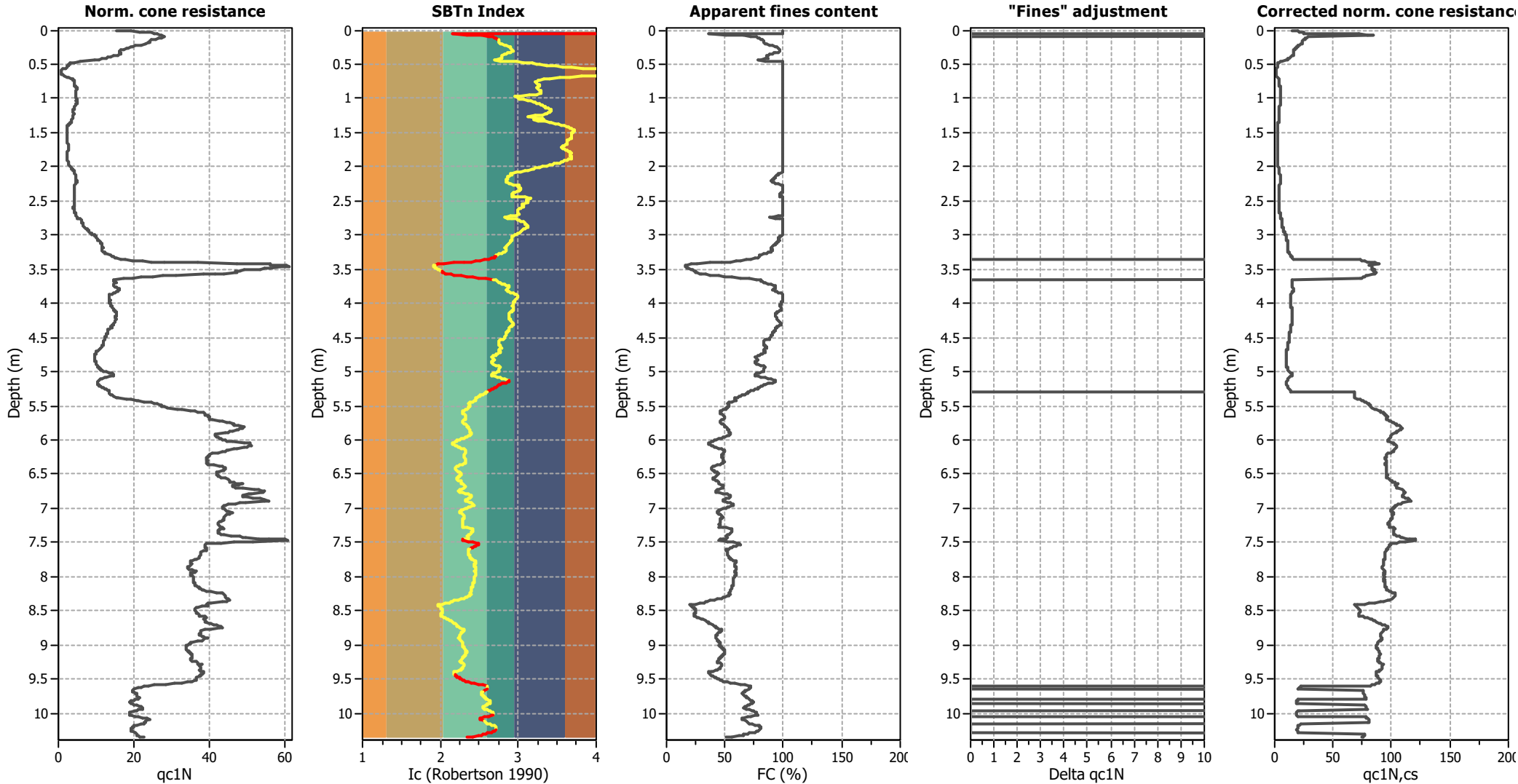
#### Input parameters and analysis data

|                                       |                   |                           |              |                             |             |
|---------------------------------------|-------------------|---------------------------|--------------|-----------------------------|-------------|
| 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: | Yes         |
| 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> : | 6.50              | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sand & Clay |
| Peak ground acceleration:             | 0.05              | Use fill:                 | No           | Limit depth applied:        | Yes         |
| Depth to water table (insitu):        | 1.00 m            | Fill height:              | N/A          | Limit depth:                | 10.00 m     |

#### SBTn 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 |

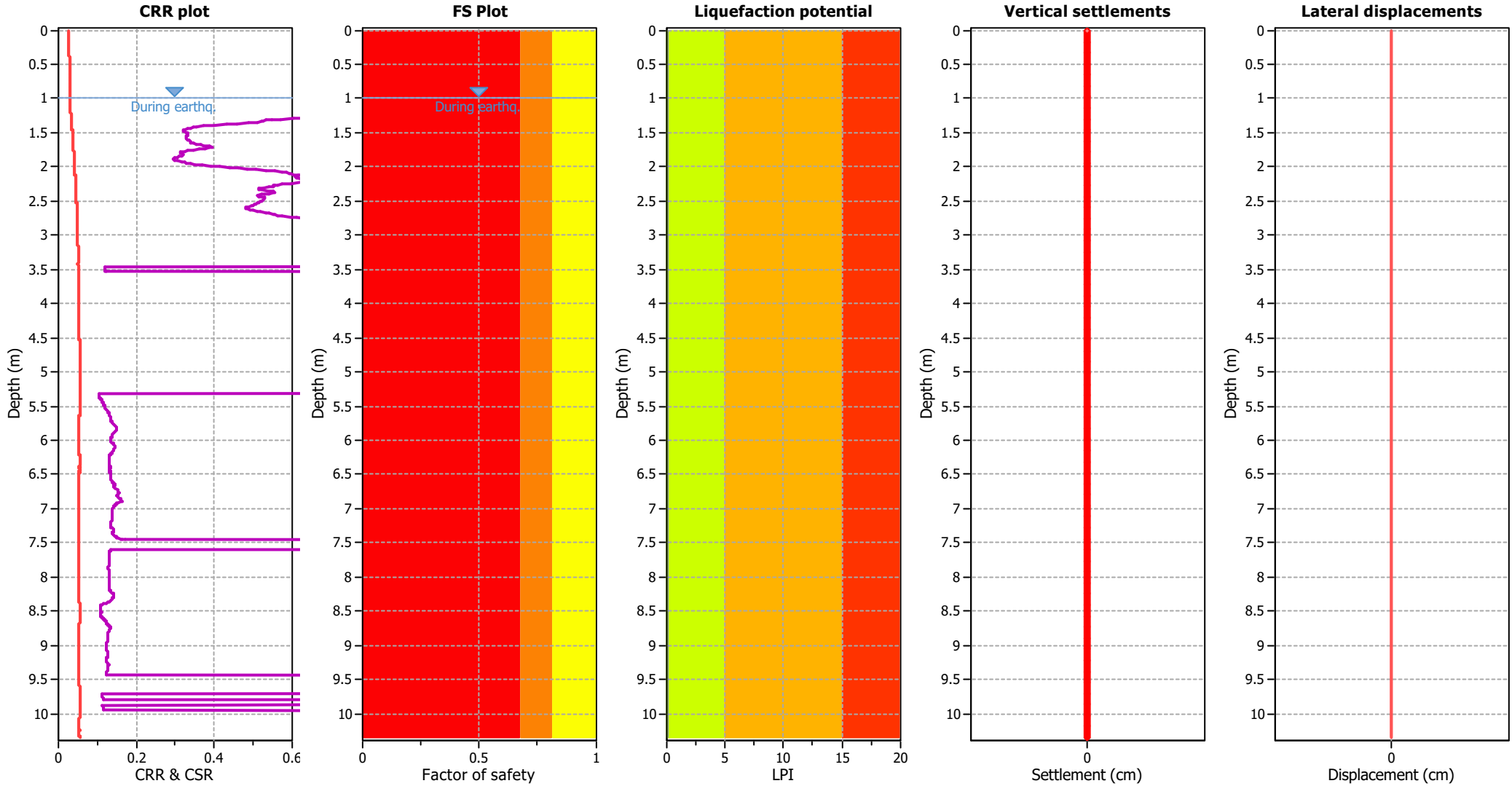
Liquefaction analysis overall plots (intermediate results)



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: | Yes         |
| Points to test:                       | Based on Ic value | Ic cut-off value:         | 2.60         | K <sub>o</sub> applied:     | Yes         |
| Earthquake magnitude M <sub>w</sub> : | 6.50              | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sand & Clay |
| Peak ground acceleration:             | 0.05              | Use fill:                 | No           | Limit depth applied:        | Yes         |
| Depth to water table (insitu):        | 1.00 m            | Fill height:              | N/A          | Limit depth:                | 10.00 m     |

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: | Yes         |
| Points to test:                | Based on Ic value | Ic cut-off value:         | 2.60         | $K_0$ applied:              | Yes         |
| Earthquake magnitude $M_w$ :   | 6.50              | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sand & Clay |
| Peak ground acceleration:      | 0.05              | Use fill:                 | No           | Limit depth applied:        | Yes         |
| Depth to water table (insitu): | 1.00 m            | Fill height:              | N/A          | Limit depth:                | 10.00 m     |

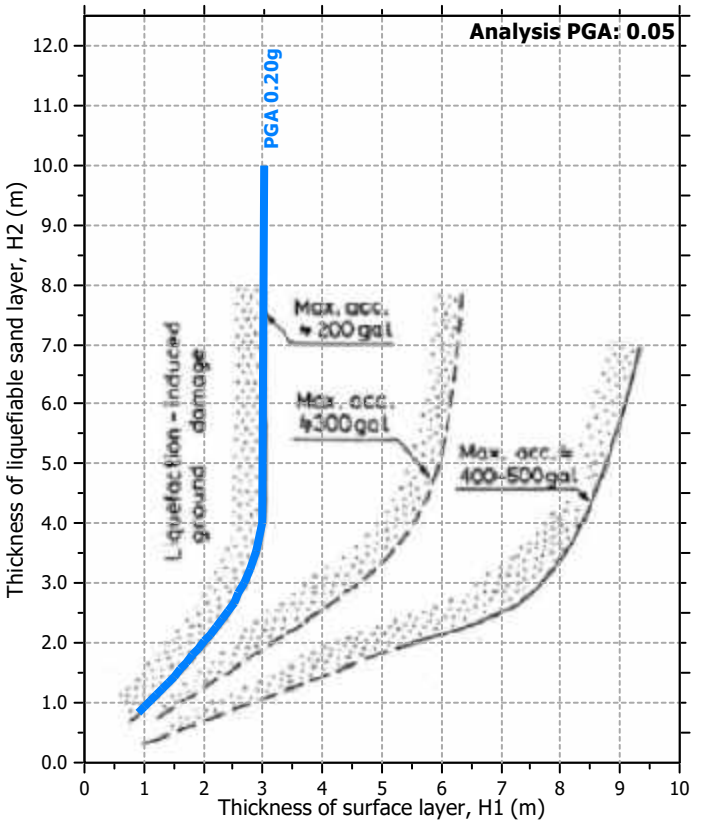
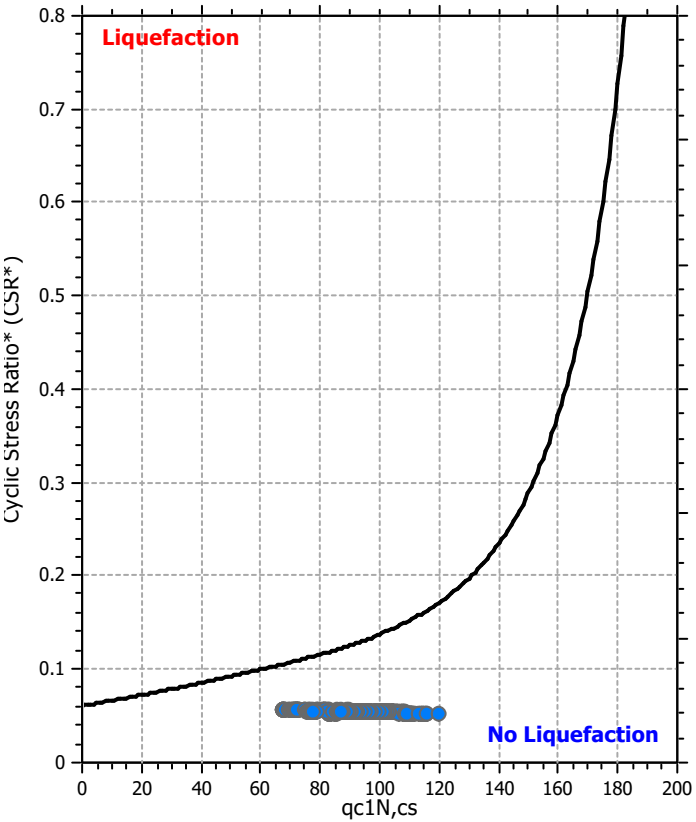
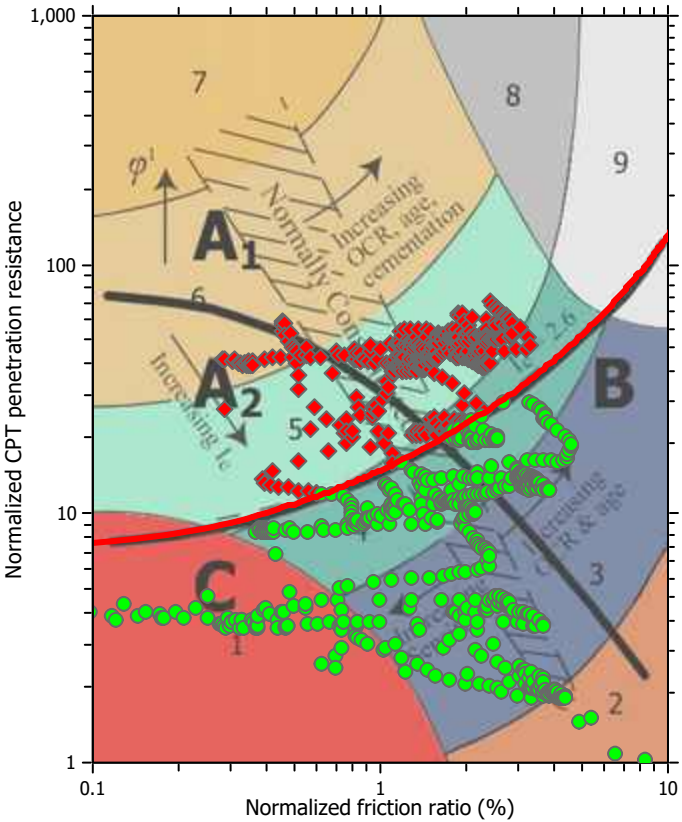
F.S. color scheme

|             |                                             |
|-------------|---------------------------------------------|
| Red         | Almost certain it will liquefy              |
| Orange      | Very likely to liquefy                      |
| Yellow      | Liquefaction and no liq. are equally likely |
| Light green | Unlike to liquefy                           |
| Dark green  | Almost certain it will not liquefy          |

LPI color scheme

|        |                |
|--------|----------------|
| Red    | Very high risk |
| Orange | High risk      |
| Yellow | Low risk       |

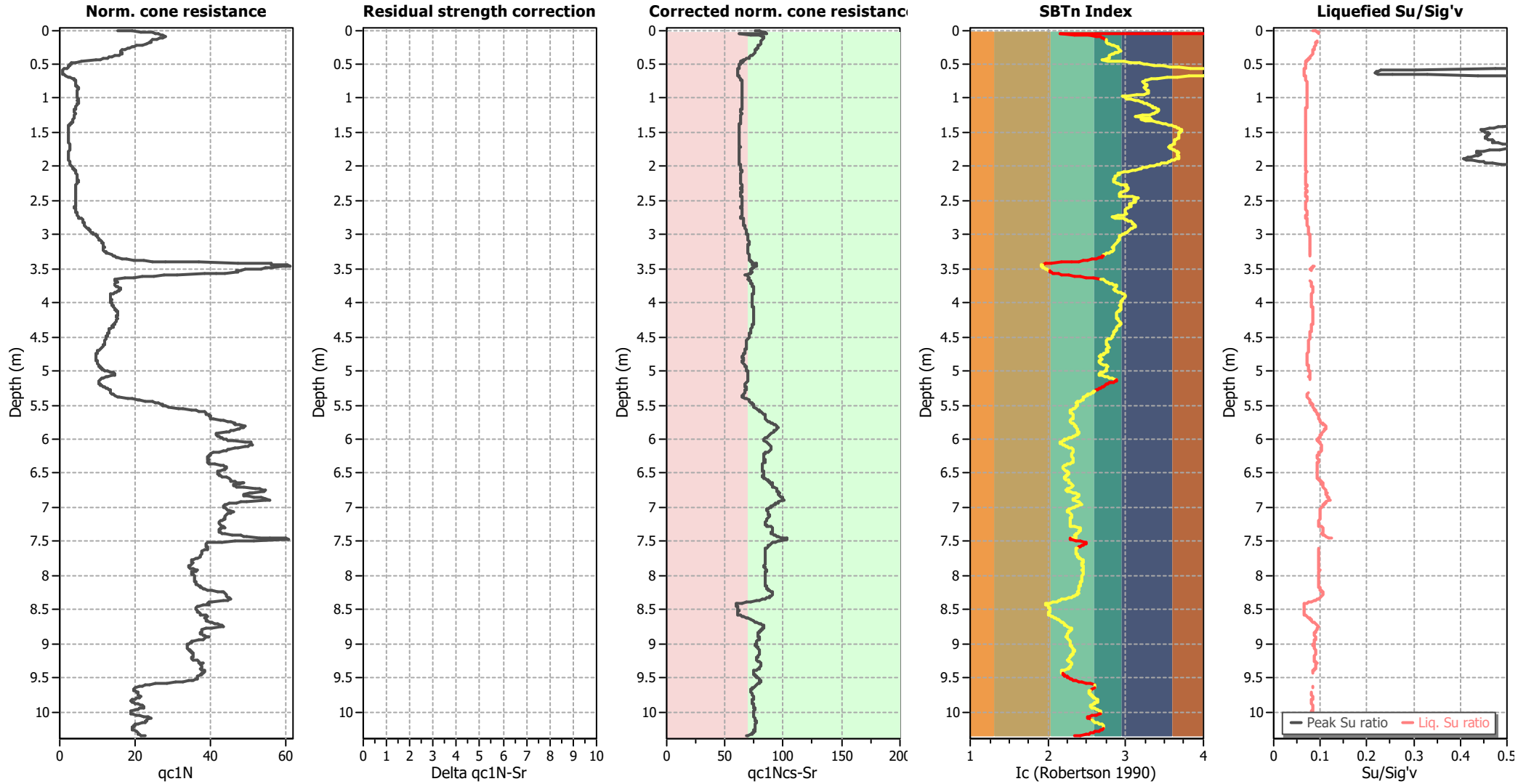
Liquefaction analysis summary plots



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: | Yes         |
| Points to test:                | Based on $I_c$ value | $I_c$ cut-off value:      | 2.60         | $K_0$ applied:              | Yes         |
| Earthquake magnitude $M_w$ :   | 6.50                 | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sand & Clay |
| Peak ground acceleration:      | 0.05                 | Use fill:                 | No           | Limit depth applied:        | Yes         |
| Depth to water table (insitu): | 1.00 m               | Fill height:              | N/A          | Limit depth:                | 10.00 m     |

Check for strength loss plots (Idriss & Boulanger (2008))



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: | Yes         |
| Points to test:                       | Based on Ic value | Ic cut-off value:         | 2.60         | K <sub>o</sub> applied:     | Yes         |
| Earthquake magnitude M <sub>w</sub> : | 6.50              | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sand & Clay |
| Peak ground acceleration:             | 0.05              | Use fill:                 | No           | Limit depth applied:        | Yes         |
| Depth to water table (insitu):        | 1.00 m            | Fill height:              | N/A          | Limit depth:                | 10.00 m     |

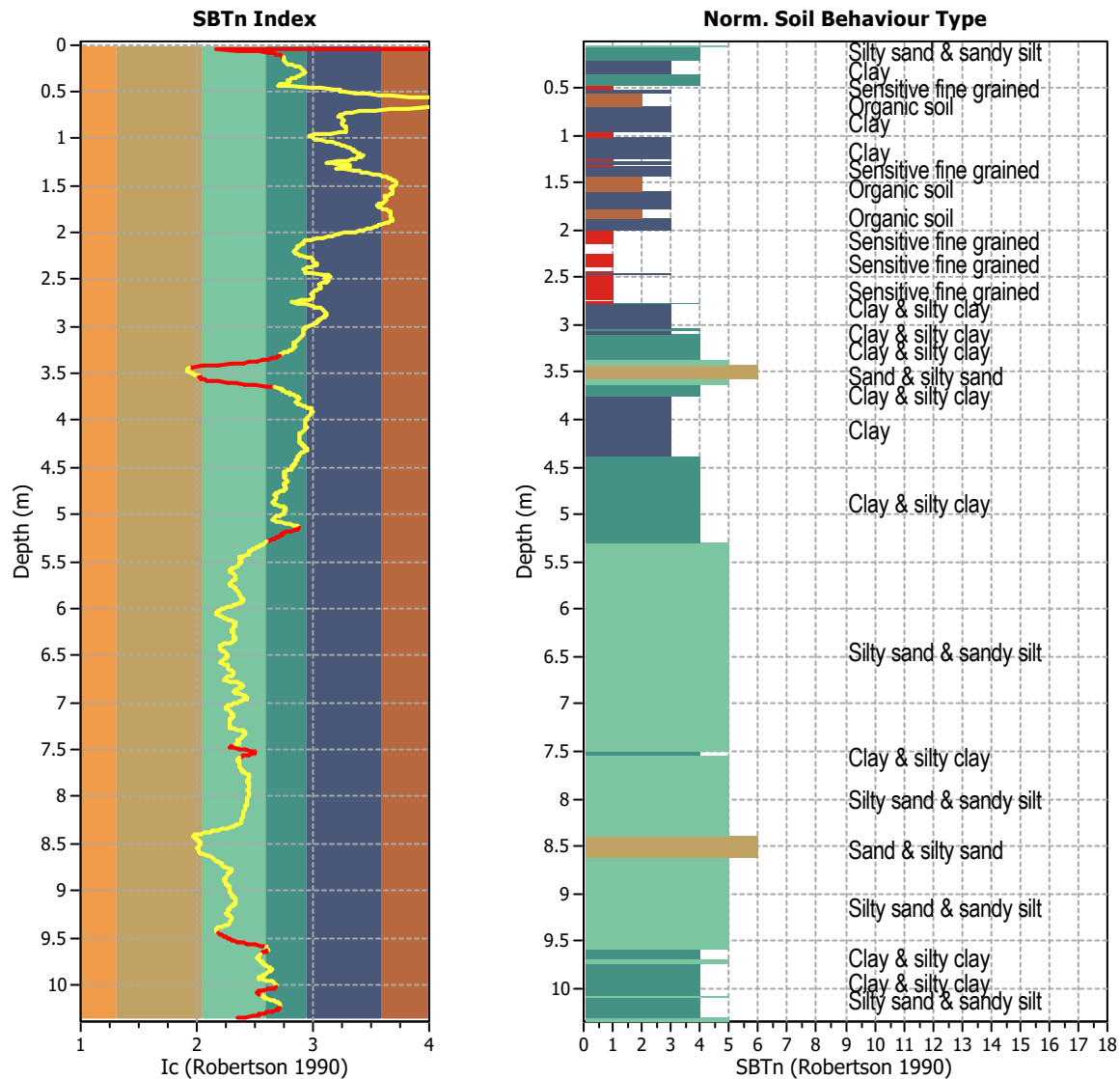
TRANSITION LAYER DETECTION ALGORITHM REPORT

Summary Details & Plots

Short description

The software will delete data when the cone is in transition from either clay to sand or vice-versa. To do this the software requires a range of  $I_c$  values over which the transition will be defined (typically somewhere between  $1.80 < I_c < 3.0$ ) and a rate of change of  $I_c$ . Transitions typically occur when the rate of change of  $I_c$  is fast (i.e.  $\Delta I_c$  is small).

The  $SBT_n$  plot below, displays in red the detected transition layers based on the parameters listed below the graphs.

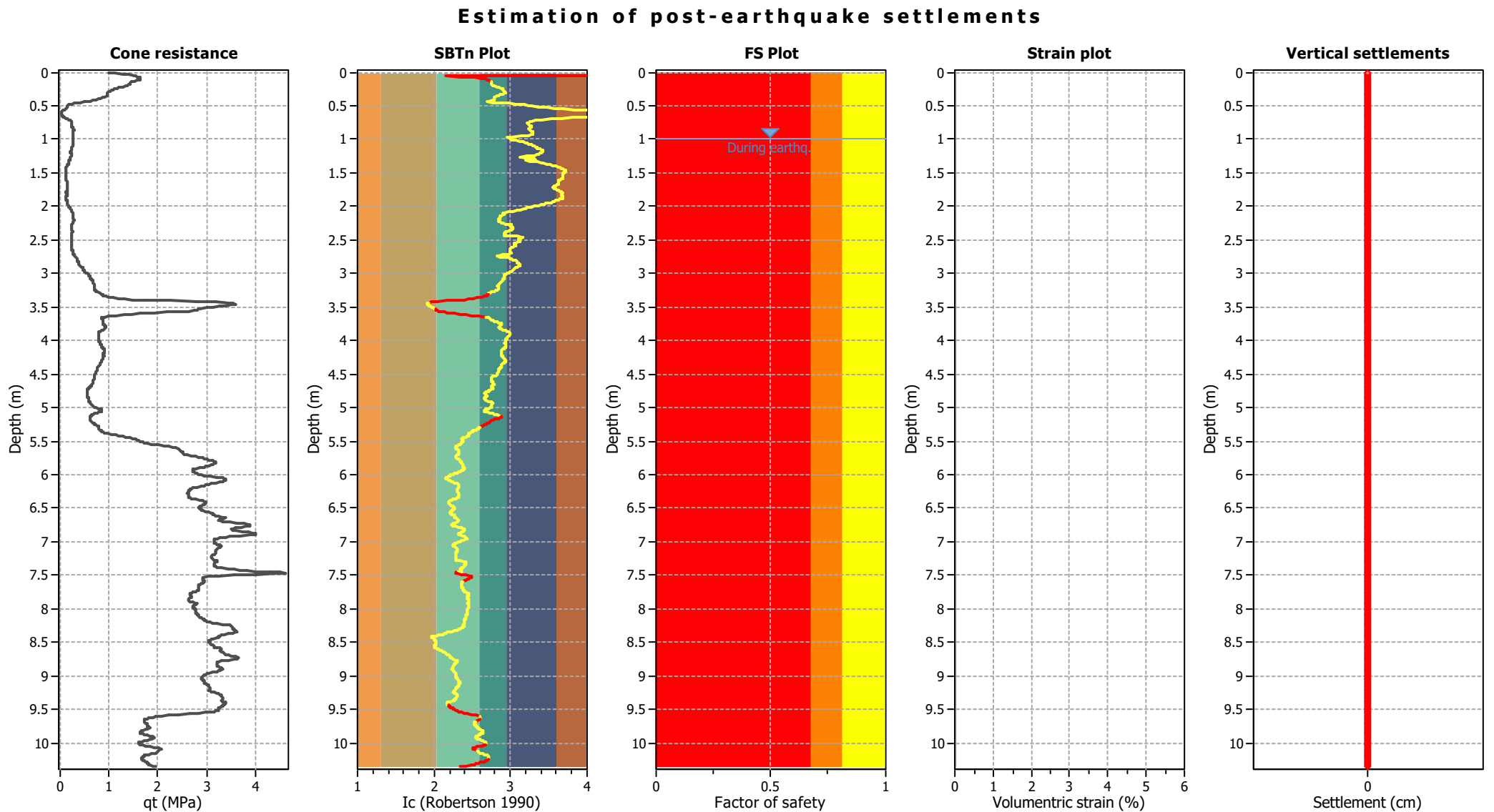


Transition layer algorithm properties

$I_c$  minimum check value: 1.70  
 $I_c$  maximum check value: 3.00  
 $I_c$  change ratio value: 0.0100  
Minimum number of points in layer: 4

General statistics

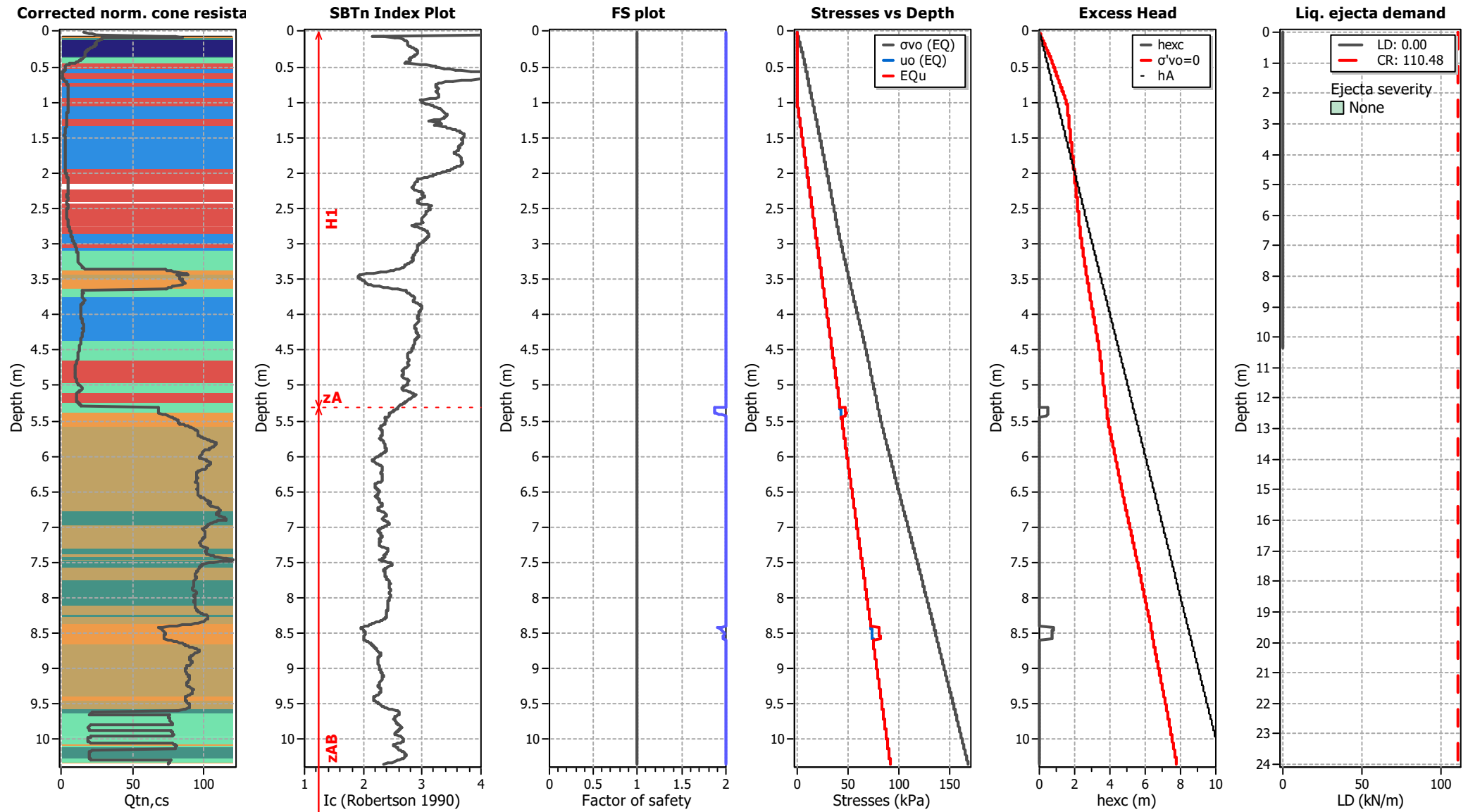
Total points in CPT file: 1035  
Total points excluded: 111  
Exclusion percentage: 10.72%  
Number of layers detected: 11



Abbreviations

- q<sub>c</sub>: Total cone resistance (cone resistance q<sub>c</sub> corrected for pore water effects)
- I<sub>c</sub>: Soil Behaviour Type Index
- FS: Calculated Factor of Safety against liquefaction
- Volumetric strain: Post-liquefaction volumetric strain

## Ejecta Severity Estimation



## LIQUEFACTION ANALYSIS REPORT

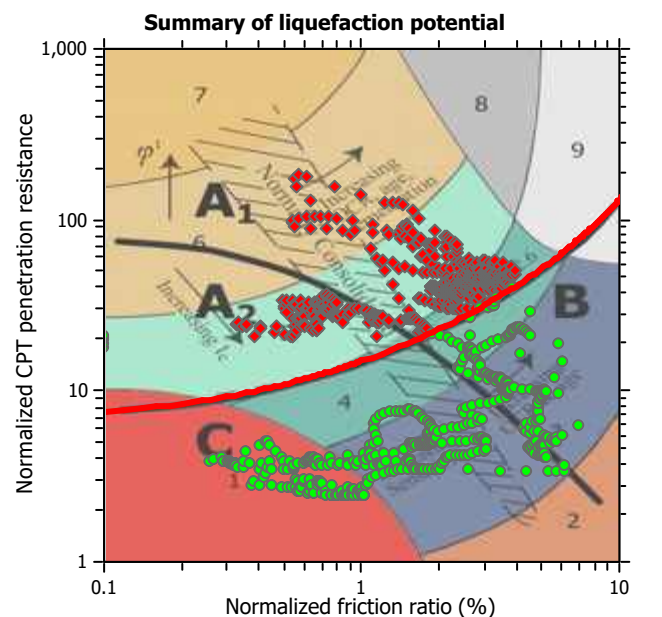
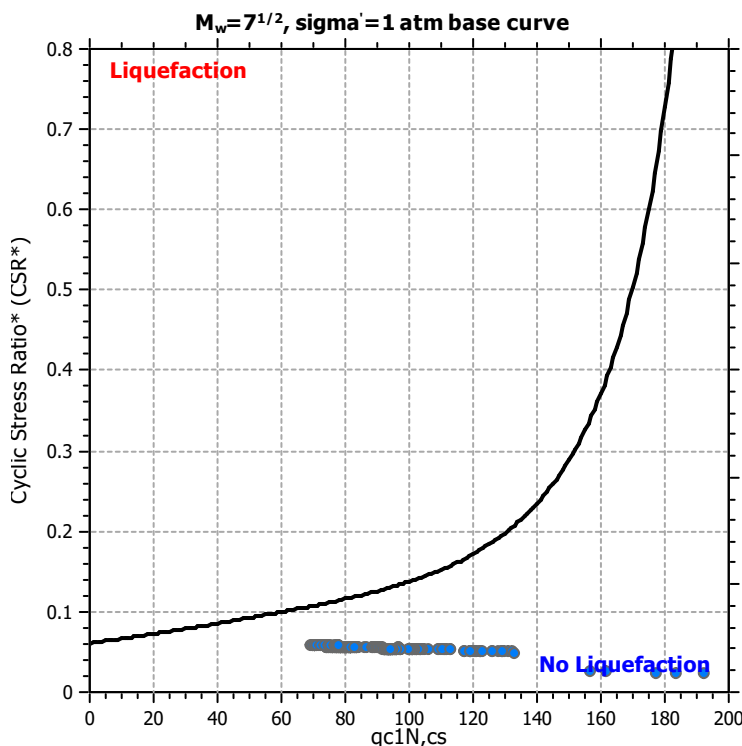
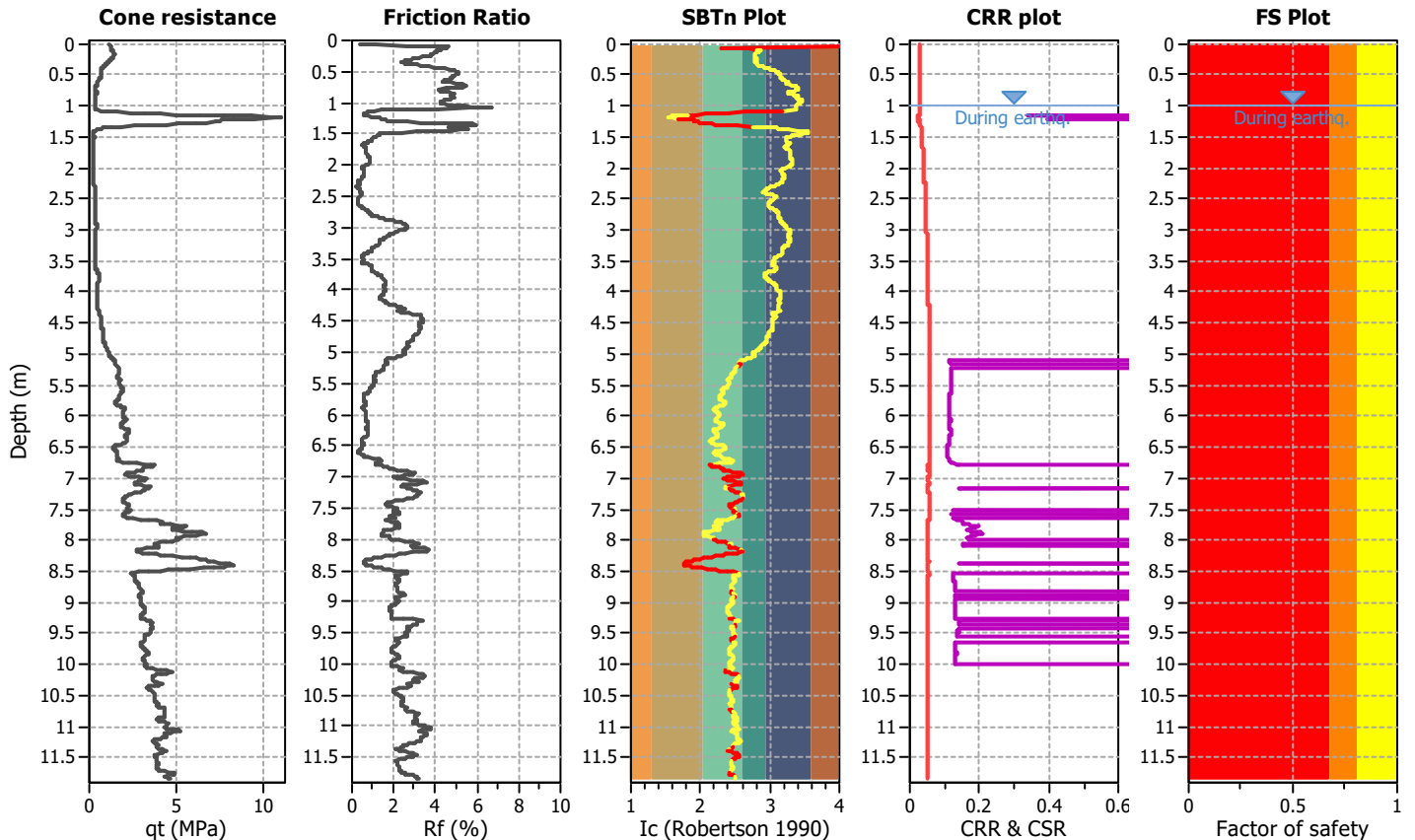
**Project title :**

**Location :**

**CPT file : CPT404**

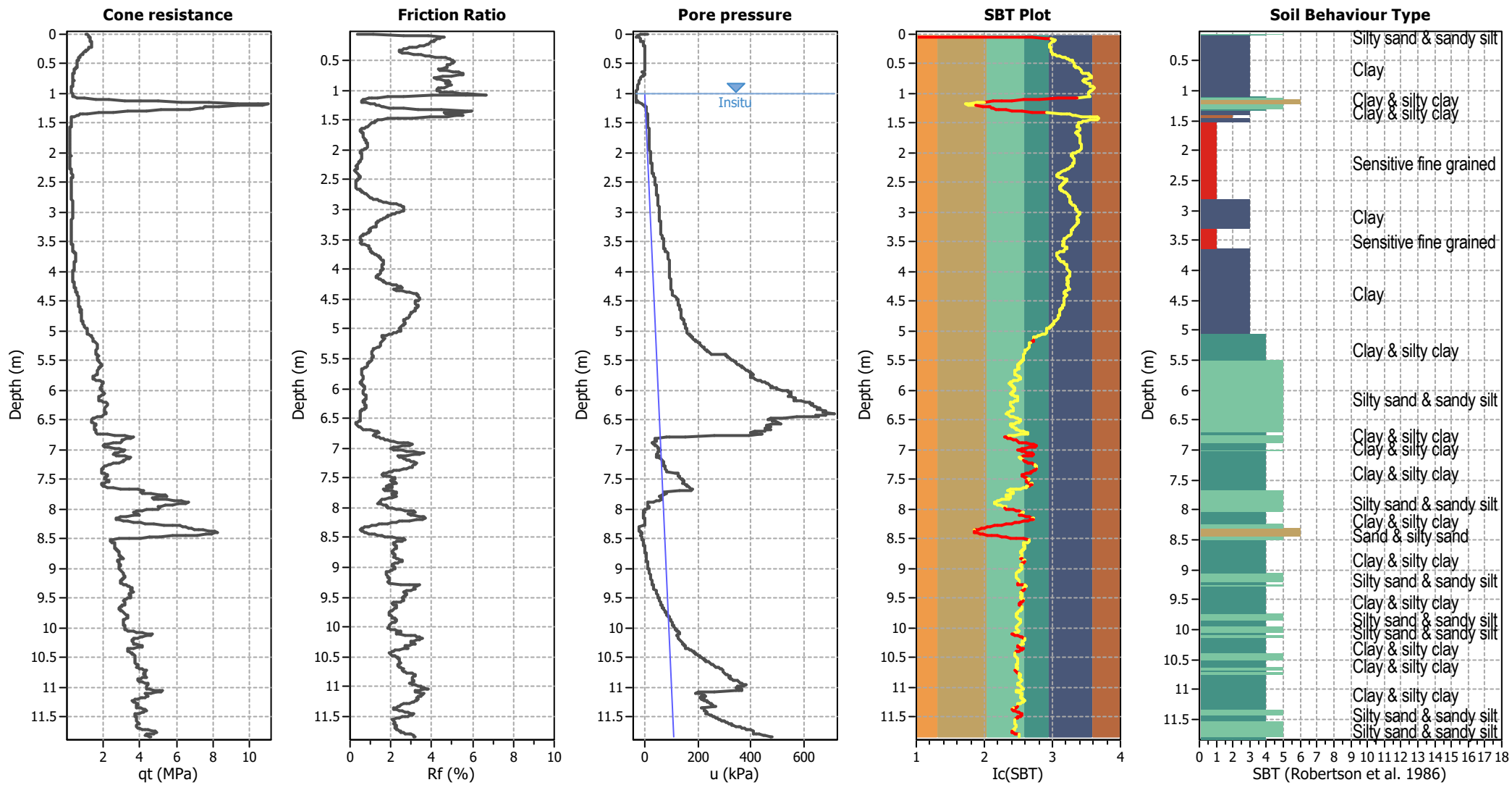
### Input parameters and analysis data

|                              |                   |                           |              |                         |     |                      |              |
|------------------------------|-------------------|---------------------------|--------------|-------------------------|-----|----------------------|--------------|
| Analysis method:             | B&I (2014)        | G.W.T. (in-situ):         | 1.00 m       | Use fill:               | No  | Clay like behavior   |              |
| Fines correction method:     | B&I (2014)        | G.W.T. (earthq.):         | 1.00 m       | Fill height:            | N/A | applied:             | Sands only   |
| Points to test:              | Based on Ic value | Average results interval: | 3            | Fill weight:            | N/A | Limit depth applied: | Yes          |
| Earthquake magnitude $M_w$ : | 6.50              | Ic cut-off value:         | 2.60         | Trans. detect. applied: | Yes | Limit depth:         | 10.00 m      |
| Peak ground acceleration:    | 0.05              | Unit weight calculation:  | Based on SBT | $K_0$ applied:          | Yes | MSF method:          | Method based |



Zone A<sub>1</sub>: Cyclic liquefaction likely depending on size and duration of cyclic loading  
Zone A<sub>2</sub>: Cyclic liquefaction and strength loss likely depending on loading and ground geometry  
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening  
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots

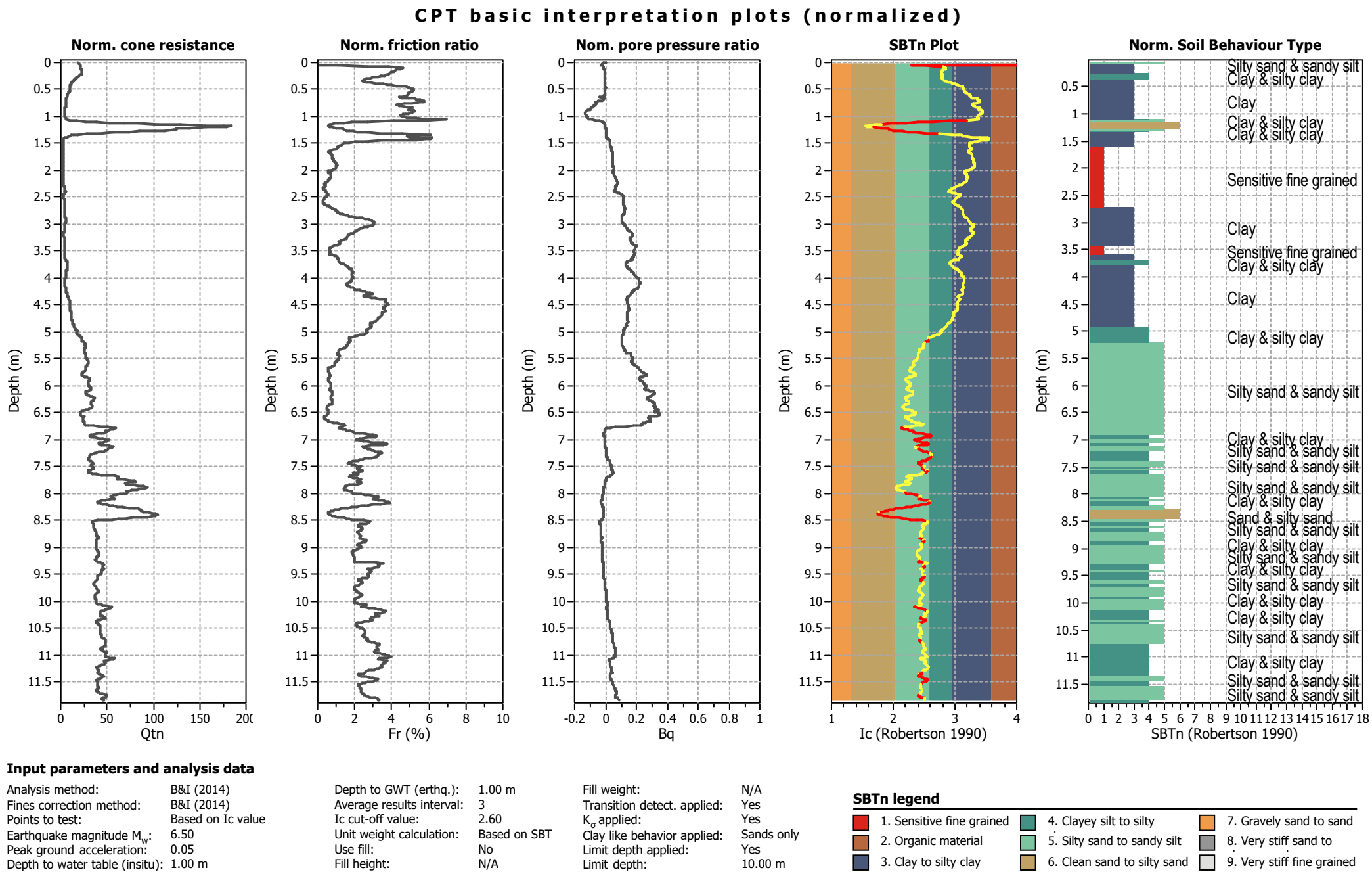


Input parameters and analysis data

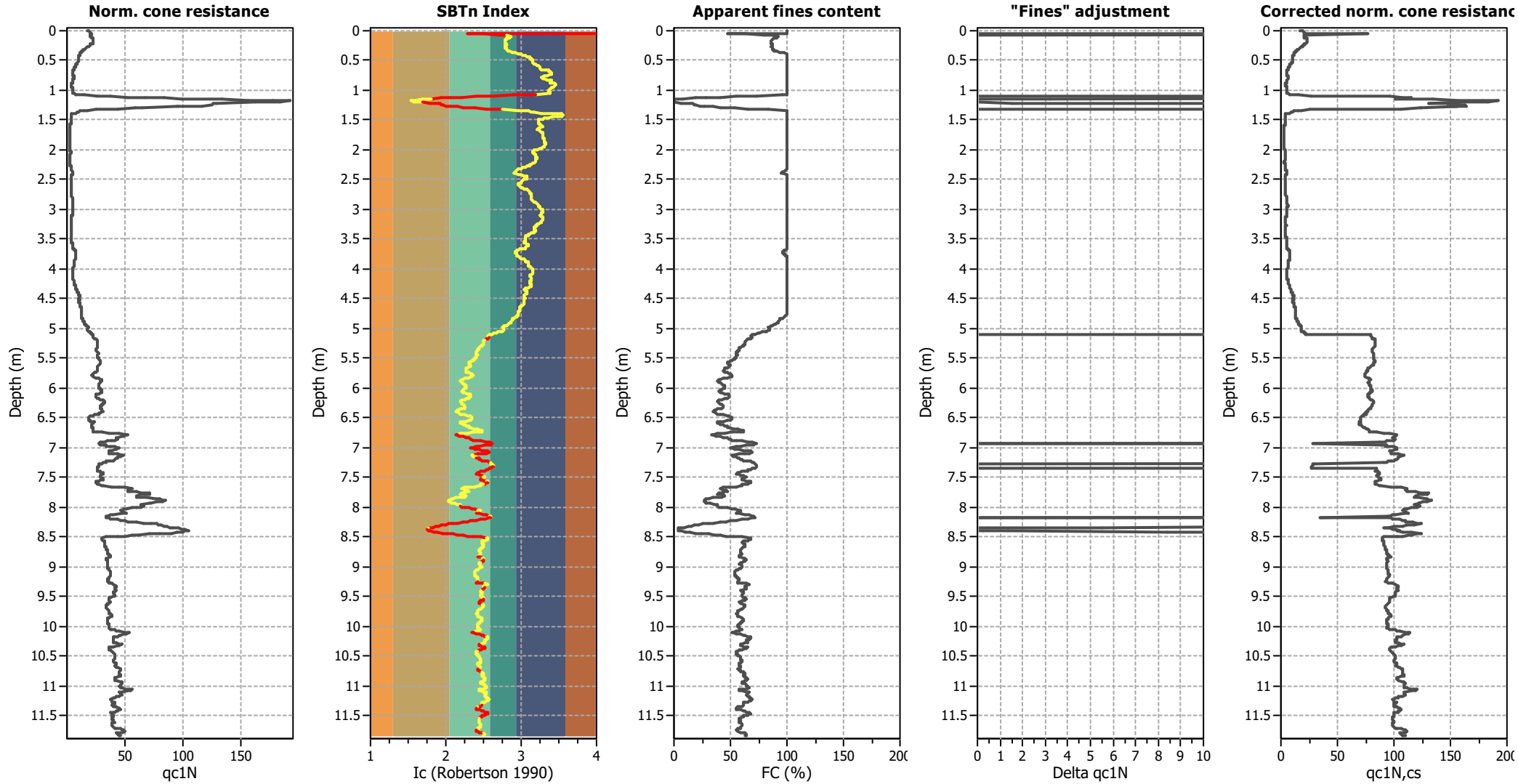
|                                       |                   |                           |              |                             |            |
|---------------------------------------|-------------------|---------------------------|--------------|-----------------------------|------------|
| Analysis 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: | Yes        |
| 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> : | 6.50              | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration:             | 0.05              | 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 |



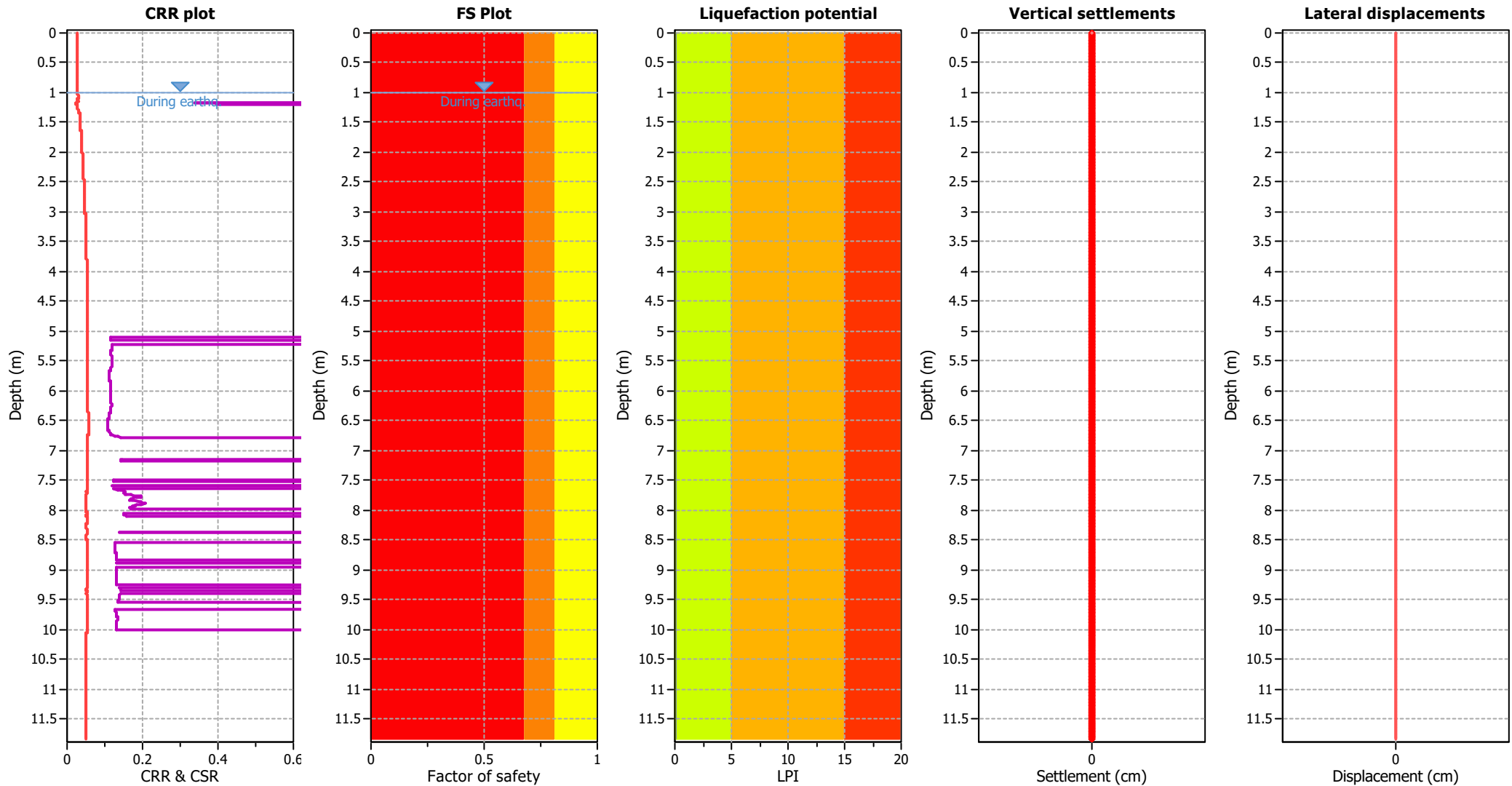
Liquefaction analysis overall plots (intermediate results)



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: | Yes        |
| Points to test:                       | Based on Ic value | Ic cut-off value:         | 2.60         | K <sub>o</sub> applied:     | Yes        |
| Earthquake magnitude M <sub>w</sub> : | 6.50              | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration:             | 0.05              | Use fill:                 | No           | Limit depth applied:        | Yes        |
| Depth to water table (insitu):        | 1.00 m            | Fill height:              | N/A          | Limit depth:                | 10.00 m    |

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: | Yes        |
| Points to test:                       | Based on Ic value | Ic cut-off value:         | 2.60         | K <sub>o</sub> applied:     | Yes        |
| Earthquake magnitude M <sub>w</sub> : | 6.50              | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration:             | 0.05              | Use fill:                 | No           | Limit depth applied:        | Yes        |
| Depth to water table (insitu):        | 1.00 m            | Fill height:              | N/A          | Limit depth:                | 10.00 m    |

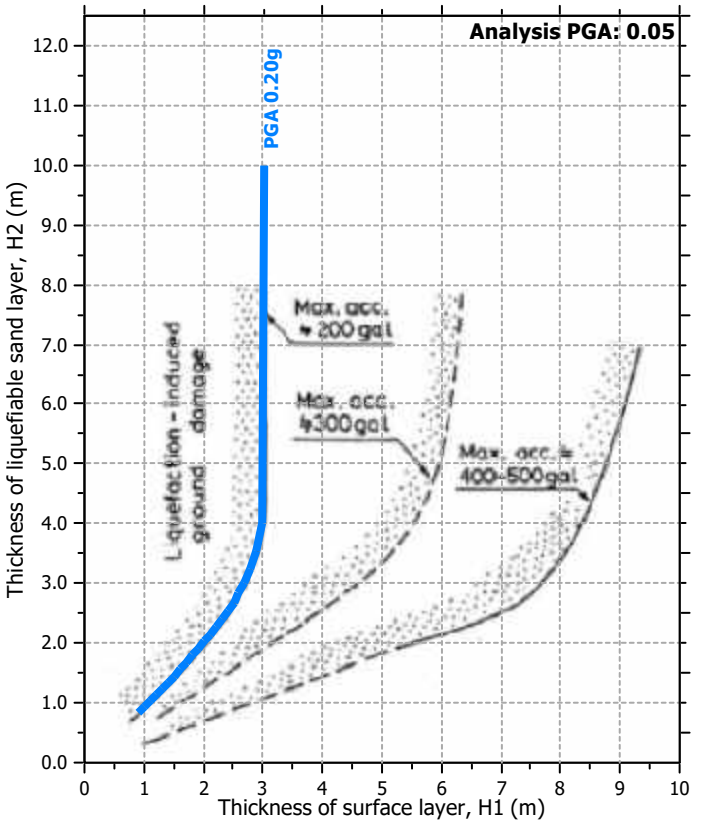
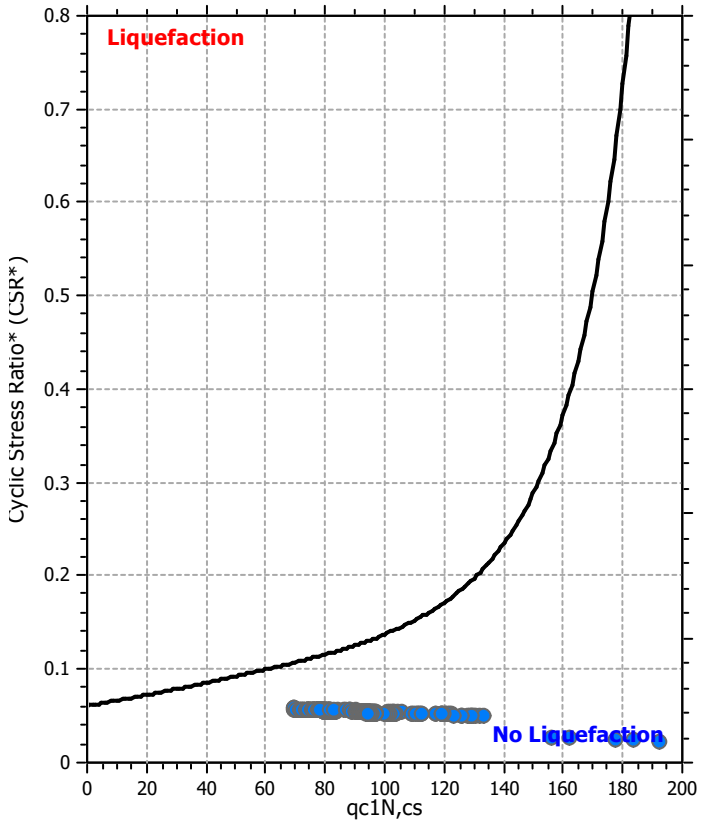
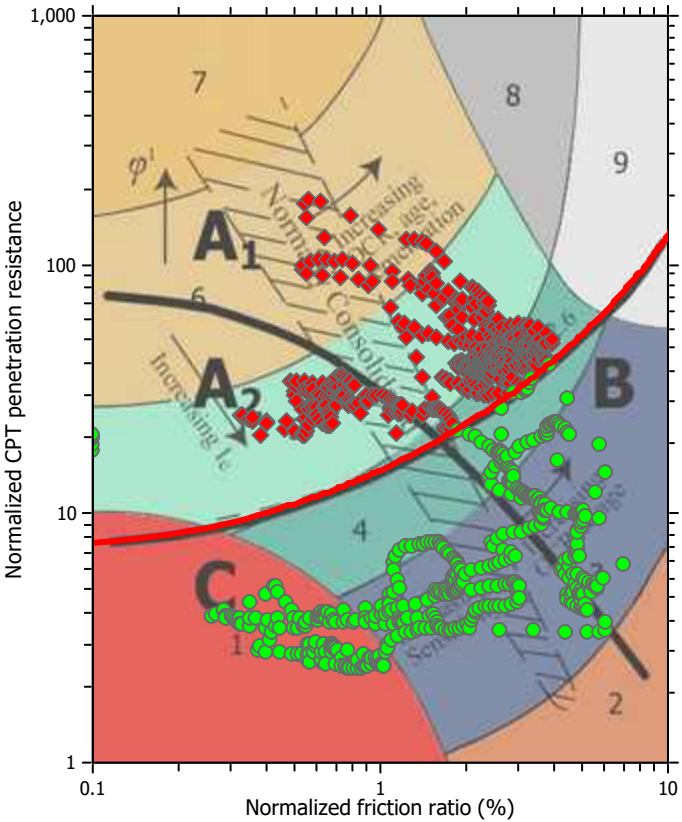
F.S. color scheme

|             |                                             |
|-------------|---------------------------------------------|
| Red         | Almost certain it will liquefy              |
| Orange      | Very likely to liquefy                      |
| Yellow      | Liquefaction and no liq. are equally likely |
| Light green | Unlike to liquefy                           |
| Dark green  | Almost certain it will not liquefy          |

LPI color scheme

|        |                |
|--------|----------------|
| Red    | Very high risk |
| Orange | High risk      |
| Yellow | Low risk       |

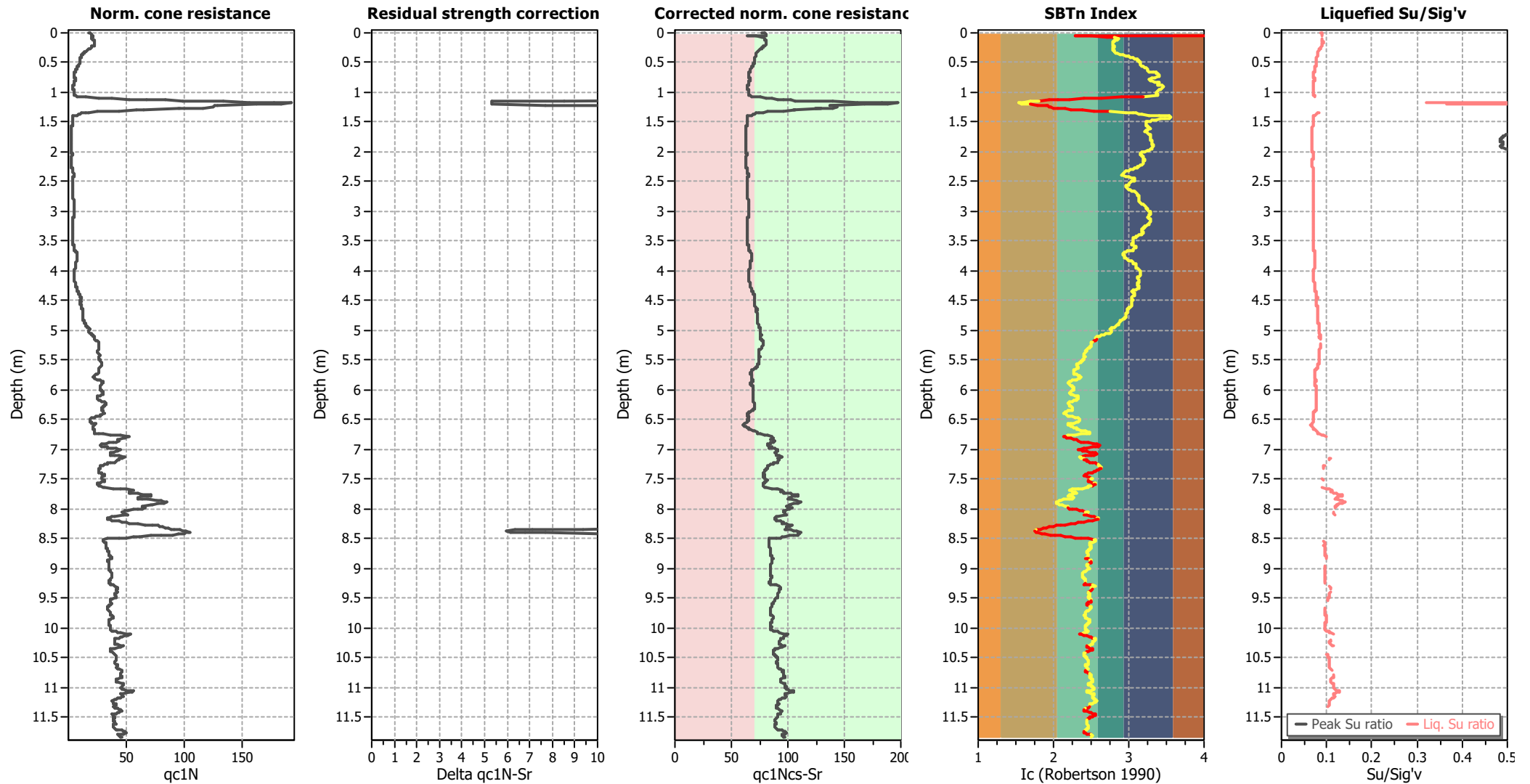
Liquefaction analysis summary plots



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: | Yes        |
| Points to test:                       | Based on Ic value | Ic cut-off value:         | 2.60         | K <sub>o</sub> applied:     | Yes        |
| Earthquake magnitude M <sub>w</sub> : | 6.50              | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration:             | 0.05              | Use fill:                 | No           | Limit depth applied:        | Yes        |
| Depth to water table (insitu):        | 1.00 m            | Fill height:              | N/A          | Limit depth:                | 10.00 m    |

## Check for strength loss plots (Idriss & Boulanger (2008))



### 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: | Yes        |
| Points to test:                       | Based on Ic value | Ic cut-off value:         | 2.60         | K <sub>o</sub> applied:     | Yes        |
| Earthquake magnitude M <sub>w</sub> : | 6.50              | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration:             | 0.05              | Use fill:                 | No           | Limit depth applied:        | Yes        |
| Depth to water table (insitu):        | 1.00 m            | Fill height:              | N/A          | Limit depth:                | 10.00 m    |

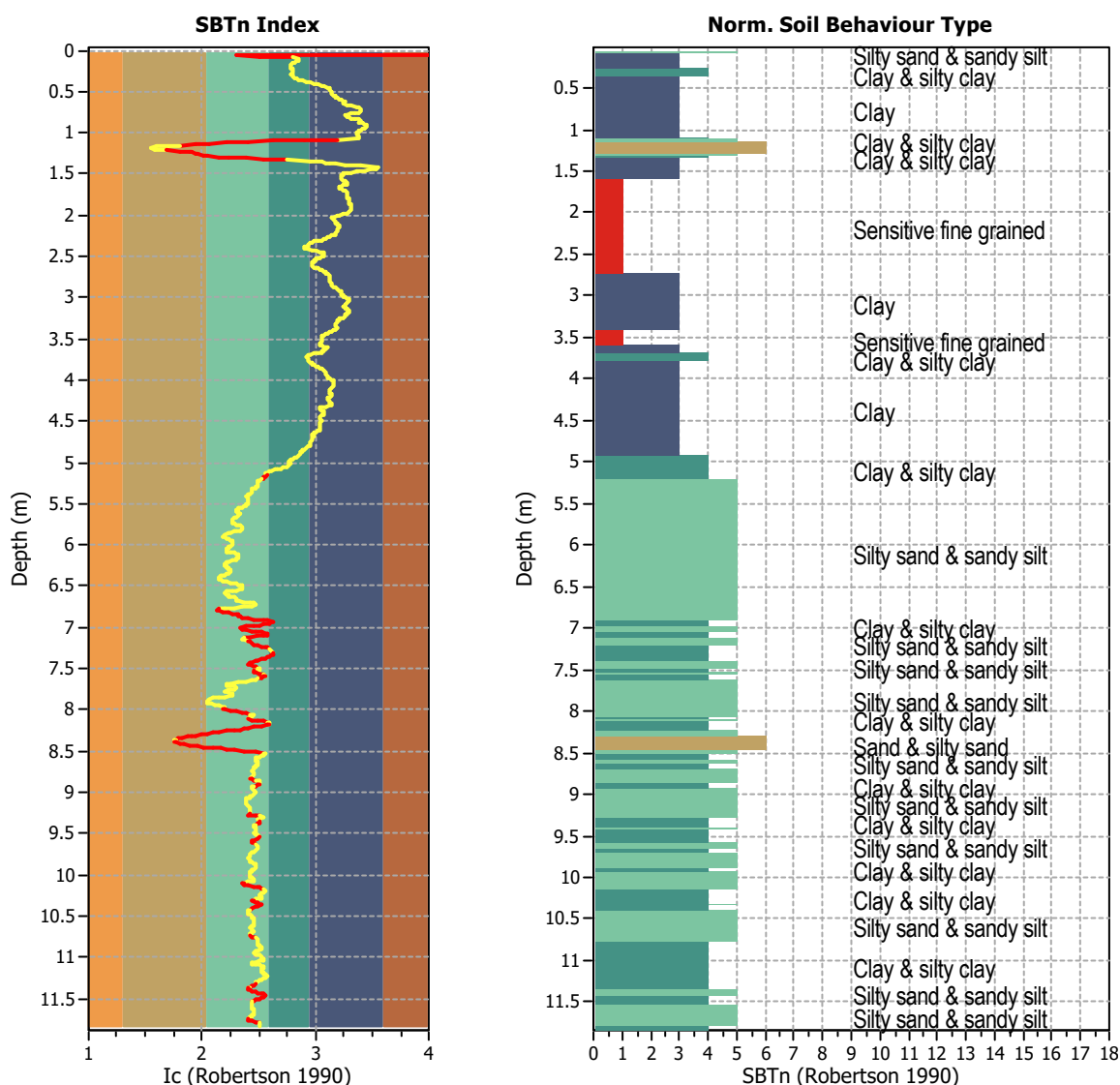
## TRANSITION LAYER DETECTION ALGORITHM REPORT

### Summary Details & Plots

#### Short description

The software will delete data when the cone is in transition from either clay to sand or vice-versa. To do this the software requires a range of  $I_c$  values over which the transition will be defined (typically somewhere between  $1.80 < I_c < 3.0$ ) and a rate of change of  $I_c$ . Transitions typically occur when the rate of change of  $I_c$  is fast (i.e.  $\Delta I_c$  is small).

The  $SBT_n$  plot below, displays in red the detected transition layers based on the parameters listed below the graphs.

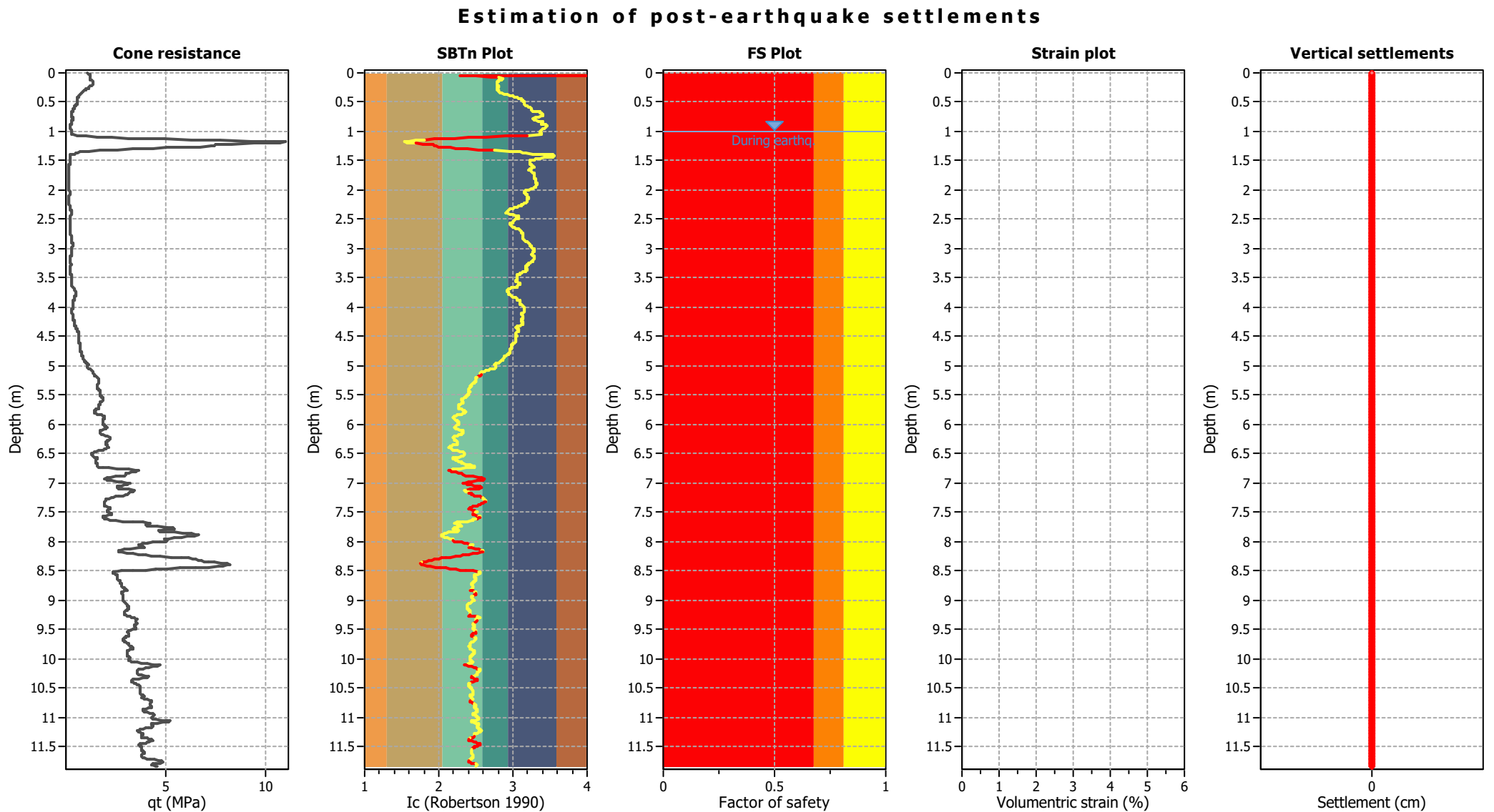


#### Transition layer algorithm properties

$I_c$  minimum check value: 1.70  
 $I_c$  maximum check value: 3.00  
 $I_c$  change ratio value: 0.0100  
 Minimum number of points in layer: 4

#### General statistics

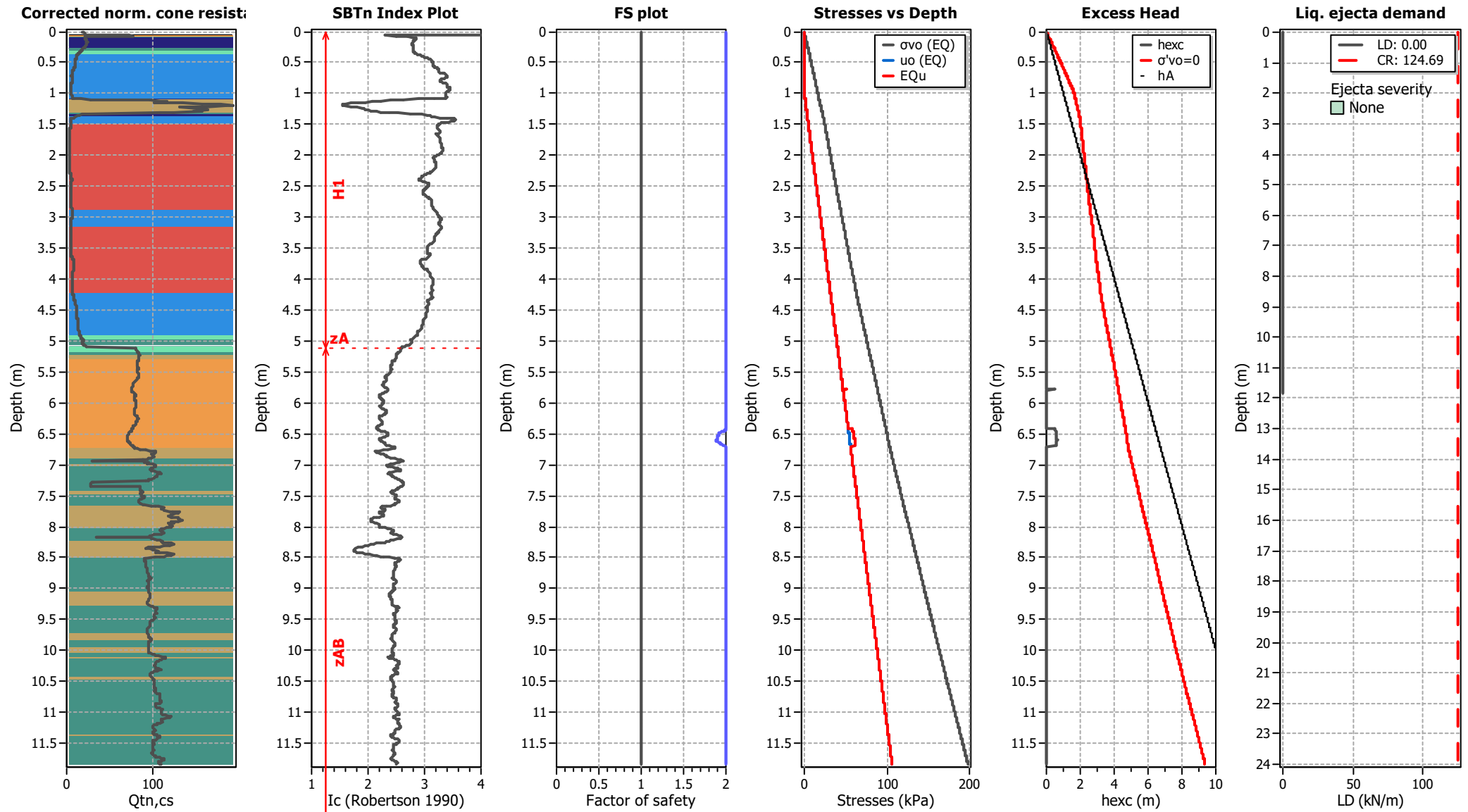
Total points in CPT file: 1184  
 Total points excluded: 233  
 Exclusion percentage: 19.68%  
 Number of layers detected: 31



Abbreviations

- q<sub>t</sub>: Total cone resistance (cone resistance q<sub>c</sub> corrected for pore water effects)
- I<sub>c</sub>: Soil Behaviour Type Index
- FS: Calculated Factor of Safety against liquefaction
- Volumetric strain: Post-liquefaction volumetric strain

## Ejecta Severity Estimation



## LIQUEFACTION ANALYSIS REPORT

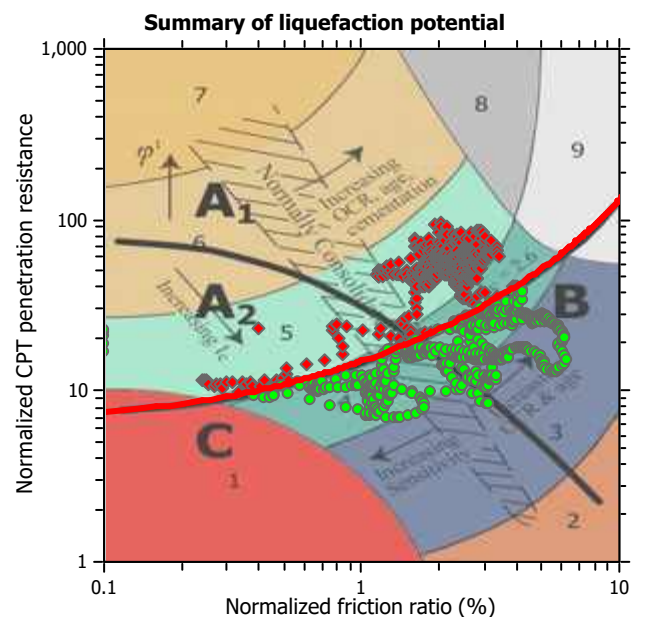
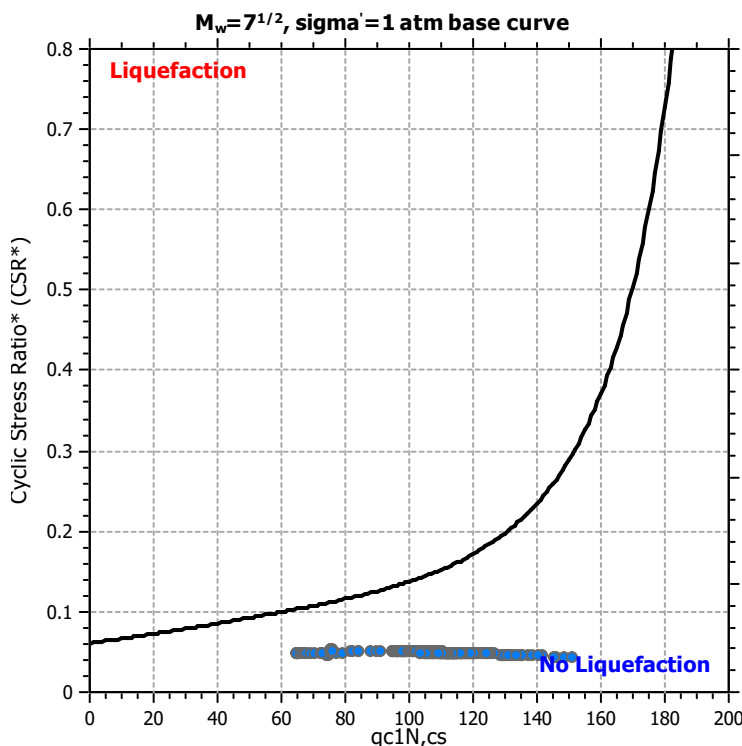
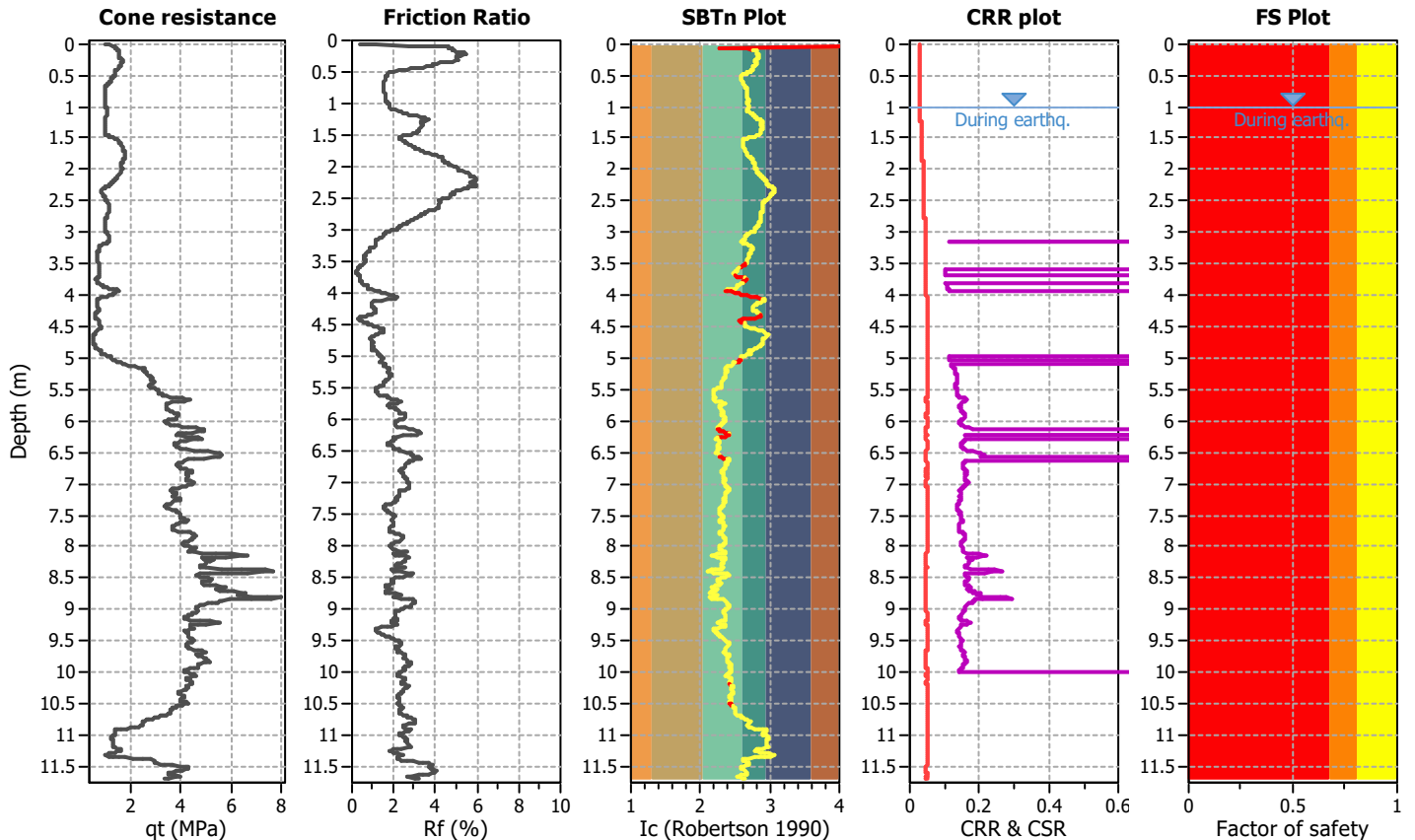
**Project title :**

**Location :**

**CPT file : CPT405**

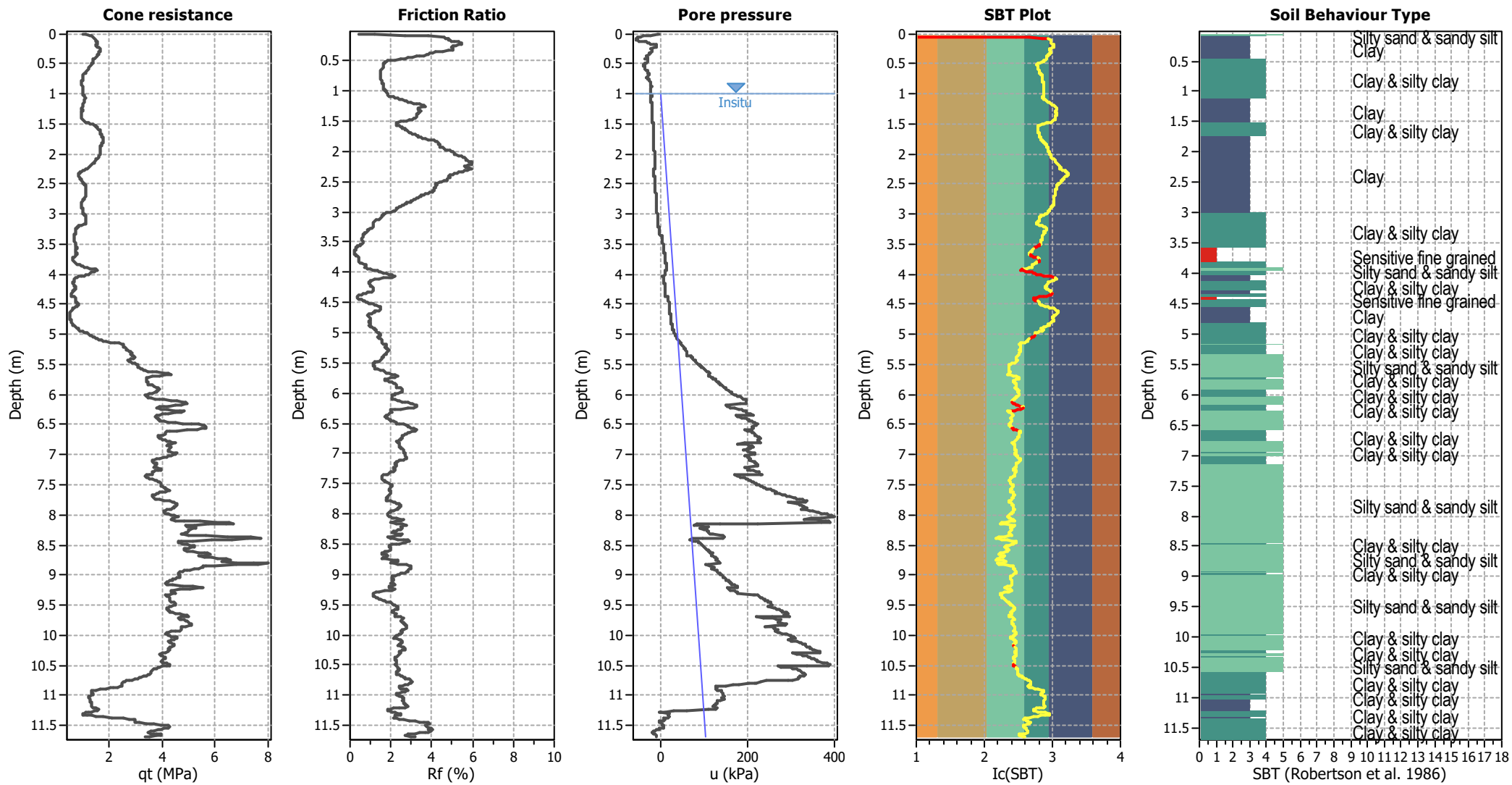
### Input parameters and analysis data

|                              |                   |                           |              |                         |     |                      |              |
|------------------------------|-------------------|---------------------------|--------------|-------------------------|-----|----------------------|--------------|
| Analysis method:             | B&I (2014)        | G.W.T. (in-situ):         | 1.00 m       | Use fill:               | No  | Clay like behavior   |              |
| Fines correction method:     | B&I (2014)        | G.W.T. (earthq.):         | 1.00 m       | Fill height:            | N/A | applied:             | Sands only   |
| Points to test:              | Based on Ic value | Average results interval: | 3            | Fill weight:            | N/A | Limit depth applied: | Yes          |
| Earthquake magnitude $M_w$ : | 6.50              | Ic cut-off value:         | 2.60         | Trans. detect. applied: | Yes | Limit depth:         | 10.00 m      |
| Peak ground acceleration:    | 0.05              | Unit weight calculation:  | Based on SBT | $K_\sigma$ applied:     | Yes | MSF method:          | Method based |



Zone A<sub>1</sub>: Cyclic liquefaction likely depending on size and duration of cyclic loading  
Zone A<sub>2</sub>: Cyclic liquefaction and strength loss likely depending on loading and ground geometry  
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening  
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



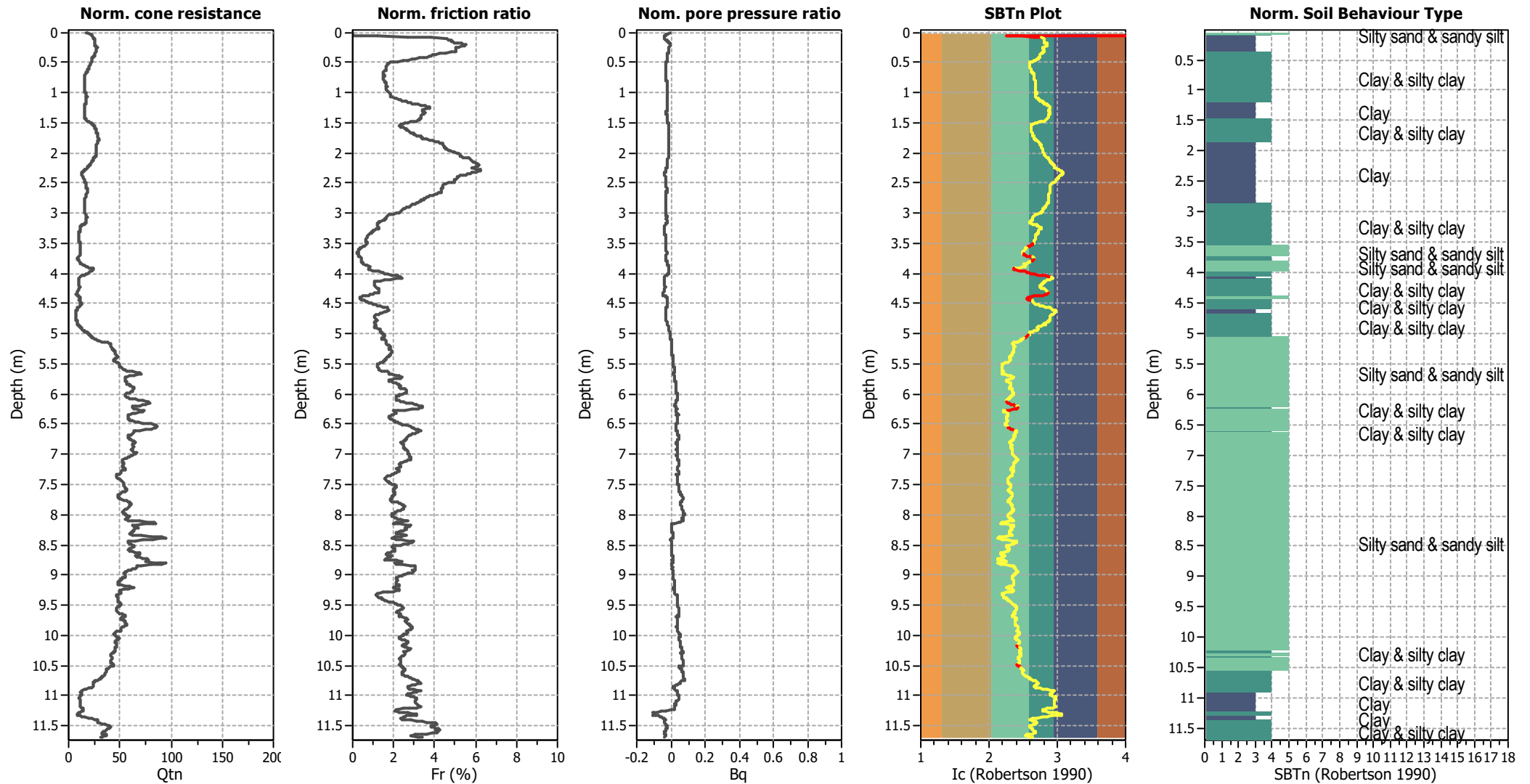
Input parameters and analysis data

|                                       |                   |                           |              |                             |            |
|---------------------------------------|-------------------|---------------------------|--------------|-----------------------------|------------|
| 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: | Yes        |
| 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> : | 6.50              | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration:             | 0.05              | 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 (normalized)



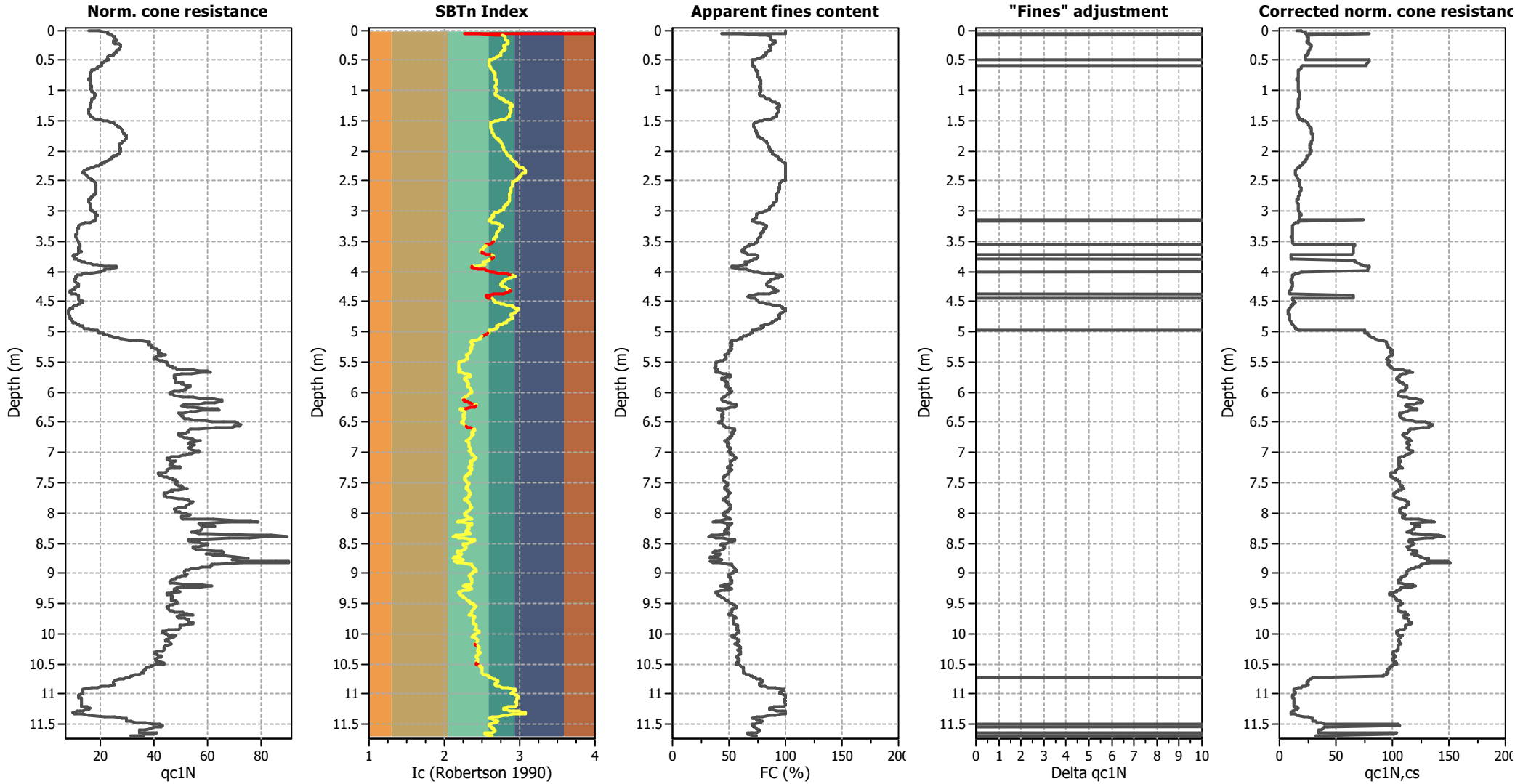
#### Input parameters and analysis data

|                                       |                   |                           |              |                             |            |
|---------------------------------------|-------------------|---------------------------|--------------|-----------------------------|------------|
| 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: | Yes        |
| Points to test:                       | Based on Ic value | Ic cut-off value:         | 2.60         | K <sub>o</sub> applied:     | Yes        |
| Earthquake magnitude M <sub>w</sub> : | 6.50              | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration:             | 0.05              | Use fill:                 | No           | Limit depth applied:        | Yes        |
| Depth to water table (insitu):        | 1.00 m            | Fill height:              | N/A          | Limit depth:                | 10.00 m    |

#### SBTn 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 |

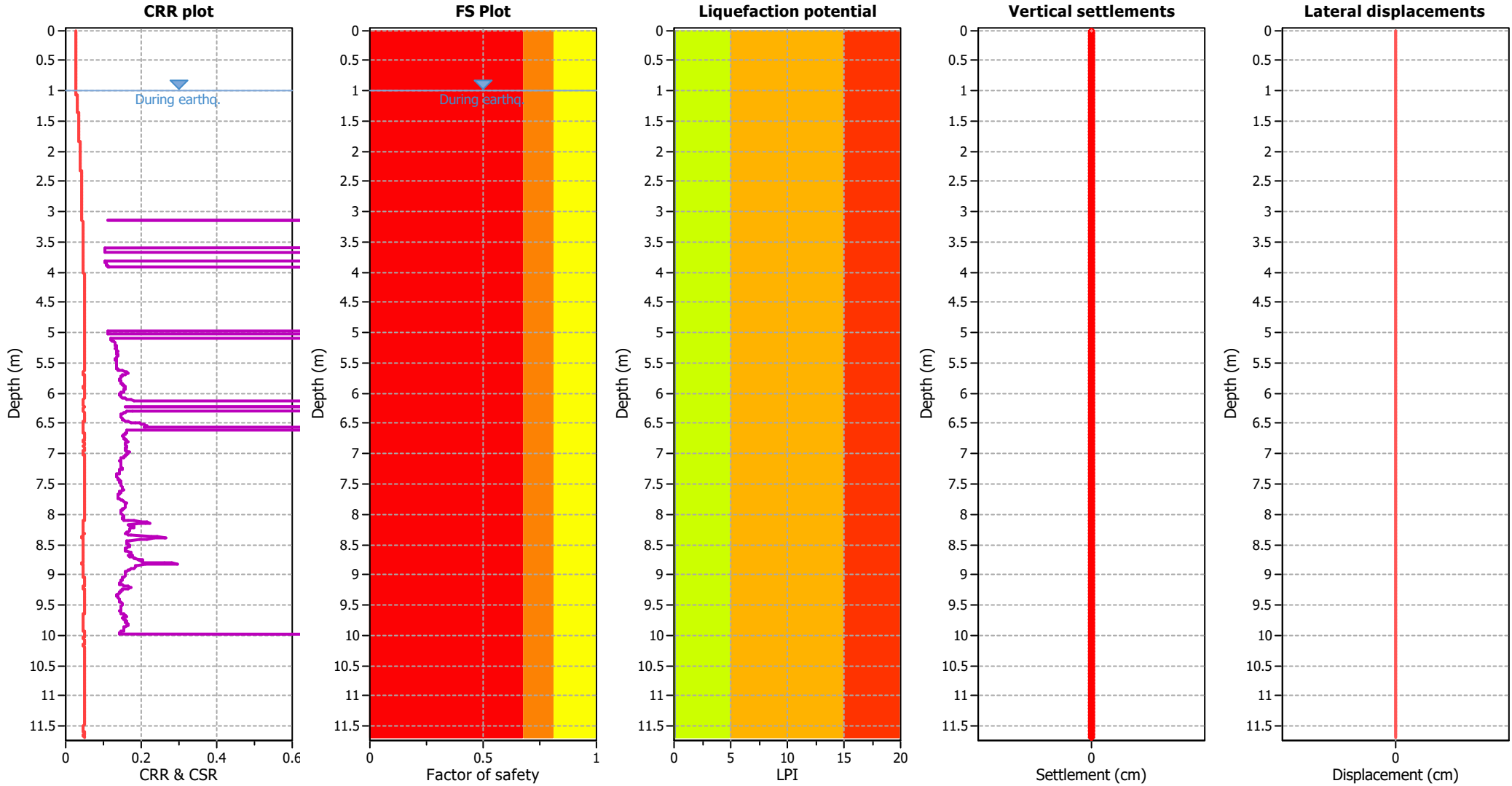
Liquefaction analysis overall plots (intermediate results)



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: | Yes        |
| Points to test:                       | Based on Ic value | Ic cut-off value:         | 2.60         | K <sub>o</sub> applied:     | Yes        |
| Earthquake magnitude M <sub>w</sub> : | 6.50              | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration:             | 0.05              | Use fill:                 | No           | Limit depth applied:        | Yes        |
| Depth to water table (insitu):        | 1.00 m            | Fill height:              | N/A          | Limit depth:                | 10.00 m    |

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: | Yes        |
| Points to test:                       | Based on Ic value | Ic cut-off value:         | 2.60         | K <sub>o</sub> applied:     | Yes        |
| Earthquake magnitude M <sub>w</sub> : | 6.50              | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration:             | 0.05              | Use fill:                 | No           | Limit depth applied:        | Yes        |
| Depth to water table (insitu):        | 1.00 m            | Fill height:              | N/A          | Limit depth:                | 10.00 m    |

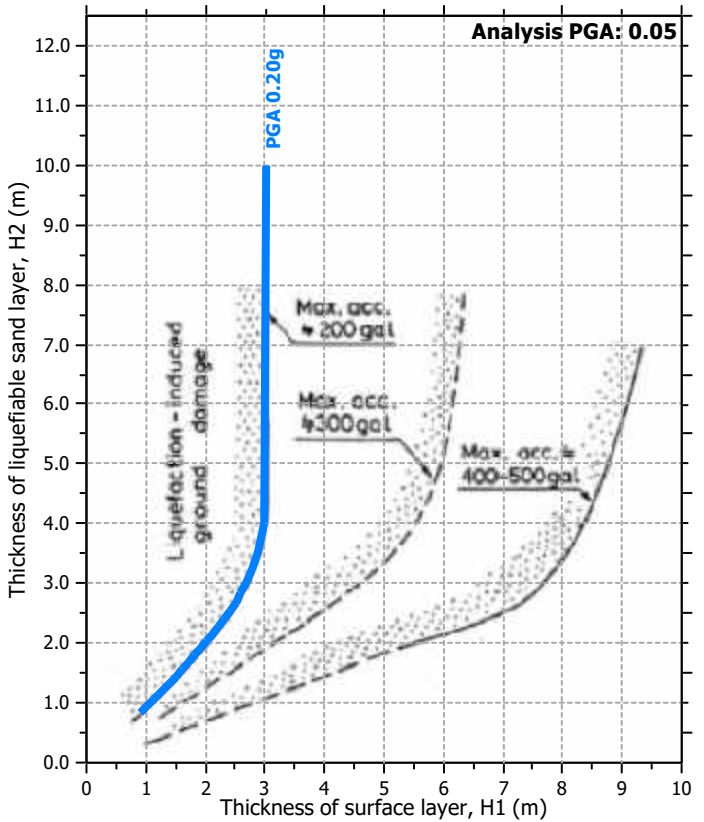
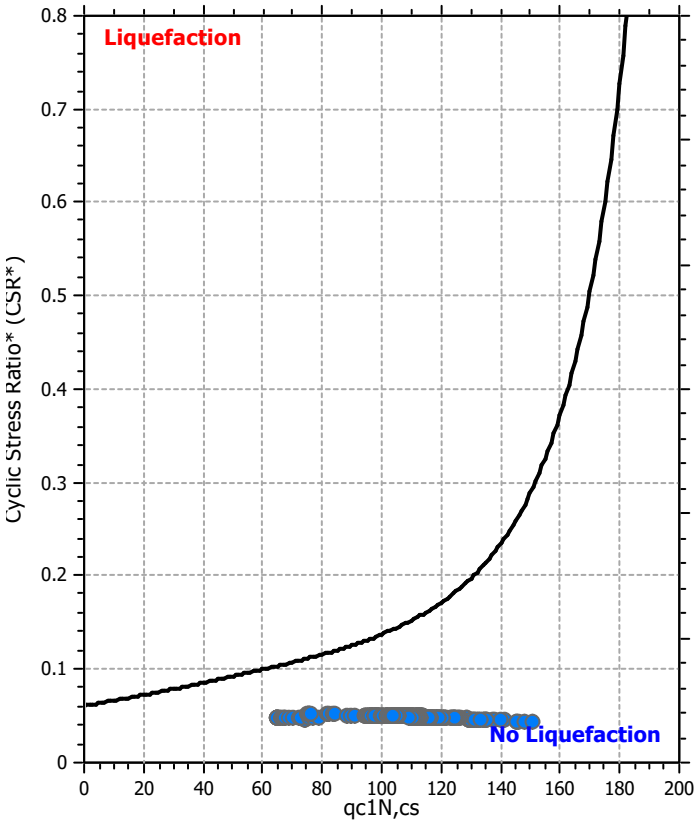
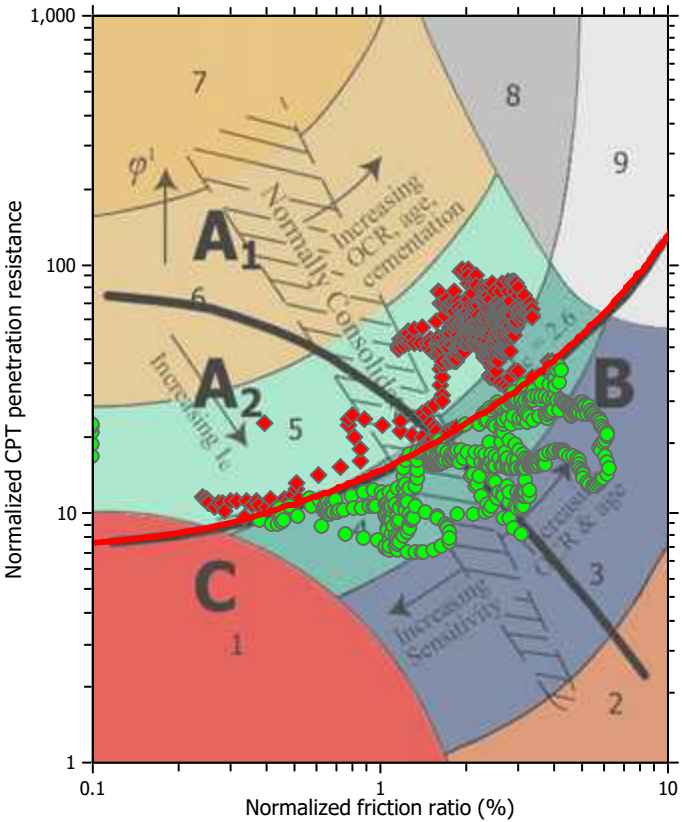
F.S. color scheme

|             |                                             |
|-------------|---------------------------------------------|
| Red         | Almost certain it will liquefy              |
| Orange      | Very likely to liquefy                      |
| Yellow      | Liquefaction and no liq. are equally likely |
| Light green | Unlike to liquefy                           |
| Dark green  | Almost certain it will not liquefy          |

LPI color scheme

|        |                |
|--------|----------------|
| Red    | Very high risk |
| Orange | High risk      |
| Yellow | Low risk       |

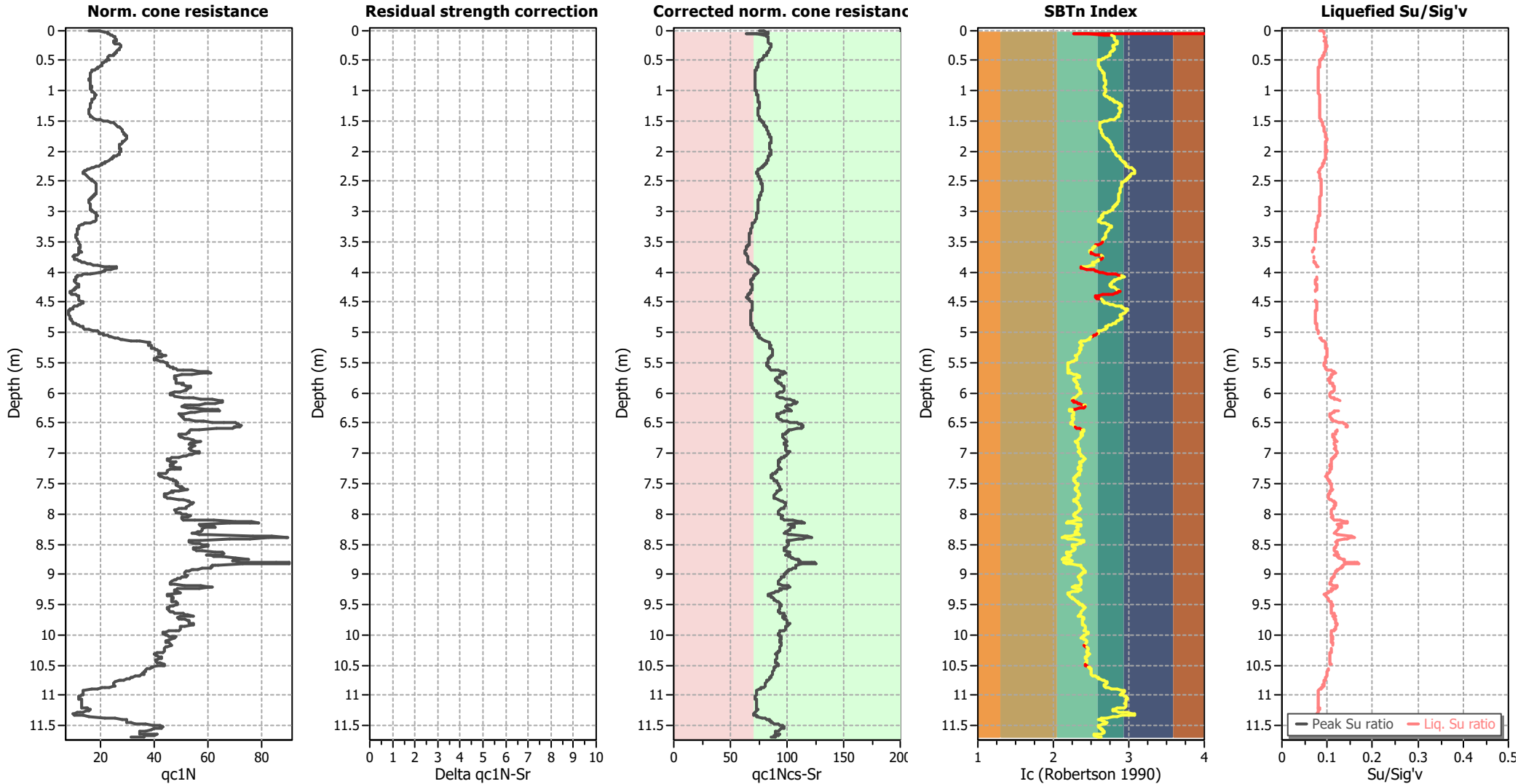
Liquefaction analysis summary plots



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: | Yes        |
| Points to test:                | Based on $I_c$ value | $I_c$ cut-off value:      | 2.60         | $K_0$ applied:              | Yes        |
| Earthquake magnitude $M_w$ :   | 6.50                 | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration:      | 0.05                 | Use fill:                 | No           | Limit depth applied:        | Yes        |
| Depth to water table (insitu): | 1.00 m               | Fill height:              | N/A          | Limit depth:                | 10.00 m    |

Check for strength loss plots (Idriss & Boulanger (2008))



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: | Yes        |
| Points to test:                       | Based on Ic value | Ic cut-off value:         | 2.60         | K <sub>o</sub> applied:     | Yes        |
| Earthquake magnitude M <sub>w</sub> : | 6.50              | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration:             | 0.05              | Use fill:                 | No           | Limit depth applied:        | Yes        |
| Depth to water table (insitu):        | 1.00 m            | Fill height:              | N/A          | Limit depth:                | 10.00 m    |

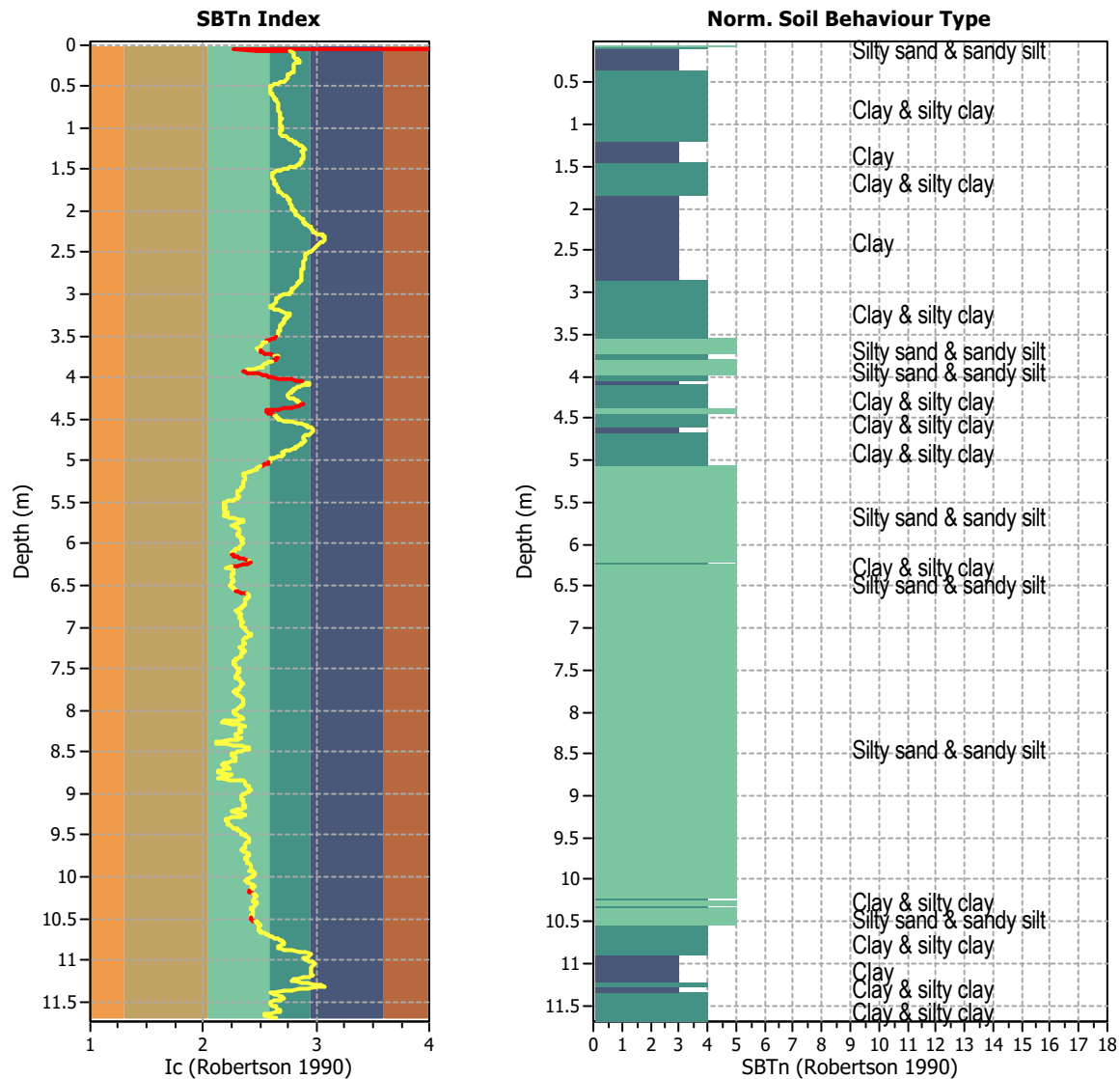
TRANSITION LAYER DETECTION ALGORITHM REPORT

Summary Details & Plots

Short description

The software will delete data when the cone is in transition from either clay to sand or vise-versa. To do this the software requires a range of  $I_c$  values over which the transition will be defined (typically somewhere between  $1.80 < I_c < 3.0$ ) and a rate of change of  $I_c$ . Transitions typically occur when the rate of change of  $I_c$  is fast (i.e.  $\Delta I_c$  is small).

The  $SBT_n$  plot below, displays in red the detected transition layers based on the parameters listed below the graphs.



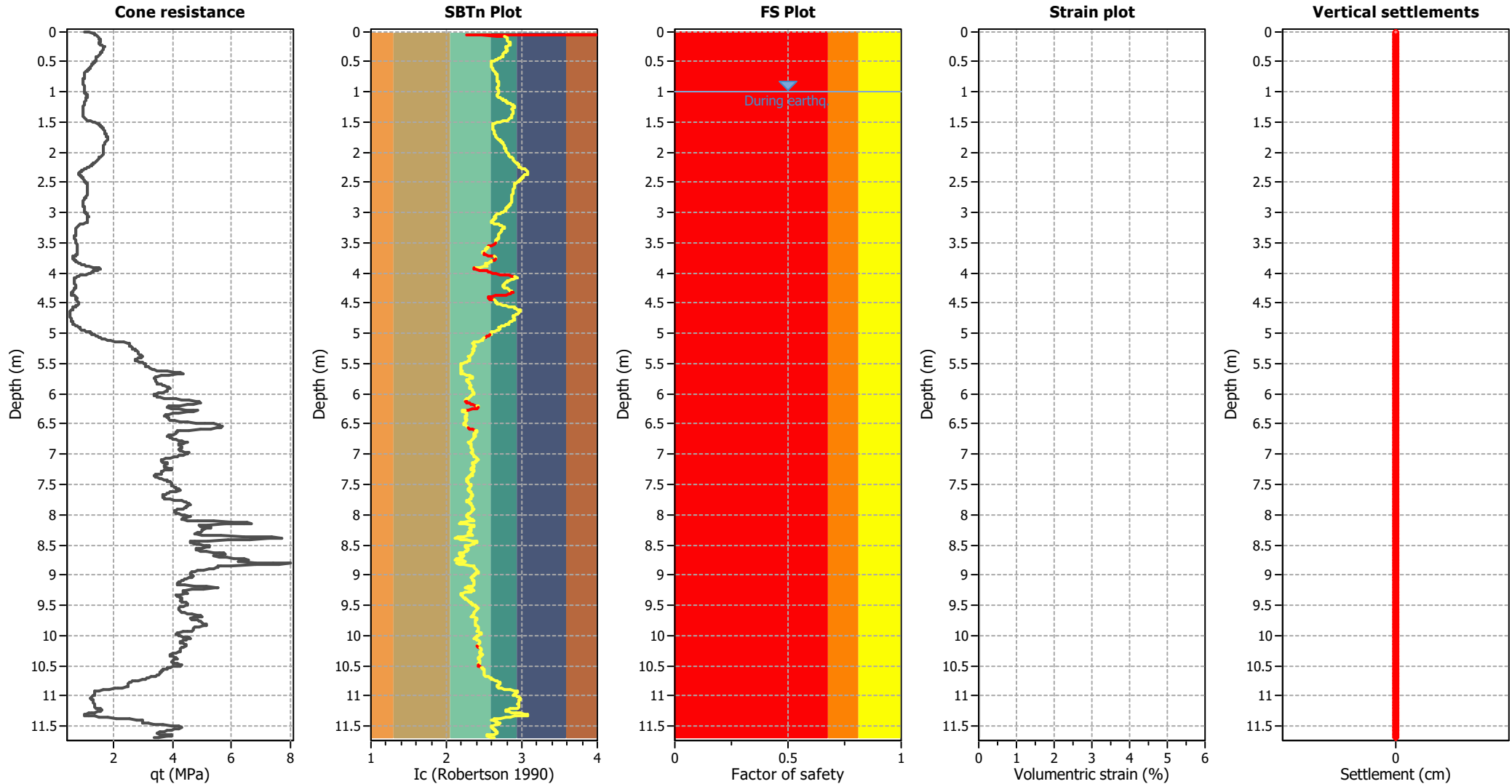
Transition layer algorithm properties

$I_c$  minimum check value: 1.70  
 $I_c$  maximum check value: 3.00  
 $I_c$  change ratio value: 0.0100  
Minimum number of points in layer: 4

General statistics

Total points in CPT file: 1169  
Total points excluded: 88  
Exclusion percentage: 7.53%  
Number of layers detected: 13

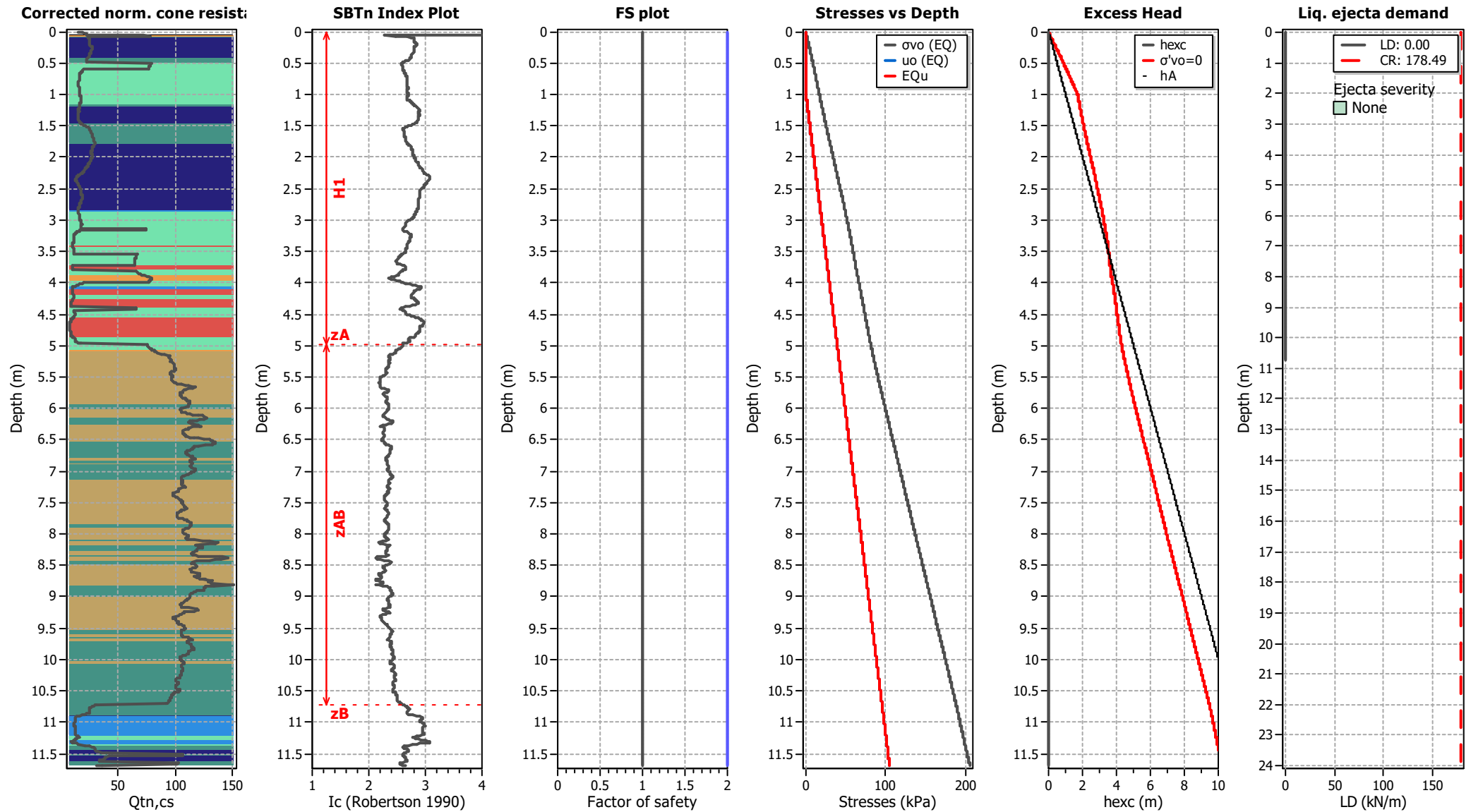
Estimation of post-earthquake settlements



Abbreviations

- q<sub>t</sub>: Total cone resistance (cone resistance q<sub>c</sub> corrected for pore water effects)
- I<sub>c</sub>: Soil Behaviour Type Index
- FS: Calculated Factor of Safety against liquefaction
- Volumetric strain: Post-liquefaction volumetric strain

## Ejecta Severity Estimation



## LIQUEFACTION ANALYSIS REPORT

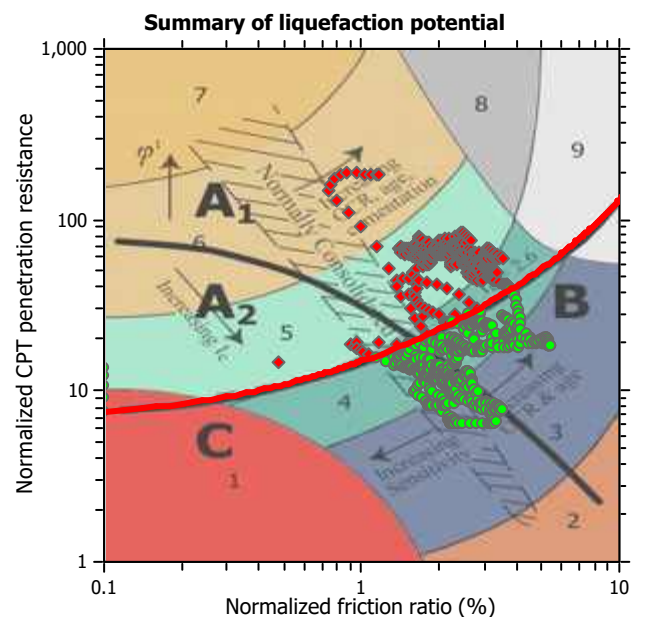
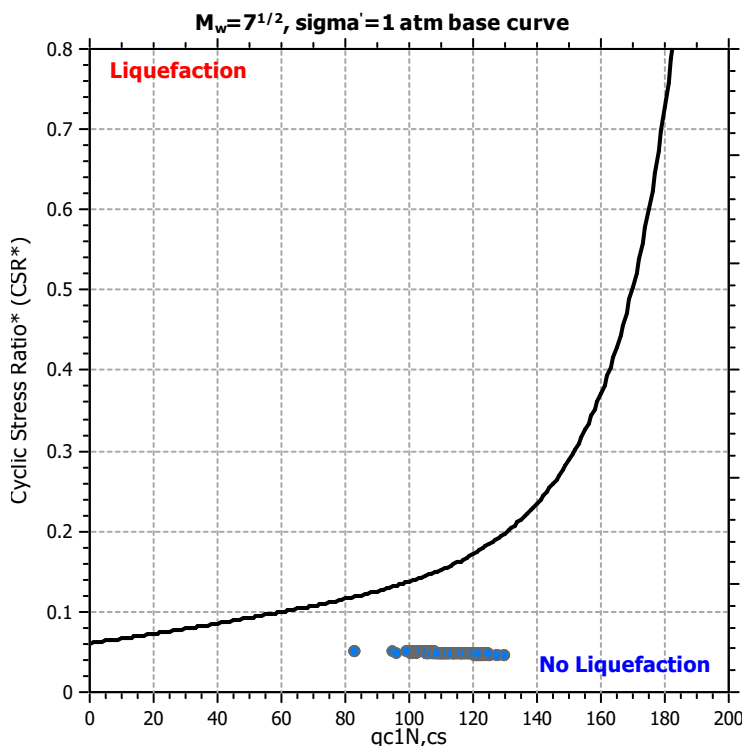
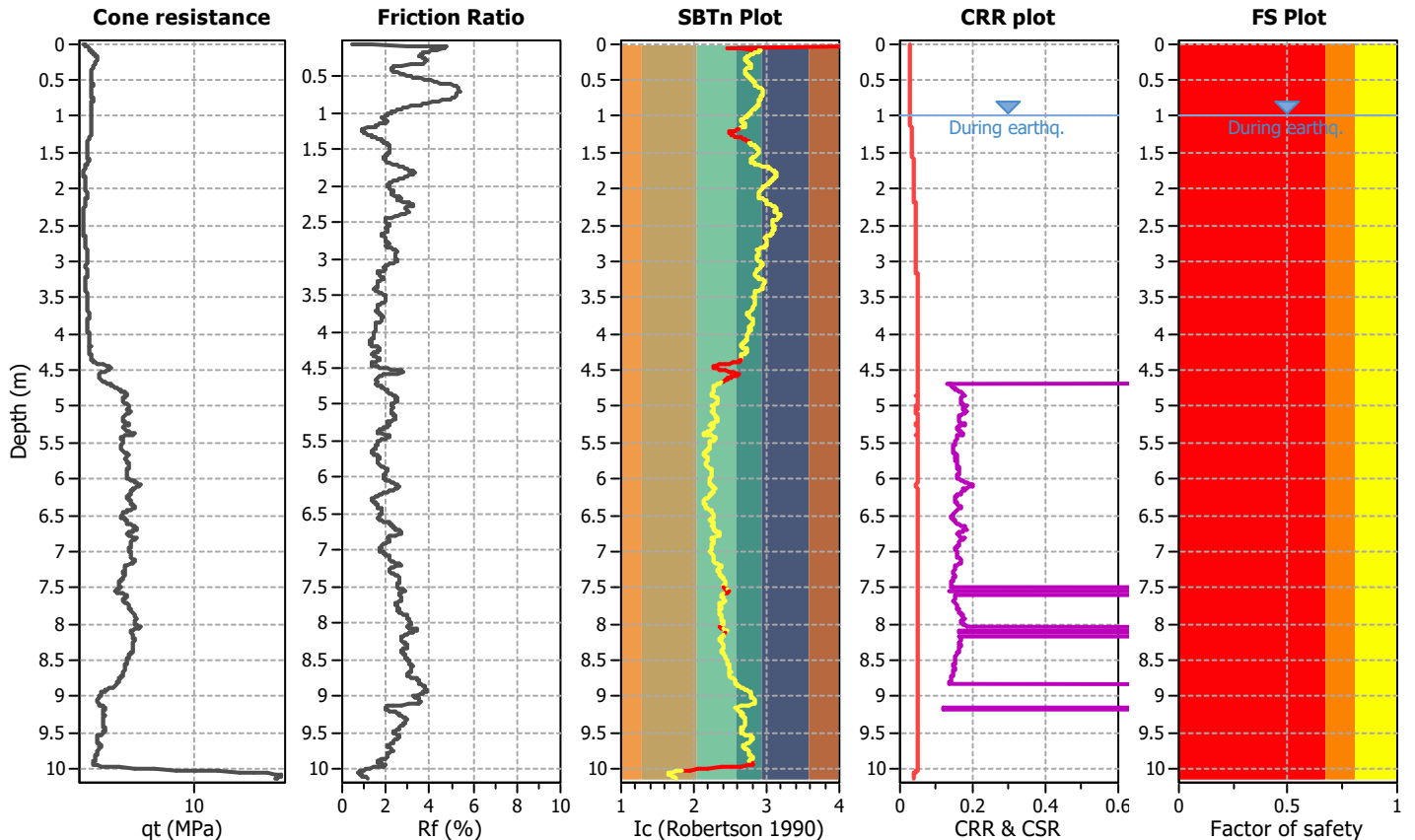
**Project title :**

**Location :**

**CPT file : CPT406**

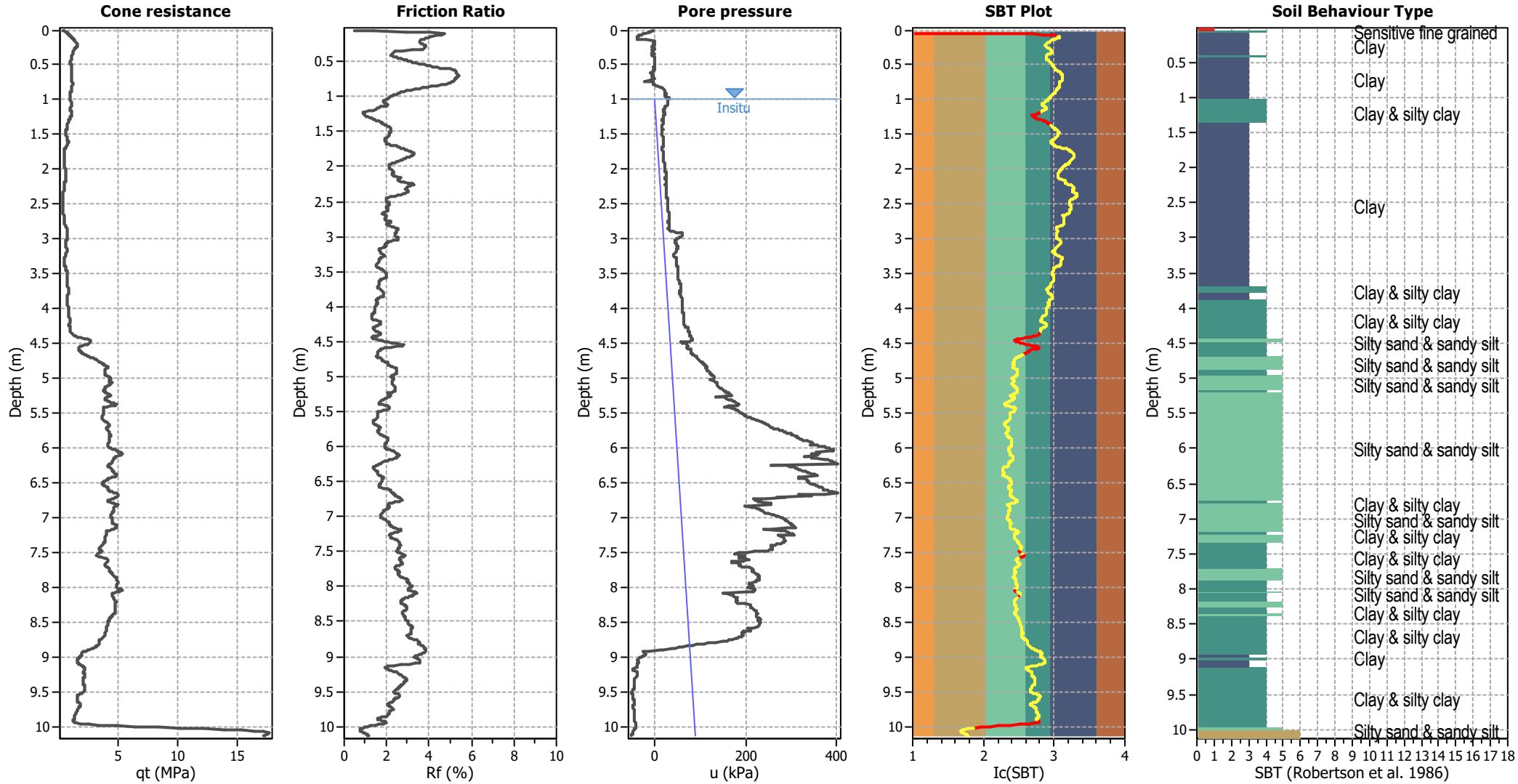
### Input parameters and analysis data

|                              |                   |                           |              |                         |     |                      |              |
|------------------------------|-------------------|---------------------------|--------------|-------------------------|-----|----------------------|--------------|
| Analysis method:             | B&I (2014)        | G.W.T. (in-situ):         | 1.00 m       | Use fill:               | No  | Clay like behavior   |              |
| Fines correction method:     | B&I (2014)        | G.W.T. (earthq.):         | 1.00 m       | Fill height:            | N/A | applied:             | Sands only   |
| Points to test:              | Based on Ic value | Average results interval: | 3            | Fill weight:            | N/A | Limit depth applied: | Yes          |
| Earthquake magnitude $M_w$ : | 6.50              | Ic cut-off value:         | 2.60         | Trans. detect. applied: | Yes | Limit depth:         | 10.00 m      |
| Peak ground acceleration:    | 0.05              | Unit weight calculation:  | Based on SBT | $K_\sigma$ applied:     | Yes | MSF method:          | Method based |



Zone A<sub>1</sub>: Cyclic liquefaction likely depending on size and duration of cyclic loading  
Zone A<sub>2</sub>: Cyclic liquefaction and strength loss likely depending on loading and ground geometry  
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening  
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots

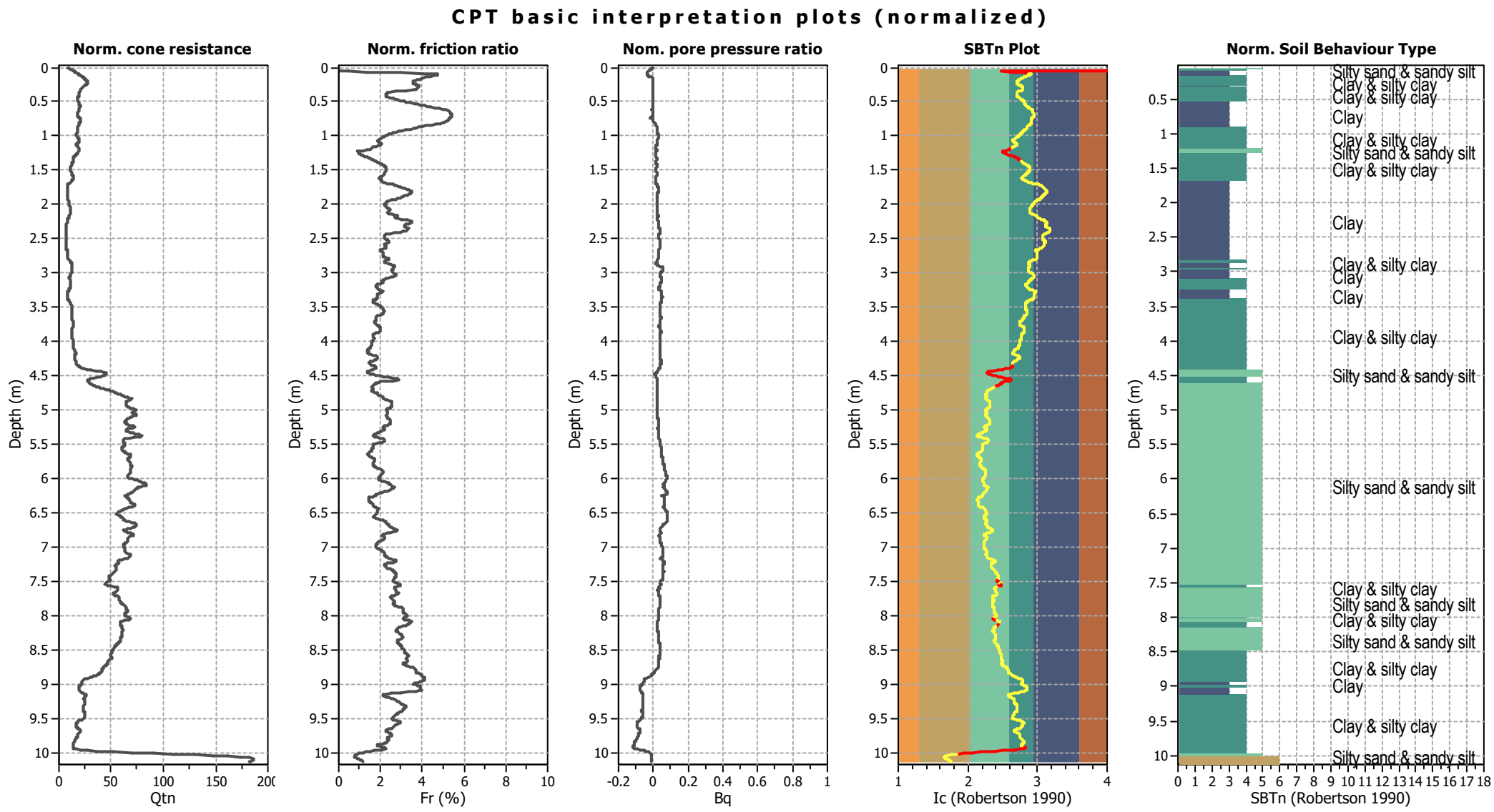


Input parameters and analysis data

|                                       |                   |                           |              |                             |            |
|---------------------------------------|-------------------|---------------------------|--------------|-----------------------------|------------|
| 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: | Yes        |
| 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> : | 6.50              | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration:             | 0.05              | 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 |



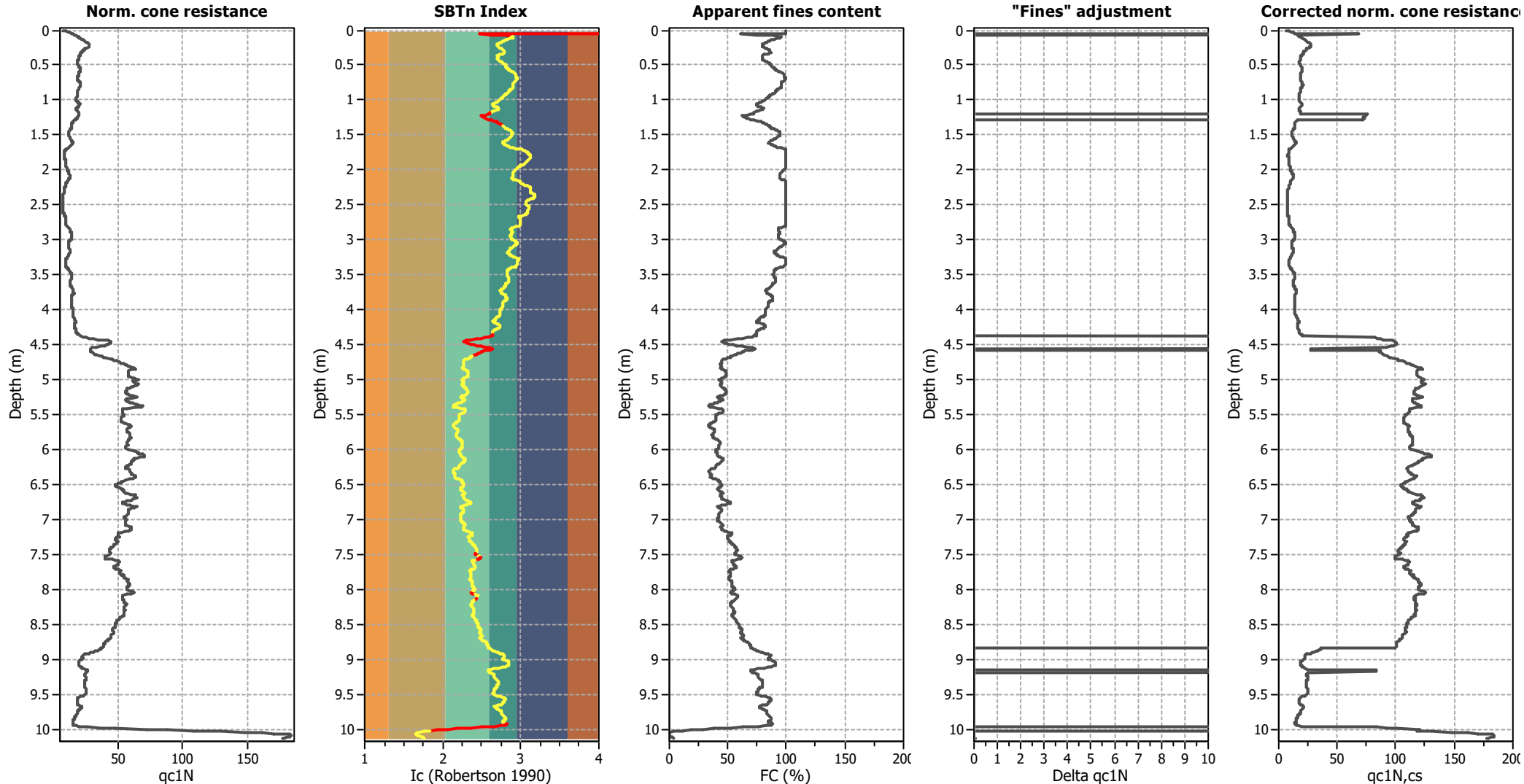
Input parameters and analysis data

|                                       |                   |                           |              |                             |            |
|---------------------------------------|-------------------|---------------------------|--------------|-----------------------------|------------|
| 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: | Yes        |
| Points to test:                       | Based on Ic value | Ic cut-off value:         | 2.60         | K <sub>o</sub> applied:     | Yes        |
| Earthquake magnitude M <sub>w</sub> : | 6.50              | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration:             | 0.05              | Use fill:                 | No           | Limit depth applied:        | Yes        |
| Depth to water table (insitu):        | 1.00 m            | Fill height:              | N/A          | Limit depth:                | 10.00 m    |

SBTn 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 |

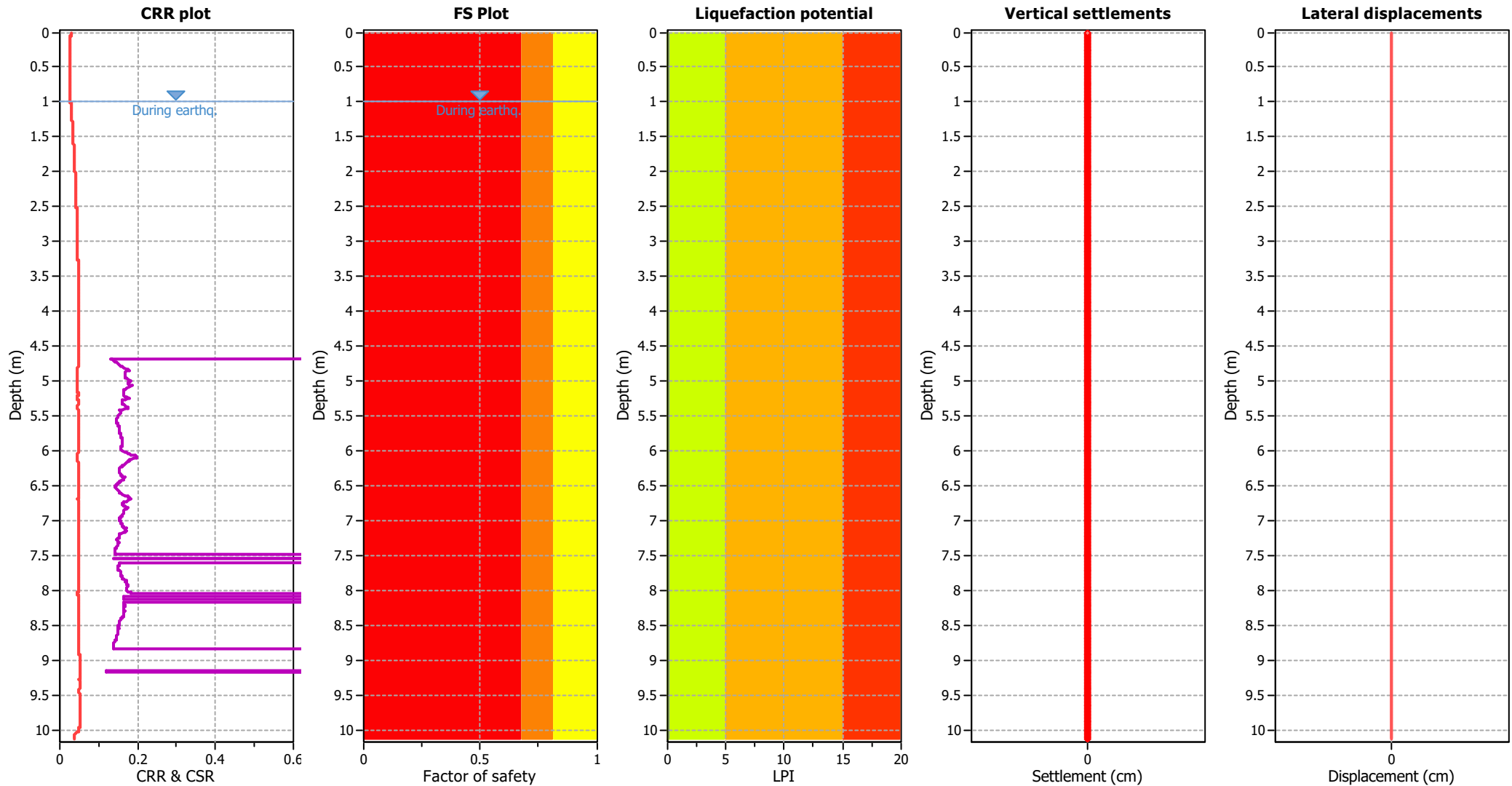
Liquefaction analysis overall plots (intermediate results)



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: | Yes        |
| Points to test:                       | Based on Ic value | Ic cut-off value:         | 2.60         | K <sub>o</sub> applied:     | Yes        |
| Earthquake magnitude M <sub>w</sub> : | 6.50              | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration:             | 0.05              | Use fill:                 | No           | Limit depth applied:        | Yes        |
| Depth to water table (insitu):        | 1.00 m            | Fill height:              | N/A          | Limit depth:                | 10.00 m    |

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: | Yes        |
| 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> : | 6.50              | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration:             | 0.05              | Use fill:                 | No           | Limit depth applied:        | Yes        |
| Depth to water table (insitu):        | 1.00 m            | Fill height:              | N/A          | Limit depth:                | 10.00 m    |

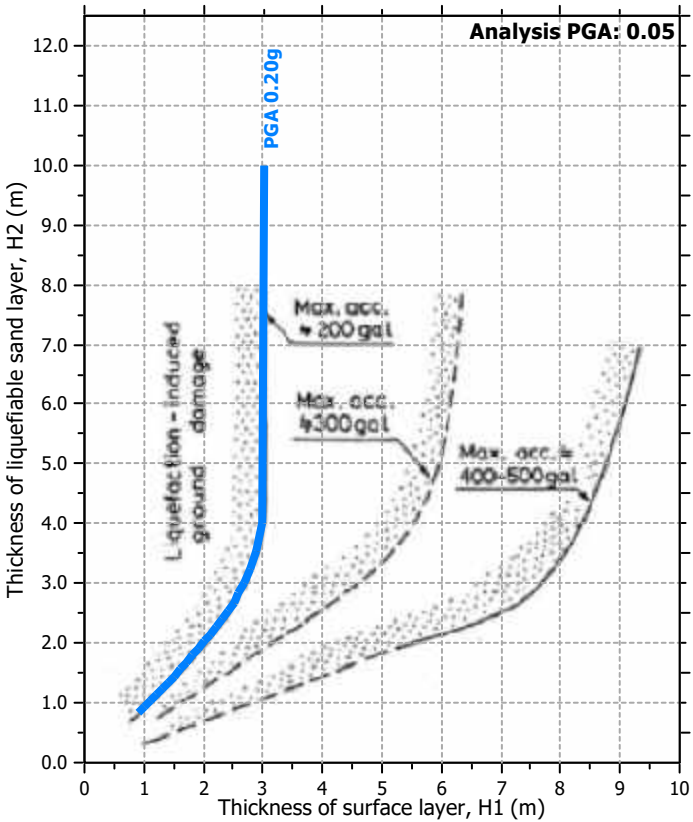
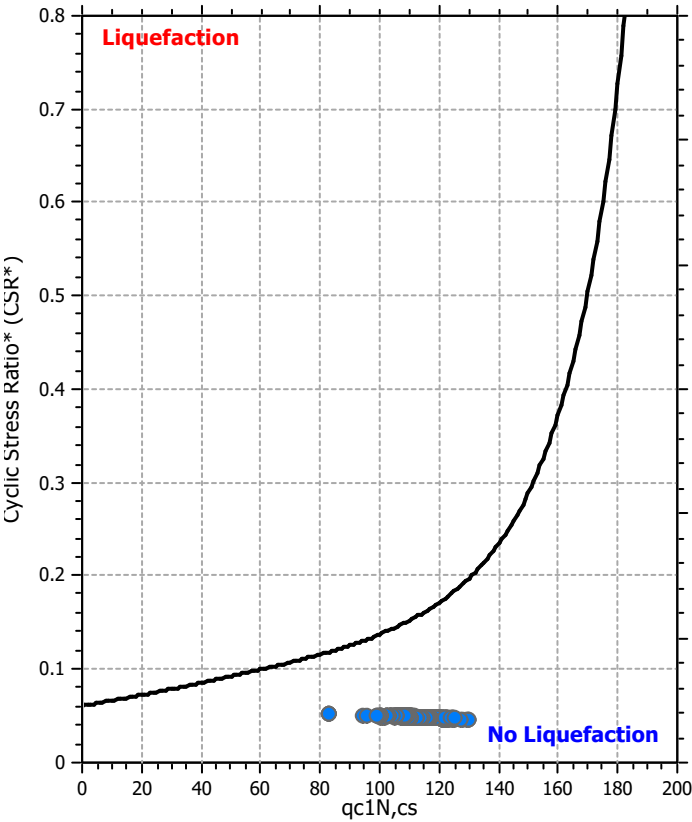
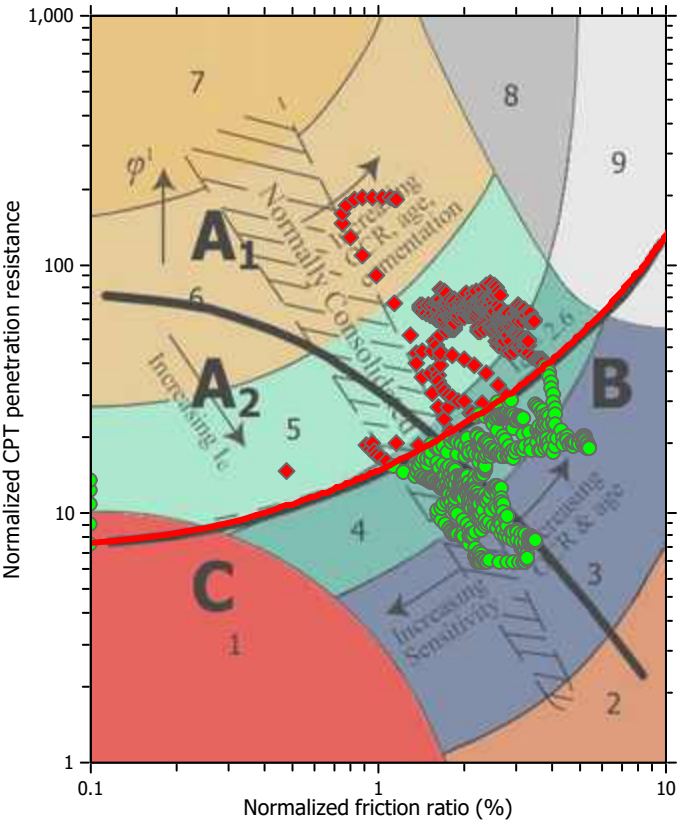
F.S. color scheme

|             |                                             |
|-------------|---------------------------------------------|
| Red         | Almost certain it will liquefy              |
| Orange      | Very likely to liquefy                      |
| Yellow      | Liquefaction and no liq. are equally likely |
| Light Green | Unlike to liquefy                           |
| Dark Green  | Almost certain it will not liquefy          |

LPI color scheme

|             |                |
|-------------|----------------|
| Red         | Very high risk |
| Orange      | High risk      |
| Light Green | Low risk       |

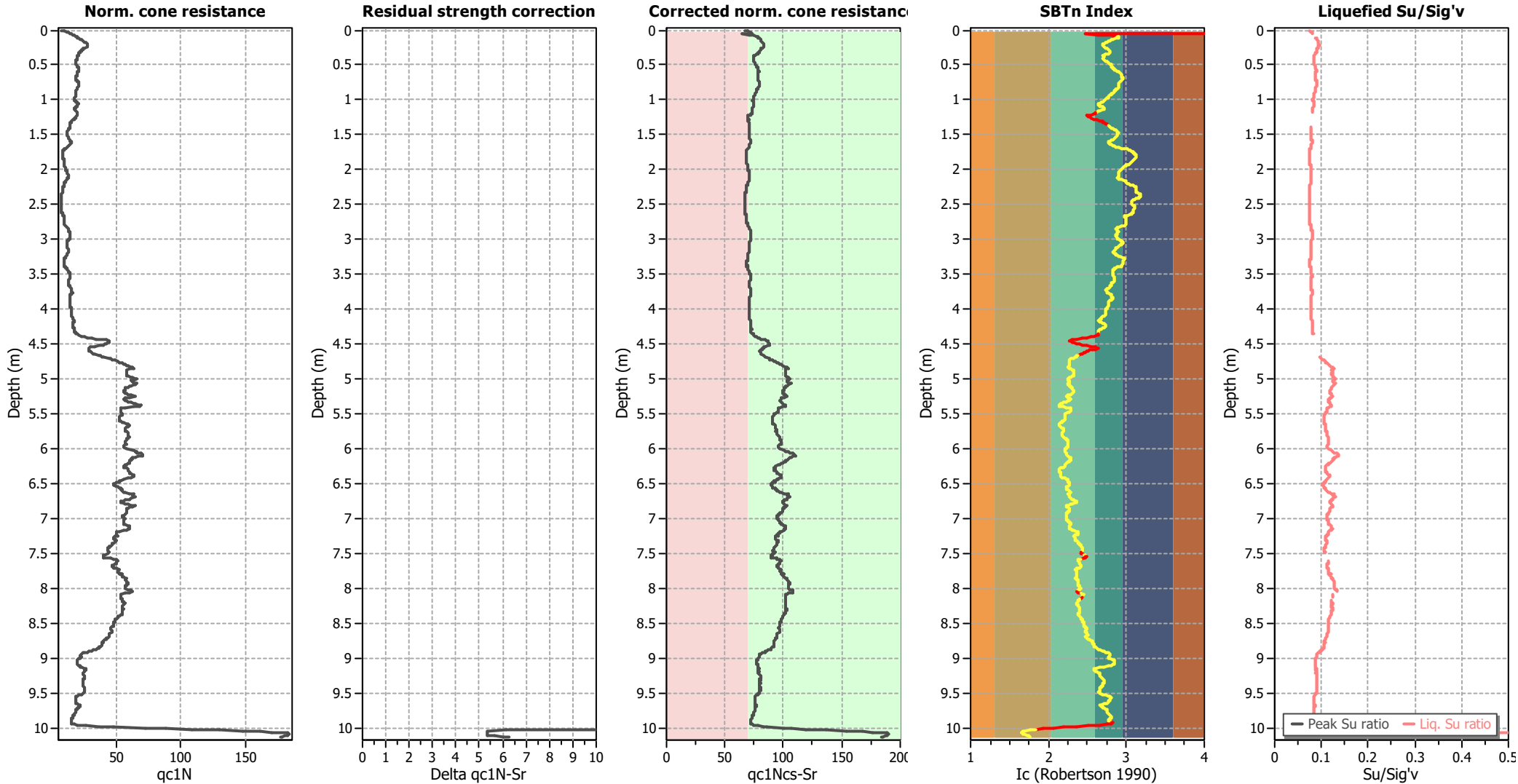
Liquefaction analysis summary plots



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: | Yes        |
| Points to test:                | Based on Ic value | Ic cut-off value:         | 2.60         | $K_0$ applied:              | Yes        |
| Earthquake magnitude $M_w$ :   | 6.50              | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration:      | 0.05              | Use fill:                 | No           | Limit depth applied:        | Yes        |
| Depth to water table (insitu): | 1.00 m            | Fill height:              | N/A          | Limit depth:                | 10.00 m    |

Check for strength loss plots (Idriss & Boulanger (2008))



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: | Yes        |
| Points to test:                | Based on $I_c$ value | $I_c$ cut-off value:      | 2.60         | $K_o$ applied:              | Yes        |
| Earthquake magnitude $M_w$ :   | 6.50                 | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration:      | 0.05                 | Use fill:                 | No           | Limit depth applied:        | Yes        |
| Depth to water table (insitu): | 1.00 m               | Fill height:              | N/A          | Limit depth:                | 10.00 m    |

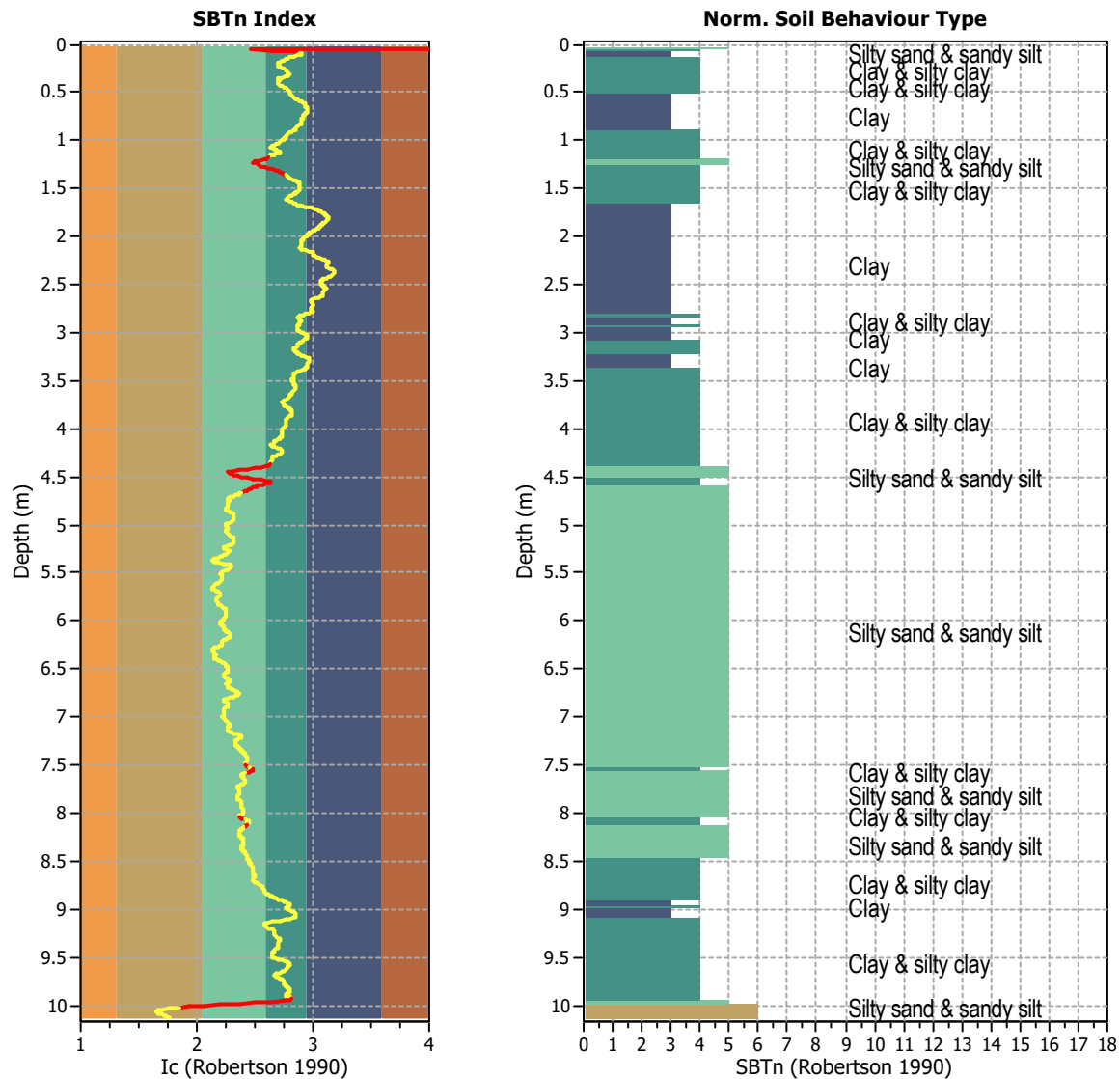
TRANSITION LAYER DETECTION ALGORITHM REPORT

Summary Details & Plots

Short description

The software will delete data when the cone is in transition from either clay to sand or vice-versa. To do this the software requires a range of  $I_c$  values over which the transition will be defined (typically somewhere between  $1.80 < I_c < 3.0$ ) and a rate of change of  $I_c$ . Transitions typically occur when the rate of change of  $I_c$  is fast (i.e.  $\Delta I_c$  is small).

The  $SBT_n$  plot below, displays in red the detected transition layers based on the parameters listed below the graphs.



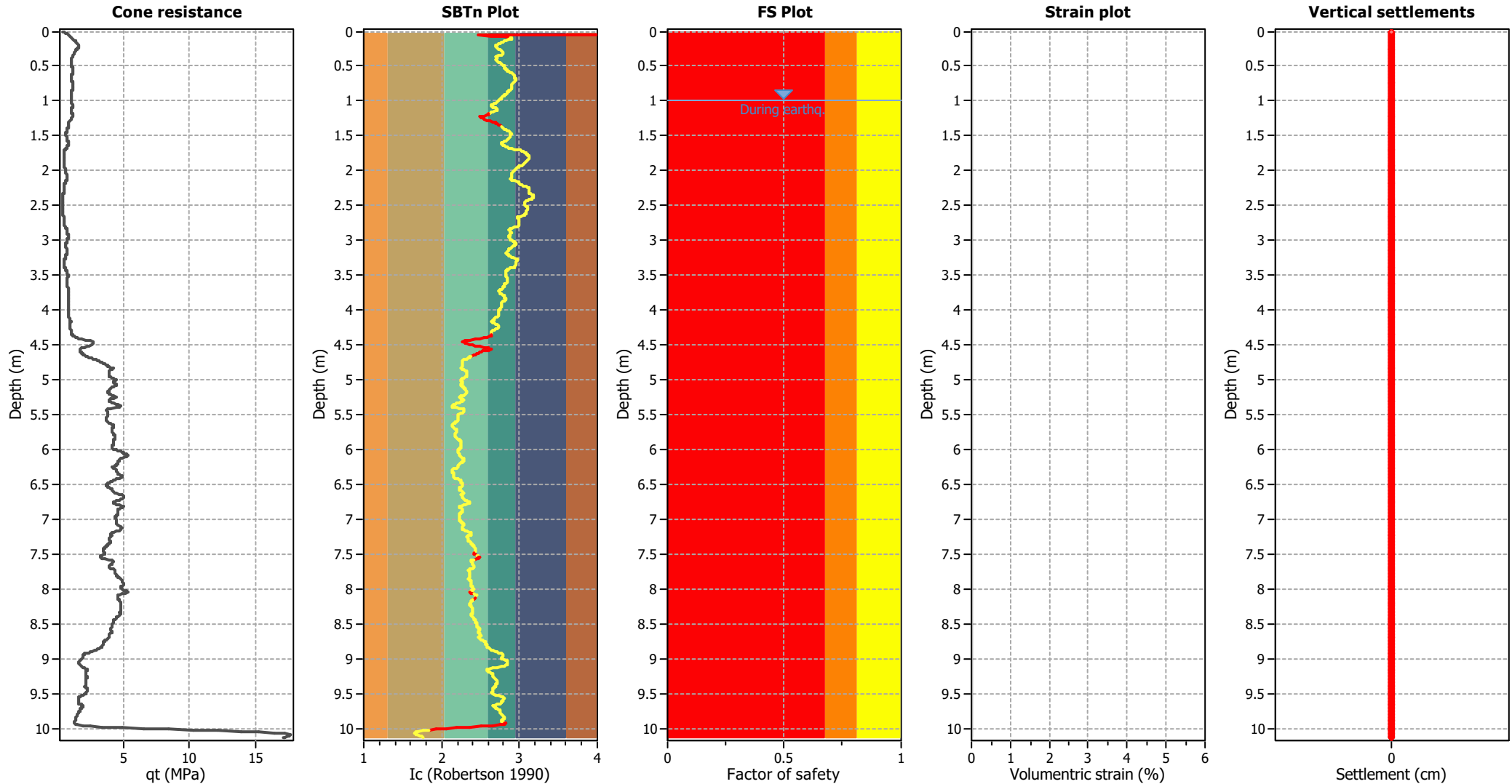
Transition layer algorithm properties

$I_c$  minimum check value: 1.70  
 $I_c$  maximum check value: 3.00  
 $I_c$  change ratio value: 0.0100  
Minimum number of points in layer: 4

General statistics

Total points in CPT file: 1013  
Total points excluded: 83  
Exclusion percentage: 8.19%  
Number of layers detected: 11

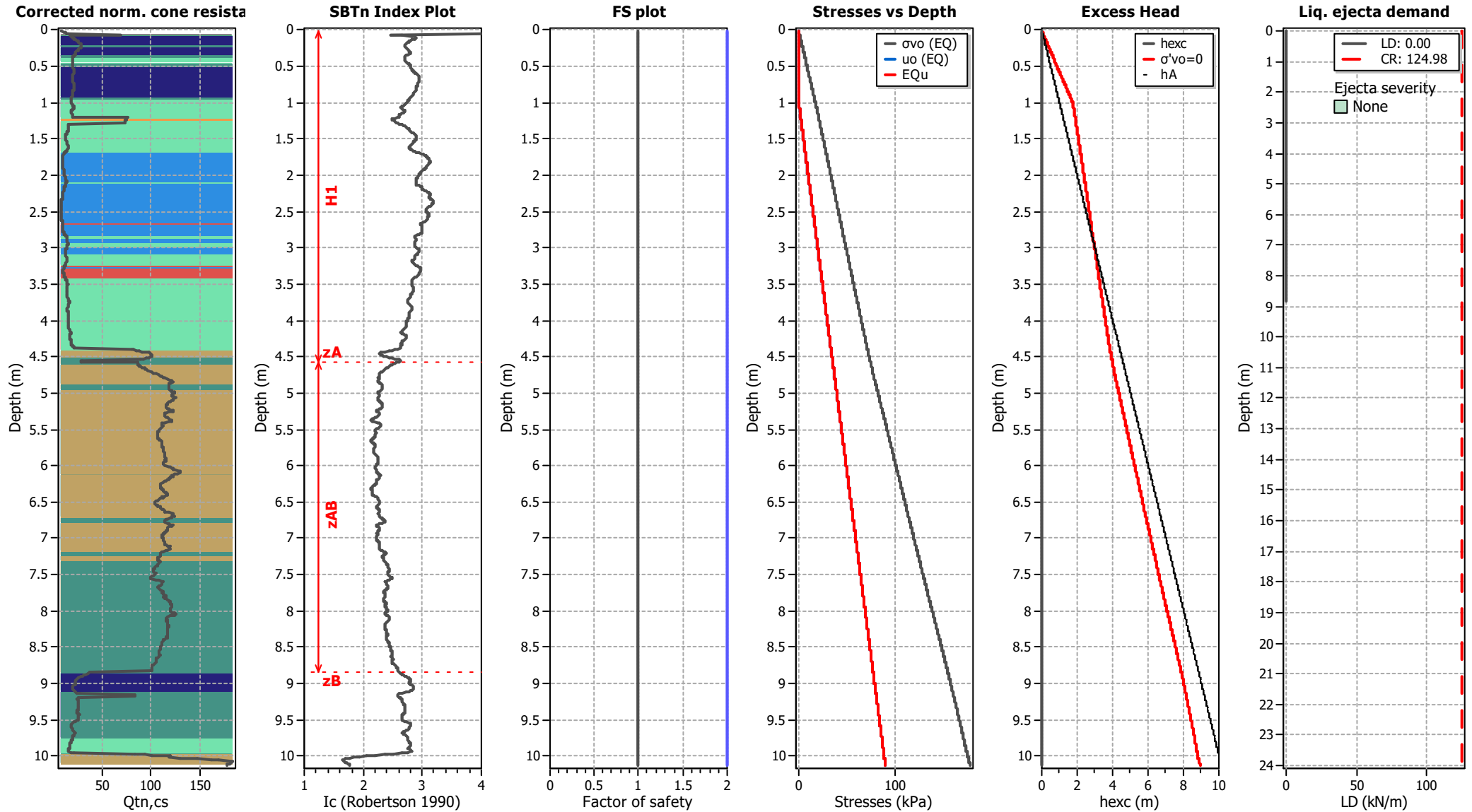
Estimation of post-earthquake settlements



Abbreviations

- q<sub>c</sub>: Total cone resistance (cone resistance q<sub>c</sub> corrected for pore water effects)
- I<sub>c</sub>: Soil Behaviour Type Index
- FS: Calculated Factor of Safety against liquefaction
- Volumetric strain: Post-liquefaction volumetric strain

## Ejecta Severity Estimation



## LIQUEFACTION ANALYSIS REPORT

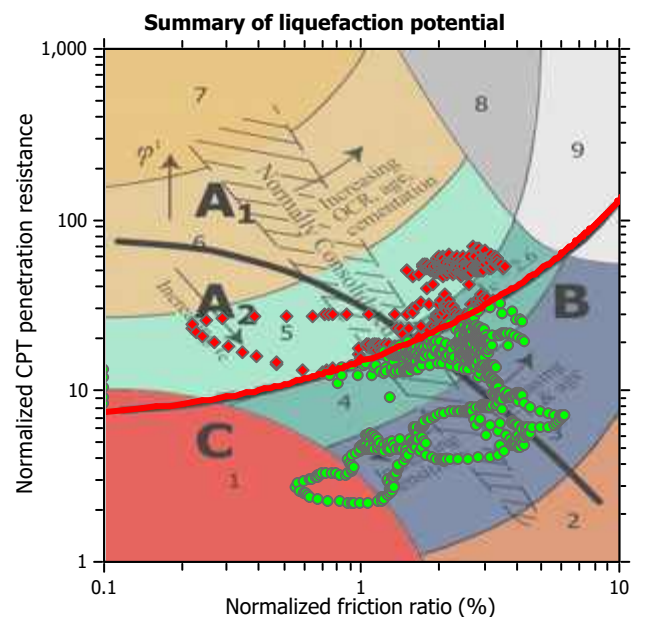
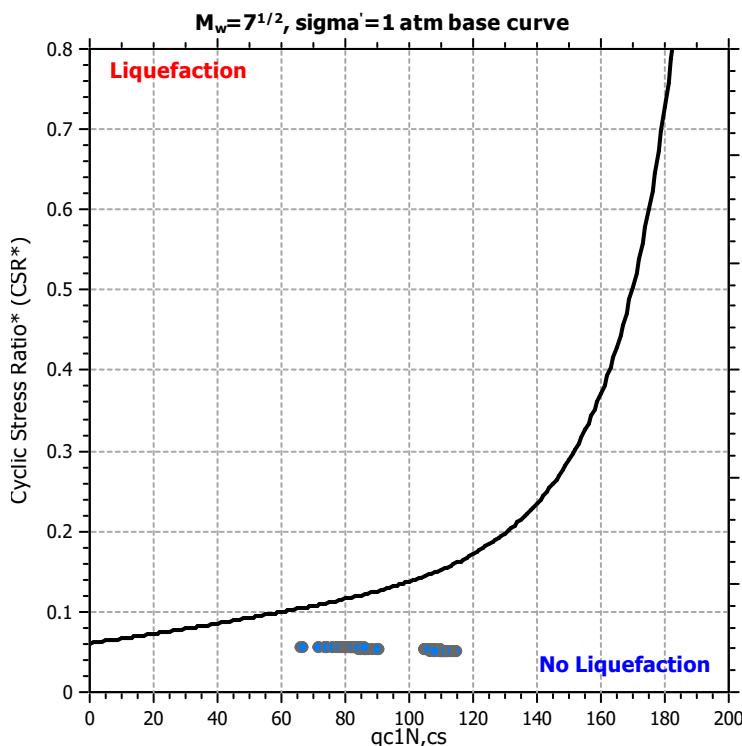
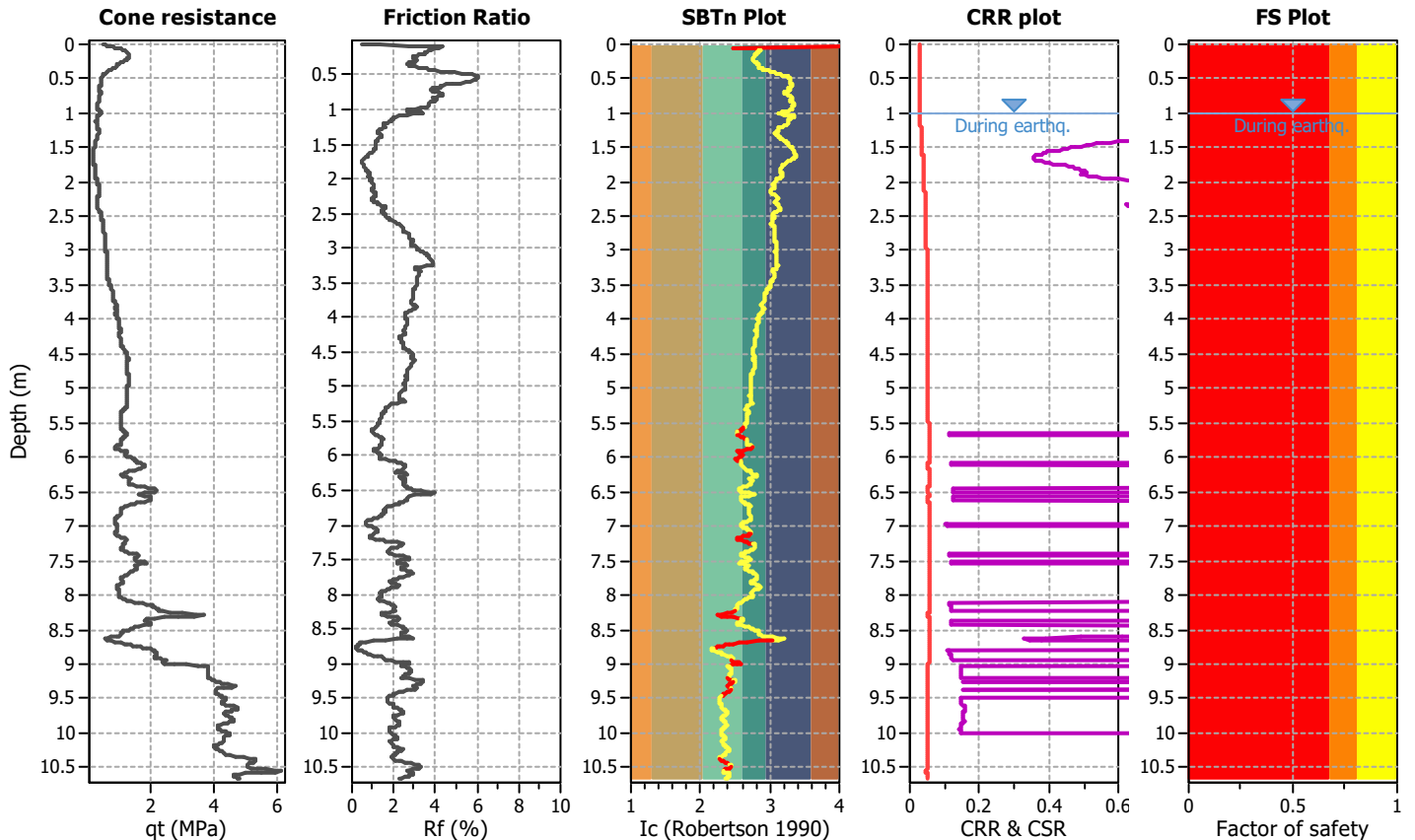
**Project title :**

**Location :**

**CPT file : CPT407**

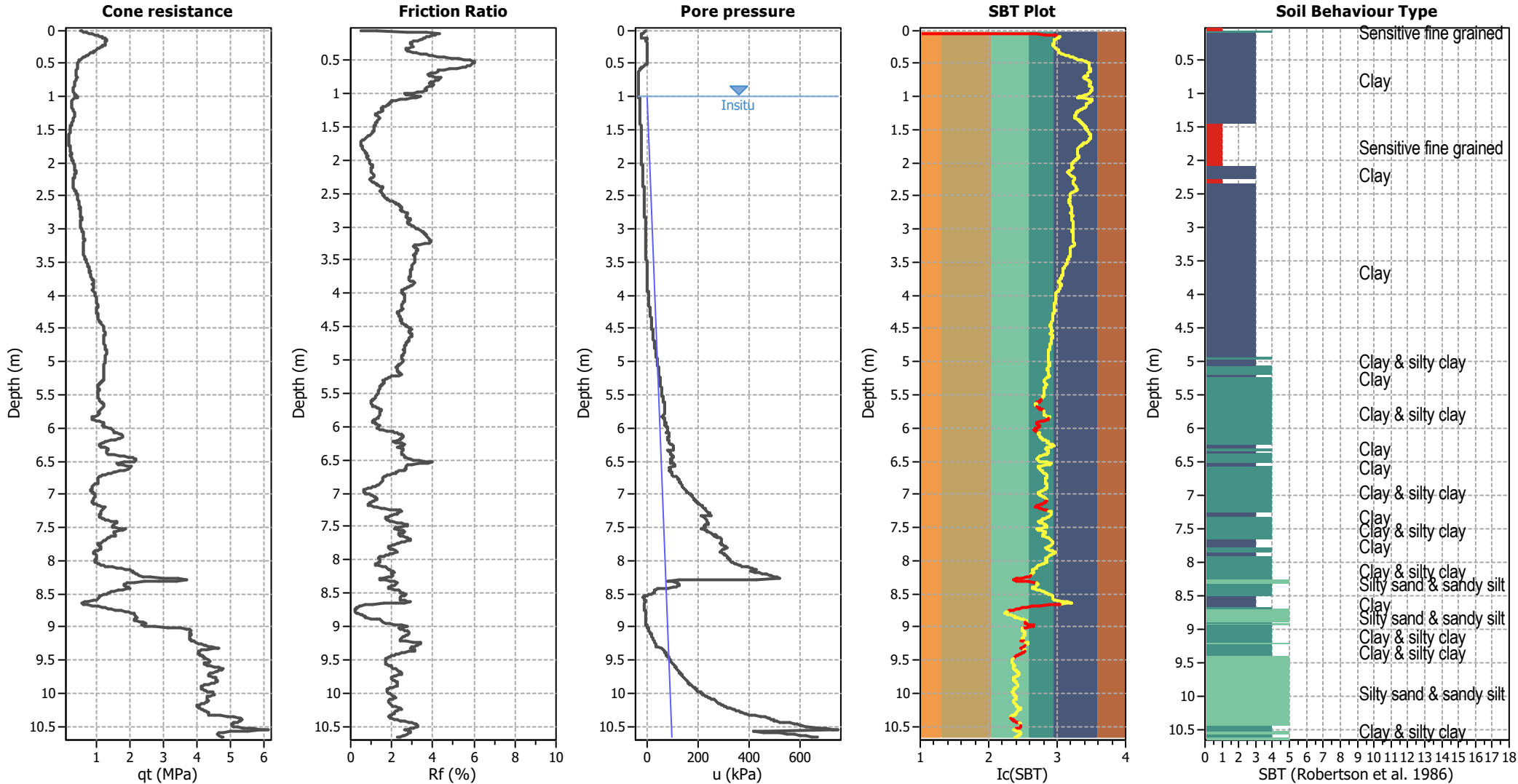
### Input parameters and analysis data

|                              |                   |                           |              |                         |     |                      |              |
|------------------------------|-------------------|---------------------------|--------------|-------------------------|-----|----------------------|--------------|
| Analysis method:             | B&I (2014)        | G.W.T. (in-situ):         | 1.00 m       | Use fill:               | No  | Clay like behavior   |              |
| Fines correction method:     | B&I (2014)        | G.W.T. (earthq.):         | 1.00 m       | Fill height:            | N/A | applied:             | Sand & Clay  |
| Points to test:              | Based on Ic value | Average results interval: | 3            | Fill weight:            | N/A | Limit depth applied: | Yes          |
| Earthquake magnitude $M_w$ : | 6.50              | Ic cut-off value:         | 2.60         | Trans. detect. applied: | Yes | Limit depth:         | 10.00 m      |
| Peak ground acceleration:    | 0.05              | Unit weight calculation:  | Based on SBT | $K_\sigma$ applied:     | Yes | MSF method:          | Method based |



Zone A<sub>1</sub>: Cyclic liquefaction likely depending on size and duration of cyclic loading  
Zone A<sub>2</sub>: Cyclic liquefaction and strength loss likely depending on loading and ground geometry  
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening  
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots

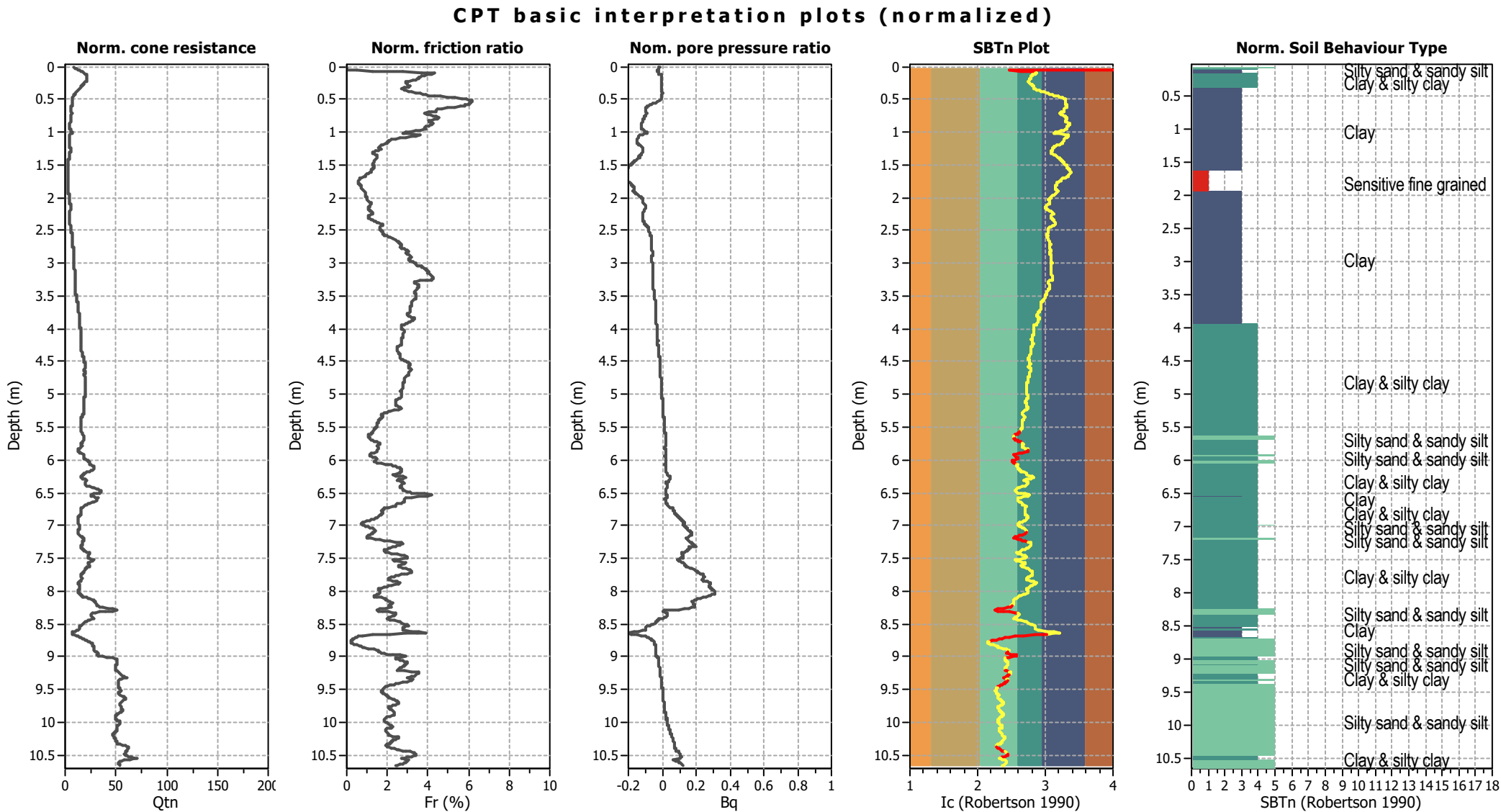


Input parameters and analysis data

|                                       |                   |                           |              |                             |             |
|---------------------------------------|-------------------|---------------------------|--------------|-----------------------------|-------------|
| 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: | Yes         |
| 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> : | 6.50              | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sand & Clay |
| Peak ground acceleration:             | 0.05              | 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 |



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: | Yes         |
| Points to test:                       | Based on Ic value | Ic cut-off value:         | 2.60         | K <sub>o</sub> applied:     | Yes         |
| Earthquake magnitude M <sub>w</sub> : | 6.50              | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sand & Clay |
| Peak ground acceleration:             | 0.05              | Use fill:                 | No           | Limit depth applied:        | Yes         |
| Depth to water table (insitu):        | 1.00 m            | Fill height:              | N/A          | Limit depth:                | 10.00 m     |

SBTn legend

1. Sensitive fine grained

2. Organic material

3. Clay to silty clay

4. Clayey silt to silty

5. Silty sand to sandy silt

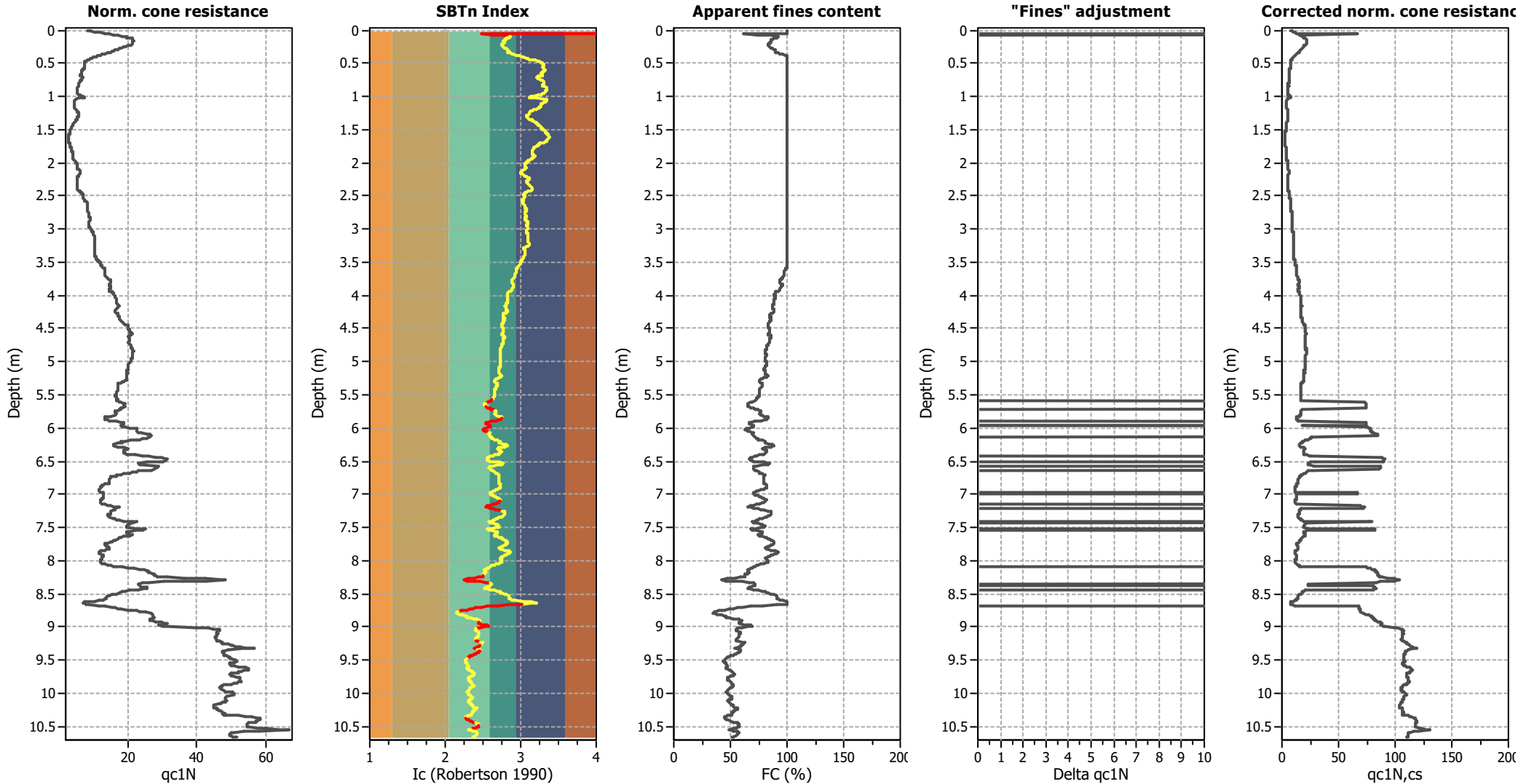
6. Clean sand to silty sand

7. Gravely sand to sand

8. Very stiff sand to

9. Very stiff fine grained

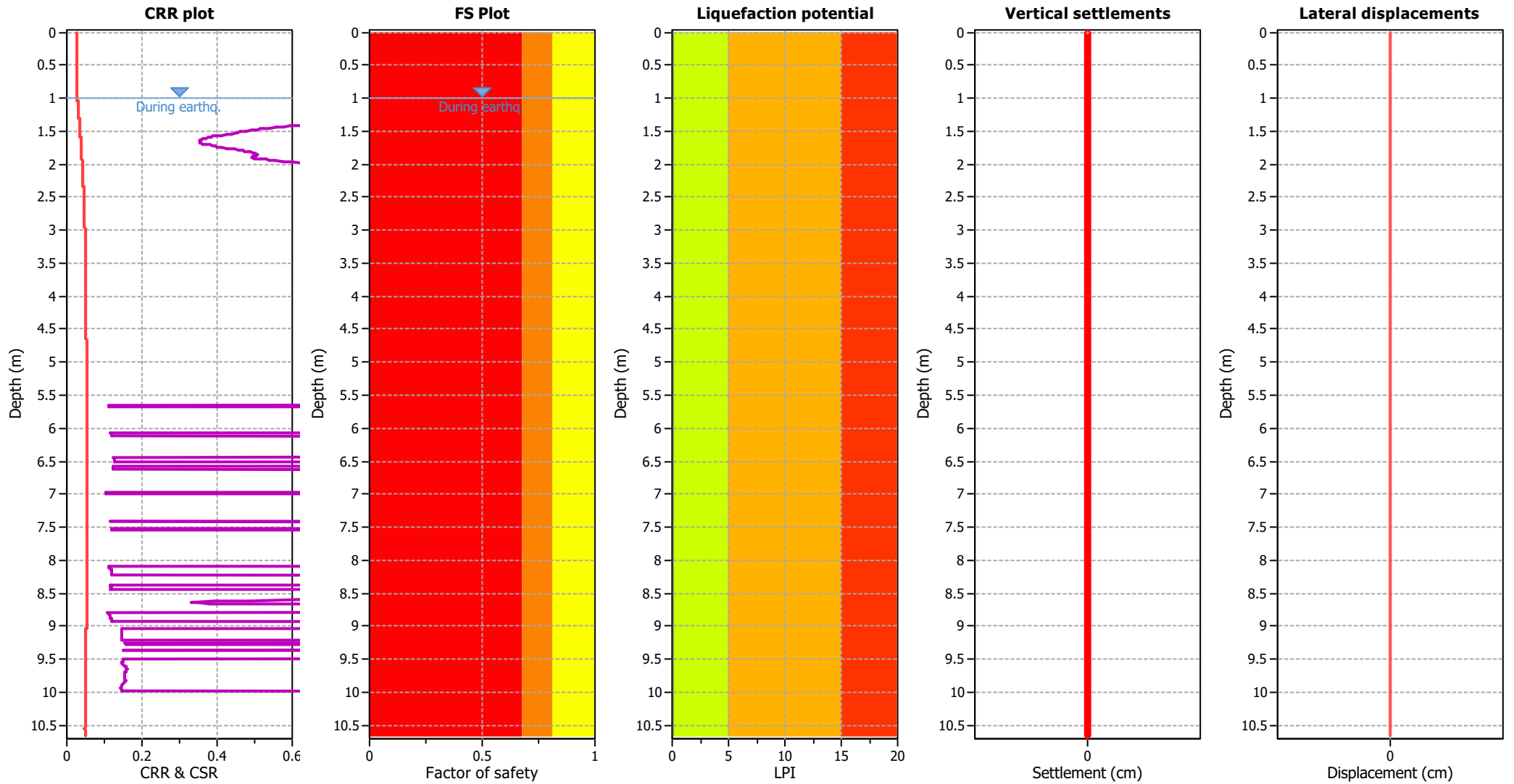
Liquefaction analysis overall plots (intermediate results)



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: | Yes         |
| Points to test:                       | Based on Ic value | Ic cut-off value:         | 2.60         | K <sub>o</sub> applied:     | Yes         |
| Earthquake magnitude M <sub>w</sub> : | 6.50              | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sand & Clay |
| Peak ground acceleration:             | 0.05              | Use fill:                 | No           | Limit depth applied:        | Yes         |
| Depth to water table (insitu):        | 1.00 m            | Fill height:              | N/A          | Limit depth:                | 10.00 m     |

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: | Yes         |
| Points to test:                       | Based on Ic value | Ic cut-off value:         | 2.60         | K <sub>o</sub> applied:     | Yes         |
| Earthquake magnitude M <sub>w</sub> : | 6.50              | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sand & Clay |
| Peak ground acceleration:             | 0.05              | Use fill:                 | No           | Limit depth applied:        | Yes         |
| Depth to water table (insitu):        | 1.00 m            | Fill height:              | N/A          | Limit depth:                | 10.00 m     |

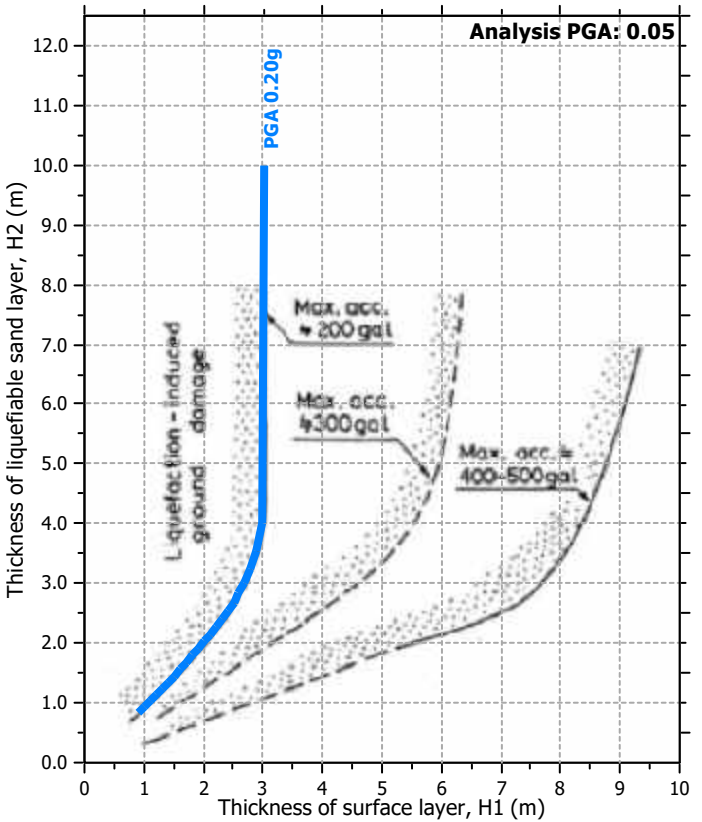
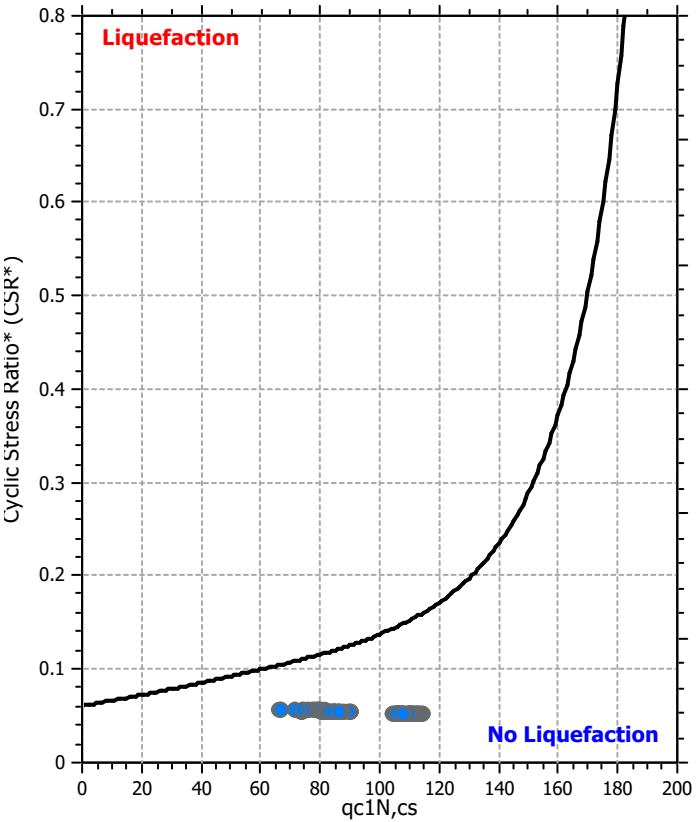
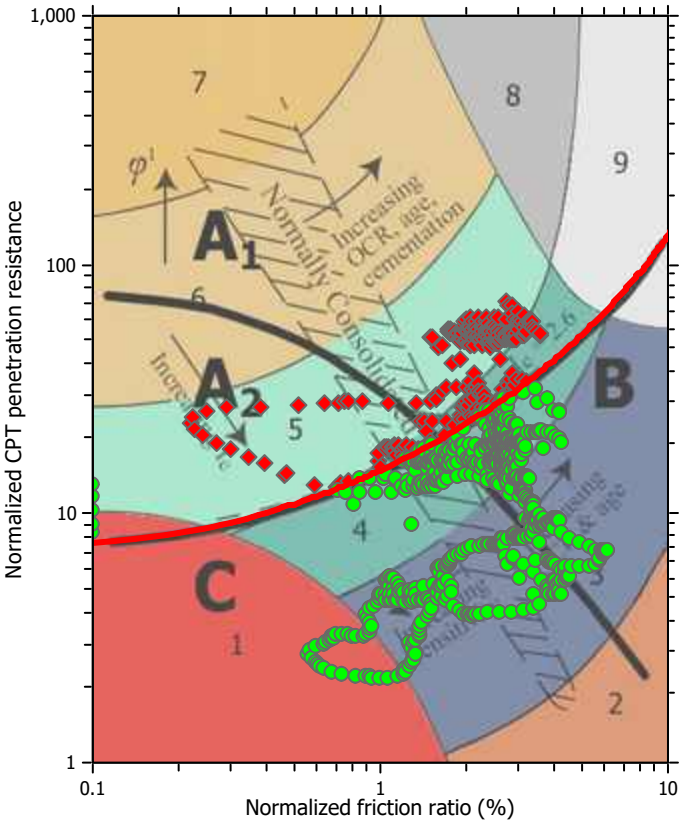
F.S. color scheme

- 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

LPI color scheme

- Very high risk
- High risk
- Low risk

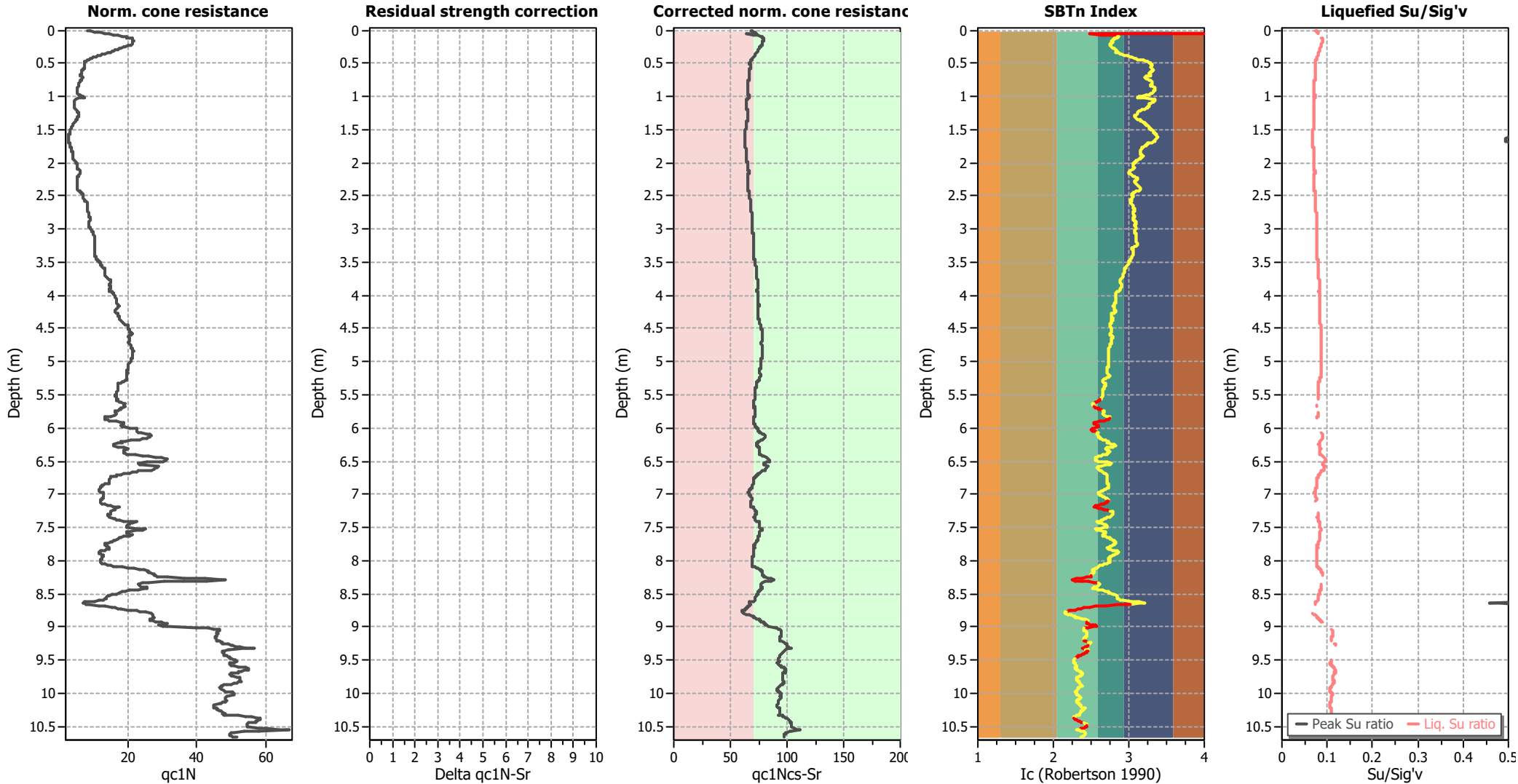
Liquefaction analysis summary plots



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: | Yes         |
| 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> : | 6.50              | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sand & Clay |
| Peak ground acceleration:             | 0.05              | Use fill:                 | No           | Limit depth applied:        | Yes         |
| Depth to water table (insitu):        | 1.00 m            | Fill height:              | N/A          | Limit depth:                | 10.00 m     |

Check for strength loss plots (Idriss & Boulanger (2008))



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: | Yes         |
| Points to test:                       | Based on Ic value | Ic cut-off value:         | 2.60         | K <sub>o</sub> applied:     | Yes         |
| Earthquake magnitude M <sub>w</sub> : | 6.50              | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sand & Clay |
| Peak ground acceleration:             | 0.05              | Use fill:                 | No           | Limit depth applied:        | Yes         |
| Depth to water table (insitu):        | 1.00 m            | Fill height:              | N/A          | Limit depth:                | 10.00 m     |

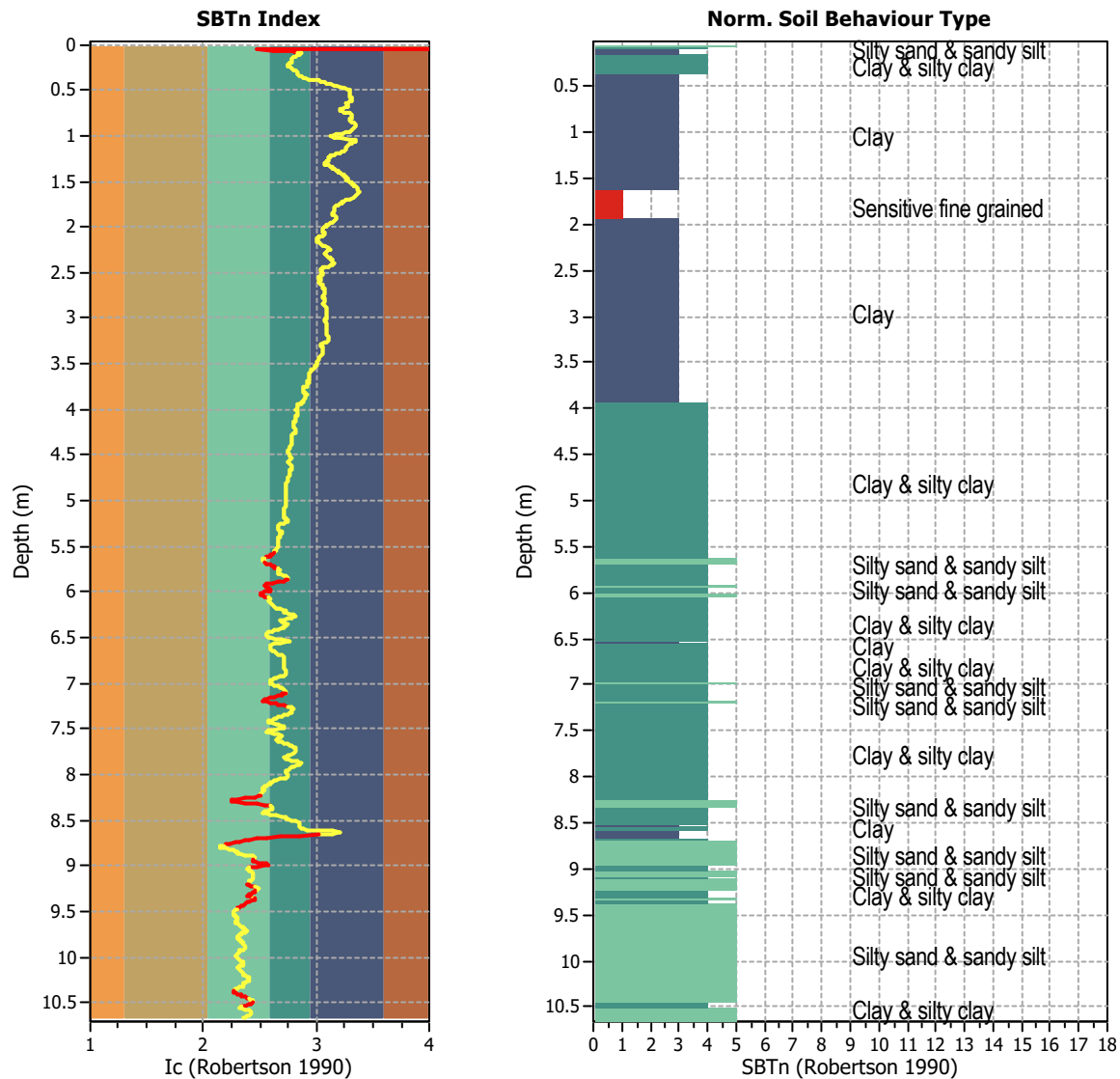
TRANSITION LAYER DETECTION ALGORITHM REPORT

Summary Details & Plots

Short description

The software will delete data when the cone is in transition from either clay to sand or vise-versa. To do this the software requires a range of  $I_c$  values over which the transition will be defined (typically somewhere between  $1.80 < I_c < 3.0$ ) and a rate of change of  $I_c$ . Transitions typically occur when the rate of change of  $I_c$  is fast (i.e.  $\Delta I_c$  is small).

The  $SBT_n$  plot below, displays in red the detected transition layers based on the parameters listed below the graphs.

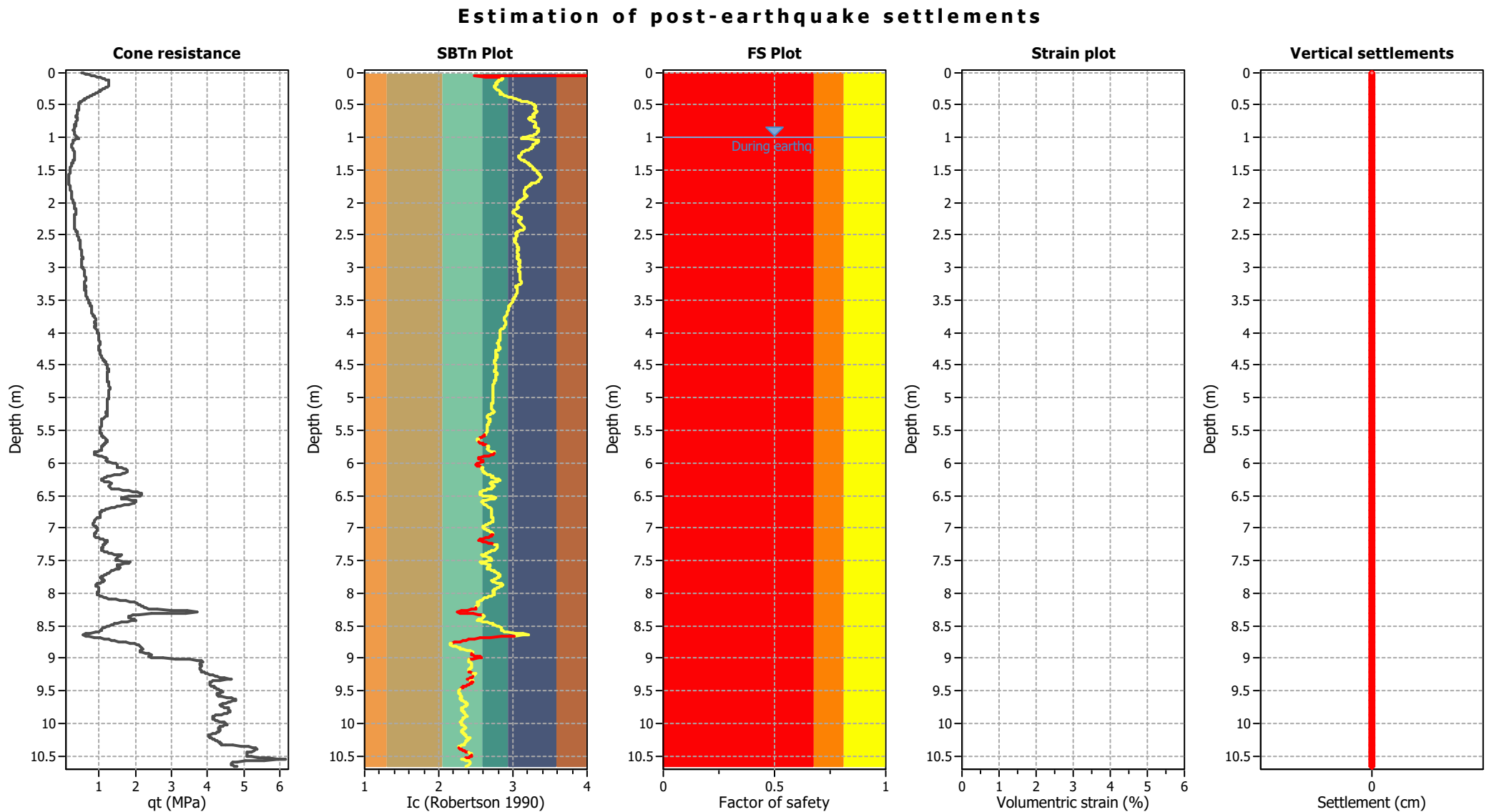


Transition layer algorithm properties

$I_c$  minimum check value: 1.70  
 $I_c$  maximum check value: 3.00  
 $I_c$  change ratio value: 0.0100  
Minimum number of points in layer: 4

General statistics

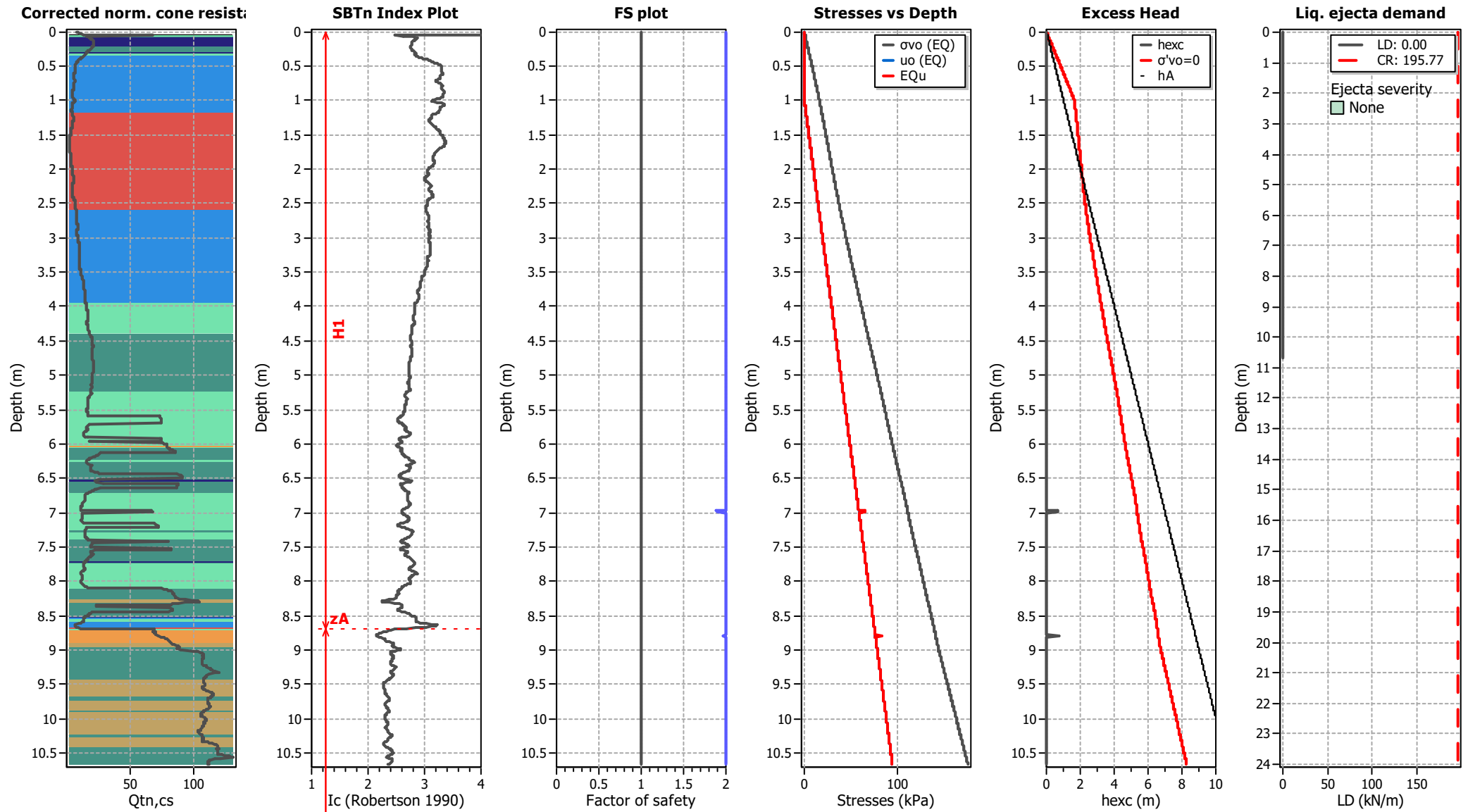
Total points in CPT file: 1066  
Total points excluded: 131  
Exclusion percentage: 12.29%  
Number of layers detected: 20



Abbreviations

- q<sub>t</sub>: Total cone resistance (cone resistance q<sub>c</sub> corrected for pore water effects)
- I<sub>c</sub>: Soil Behaviour Type Index
- FS: Calculated Factor of Safety against liquefaction
- Volumetric strain: Post-liquefaction volumetric strain

## Ejecta Severity Estimation



## LIQUEFACTION ANALYSIS REPORT

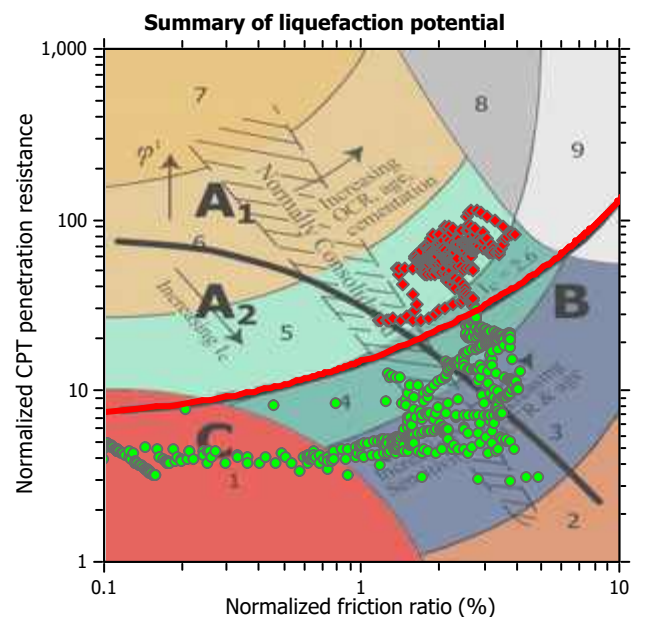
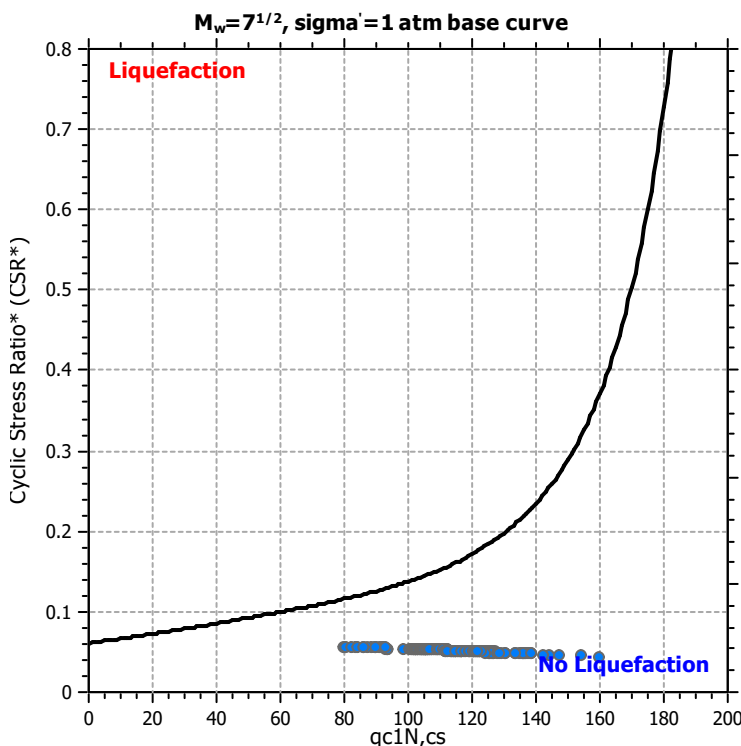
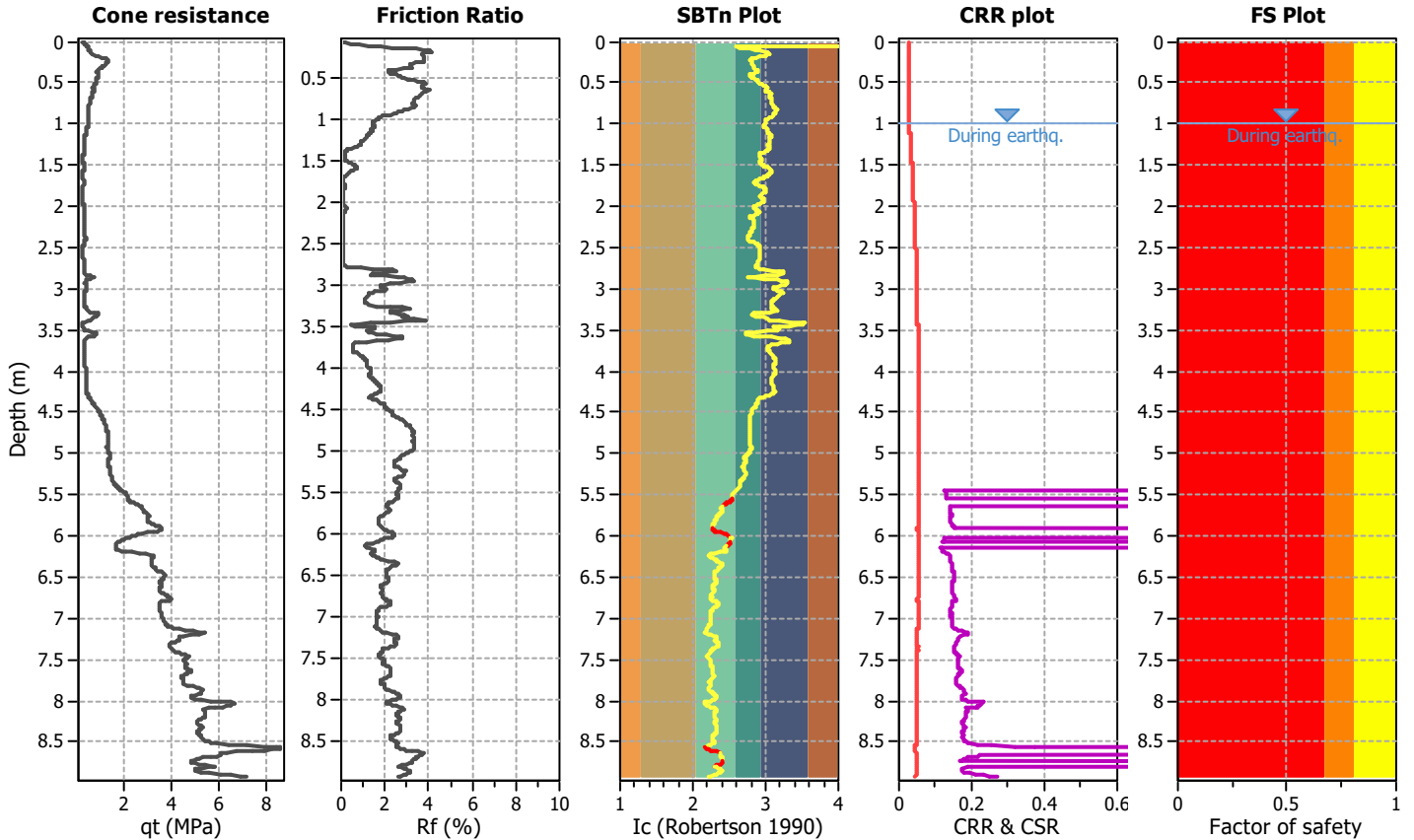
**Project title :**

**Location :**

**CPT file : CPT408**

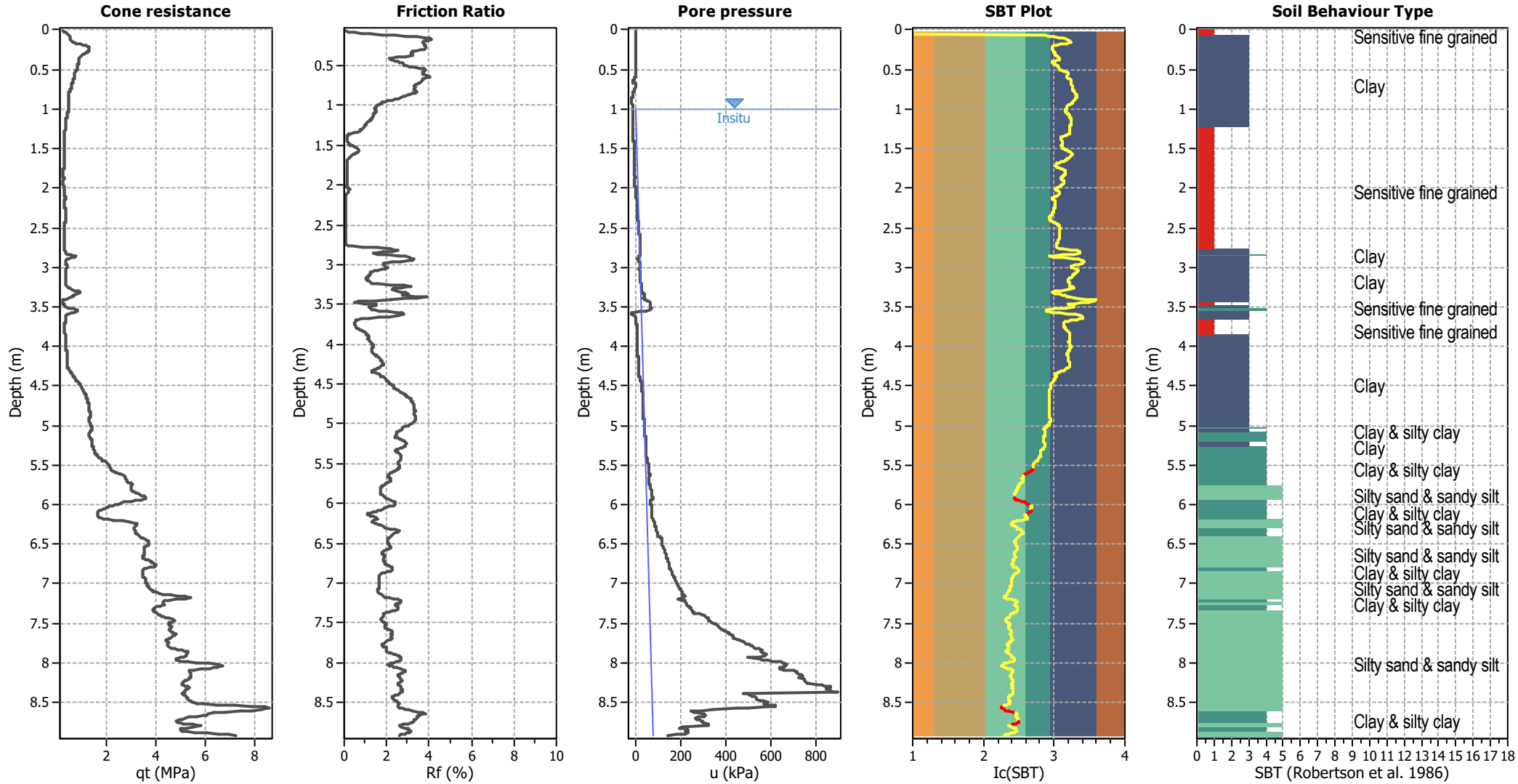
### Input parameters and analysis data

|                              |                   |                           |              |                         |     |                             |              |
|------------------------------|-------------------|---------------------------|--------------|-------------------------|-----|-----------------------------|--------------|
| Analysis method:             | B&I (2014)        | G.W.T. (in-situ):         | 1.00 m       | Use fill:               | No  | Clay like behavior applied: | Sands only   |
| Fines correction method:     | B&I (2014)        | G.W.T. (earthq.):         | 1.00 m       | Fill height:            | N/A | Limit depth applied:        | Yes          |
| Points to test:              | Based on Ic value | Average results interval: | 3            | Fill weight:            | N/A | Limit depth:                | 10.00 m      |
| Earthquake magnitude $M_w$ : | 6.50              | Ic cut-off value:         | 2.60         | Trans. detect. applied: | Yes | MSF method:                 | Method based |
| Peak ground acceleration:    | 0.05              | Unit weight calculation:  | Based on SBT | $K_\sigma$ applied:     | Yes |                             |              |



Zone A1: Cyclic liquefaction likely depending on size and duration of cyclic loading  
Zone A2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry  
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening  
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots

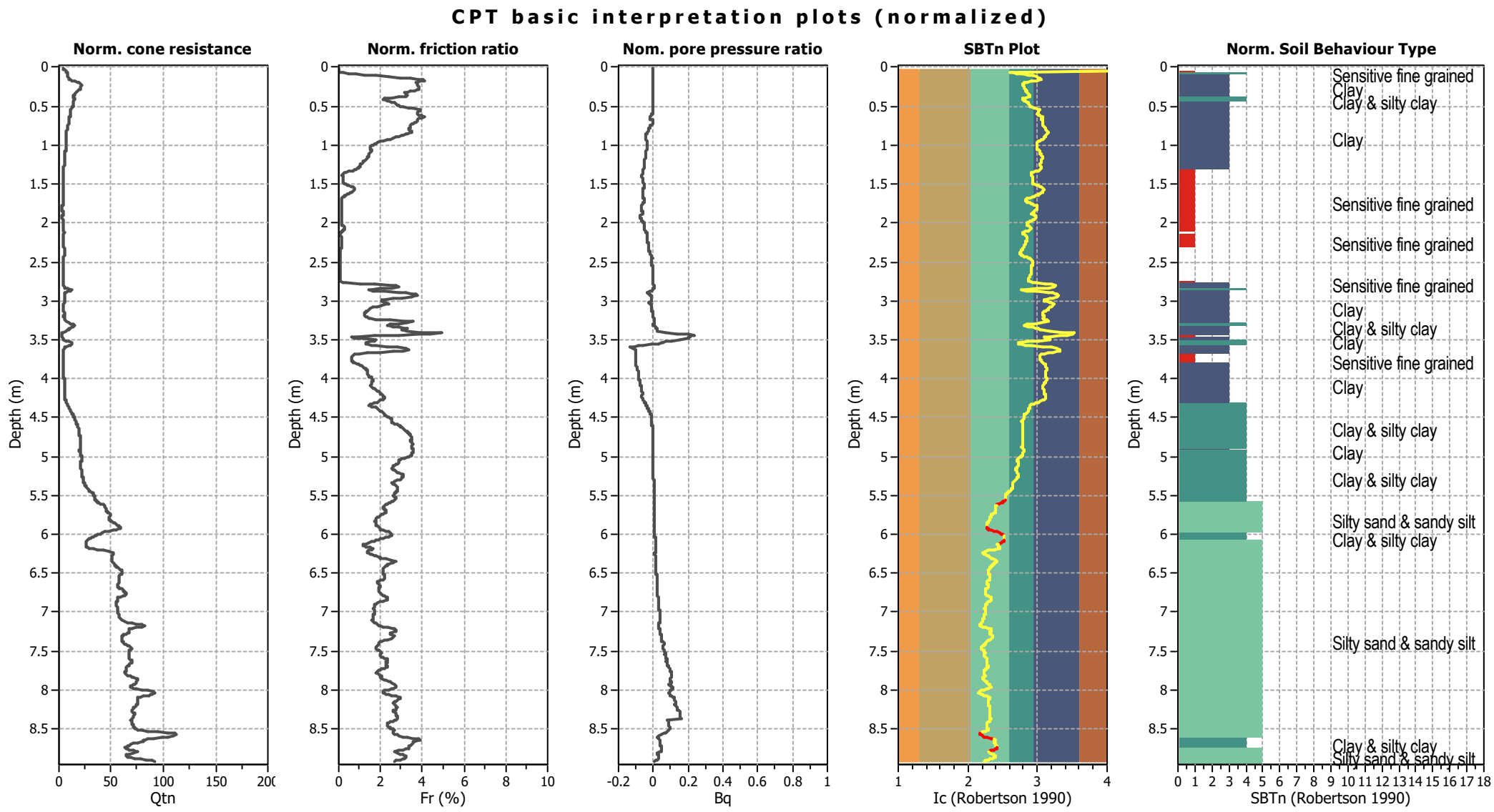


Input parameters and analysis data

|                                       |                   |                           |              |                             |            |
|---------------------------------------|-------------------|---------------------------|--------------|-----------------------------|------------|
| 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: | Yes        |
| 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> : | 6.50              | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration:             | 0.05              | 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 |



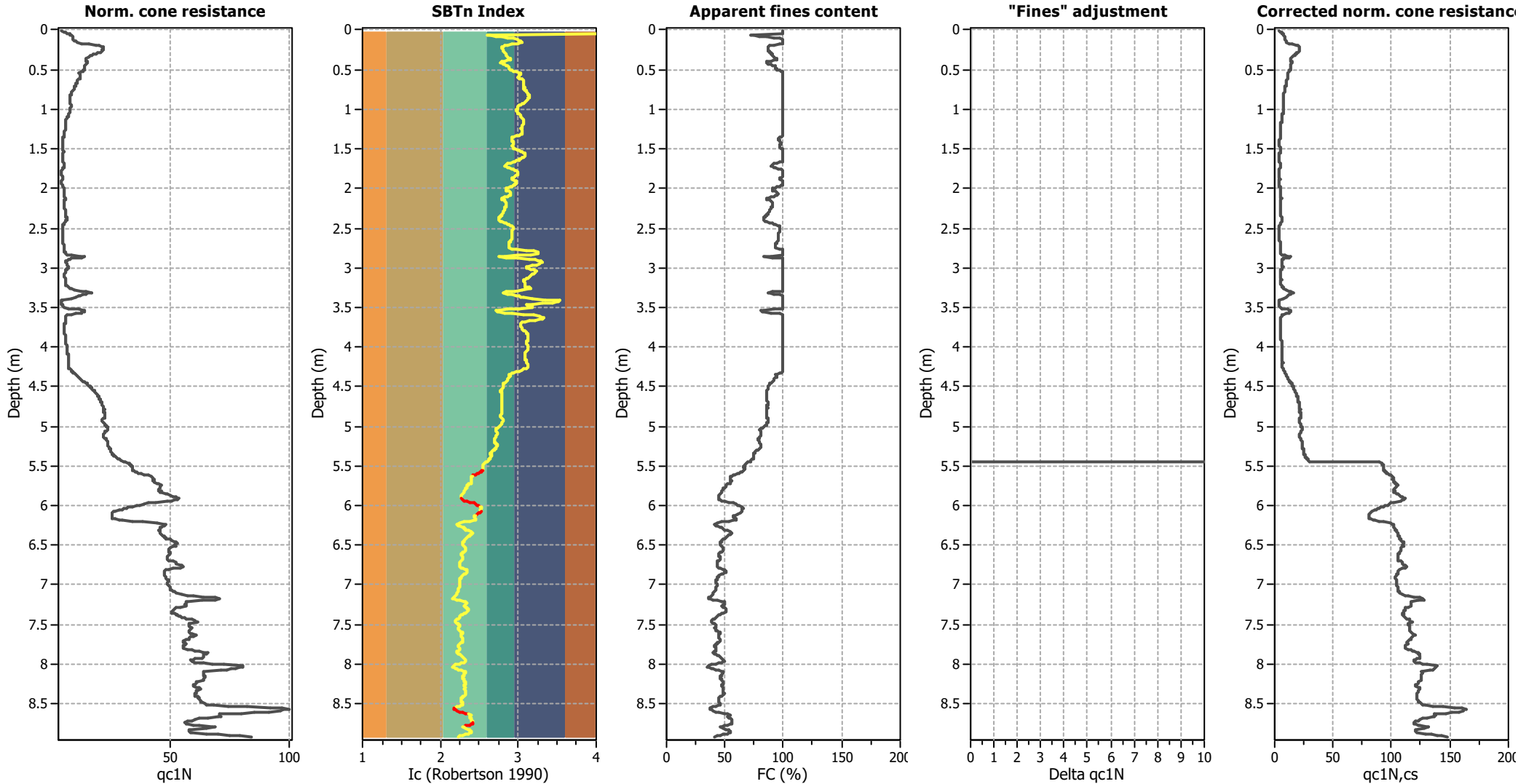
Input parameters and analysis data

|                                       |                   |                           |              |                             |            |
|---------------------------------------|-------------------|---------------------------|--------------|-----------------------------|------------|
| 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: | Yes        |
| 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> : | 6.50              | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration:             | 0.05              | Use fill:                 | No           | Limit depth applied:        | Yes        |
| Depth to water table (insitu):        | 1.00 m            | Fill height:              | N/A          | Limit depth:                | 10.00 m    |

SBTn legend

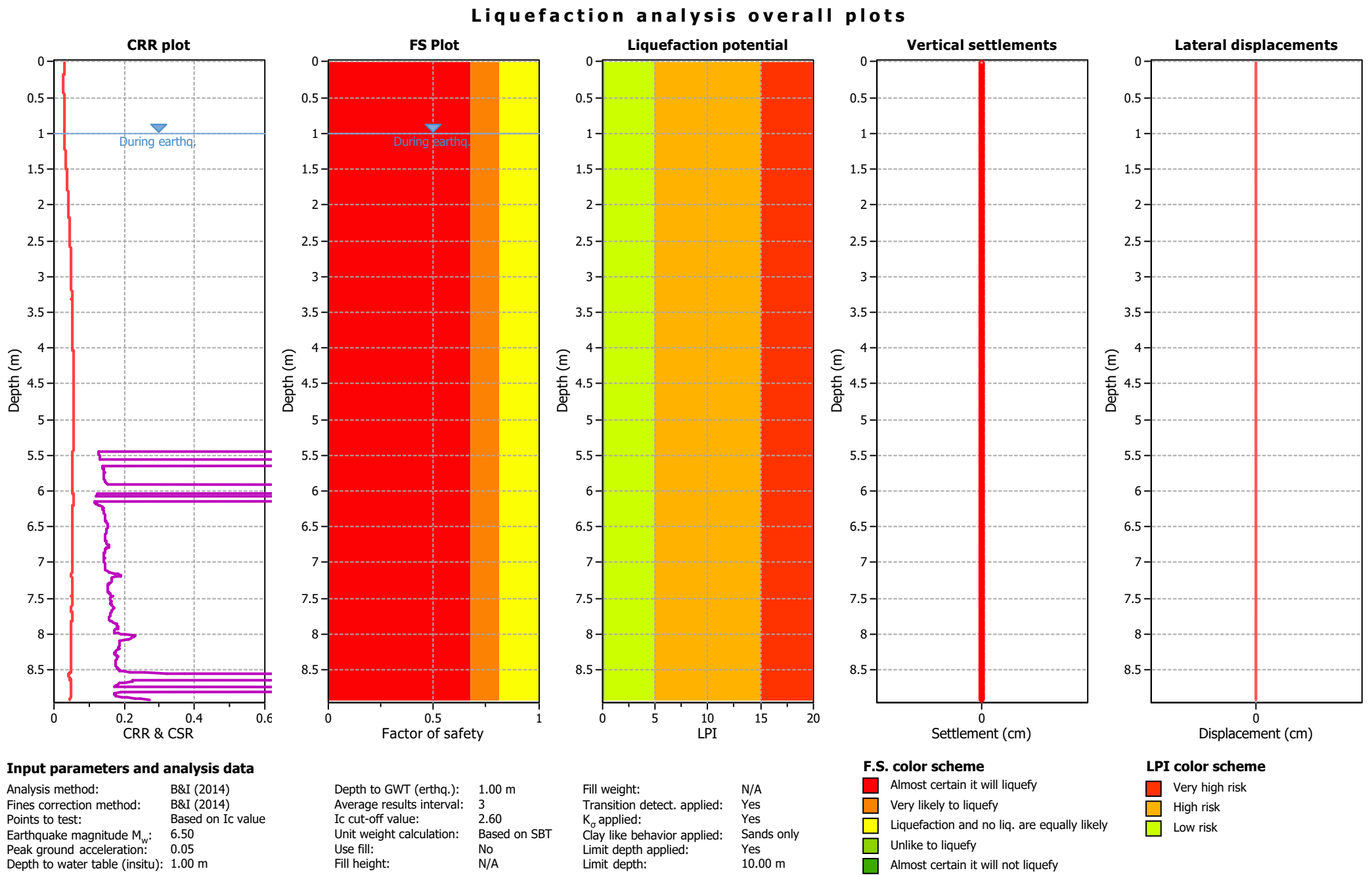
|                           |                             |                            |
|---------------------------|-----------------------------|----------------------------|
| 1. Sensitive fine grained | 4. Clayey silt to silty     | 7. Gravely sand to sand    |
| 2. Organic material       | 5. Silty 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 |

Liquefaction analysis overall plots (intermediate results)

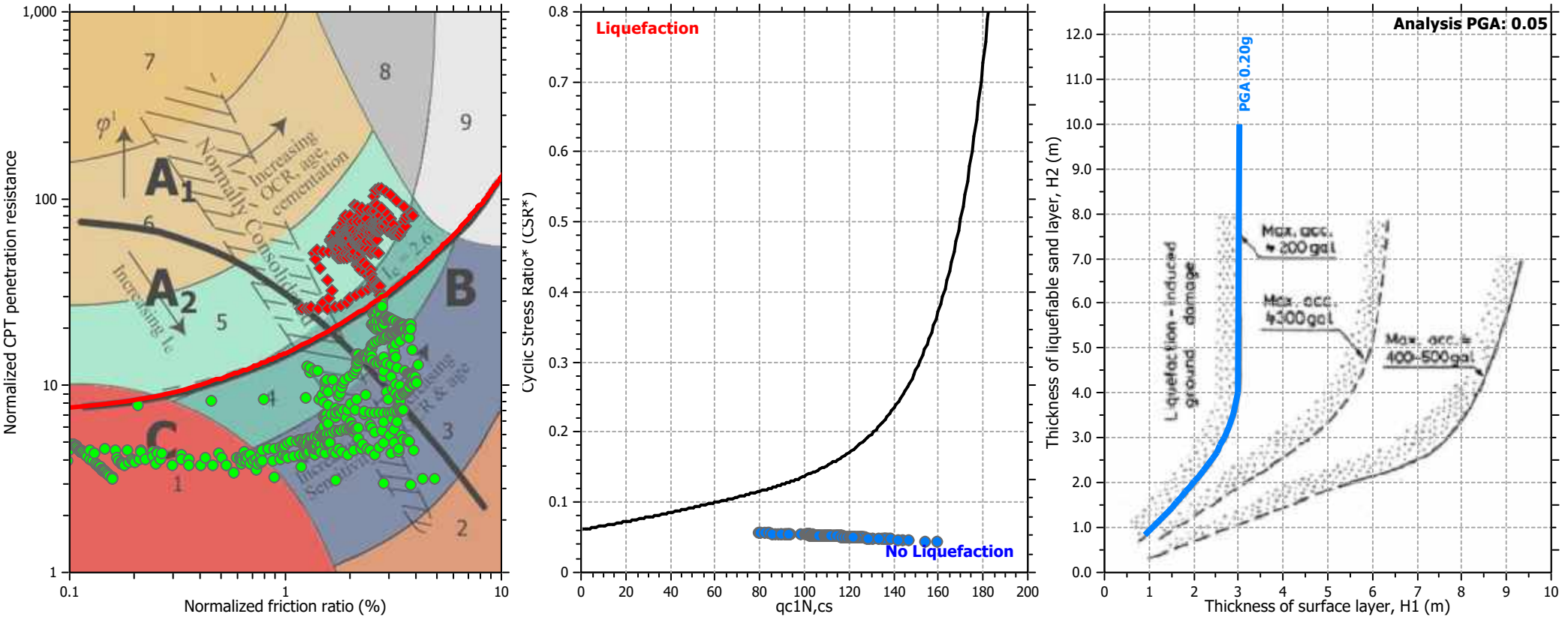


Input parameters and analysis data

|                                       |                   |                           |              |                             |            |
|---------------------------------------|-------------------|---------------------------|--------------|-----------------------------|------------|
| 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: | Yes        |
| Points to test:                       | Based on Ic value | Ic cut-off value:         | 2.60         | K <sub>o</sub> applied:     | Yes        |
| Earthquake magnitude M <sub>w</sub> : | 6.50              | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration:             | 0.05              | Use fill:                 | No           | Limit depth applied:        | Yes        |
| Depth to water table (insitu):        | 1.00 m            | Fill height:              | N/A          | Limit depth:                | 10.00 m    |



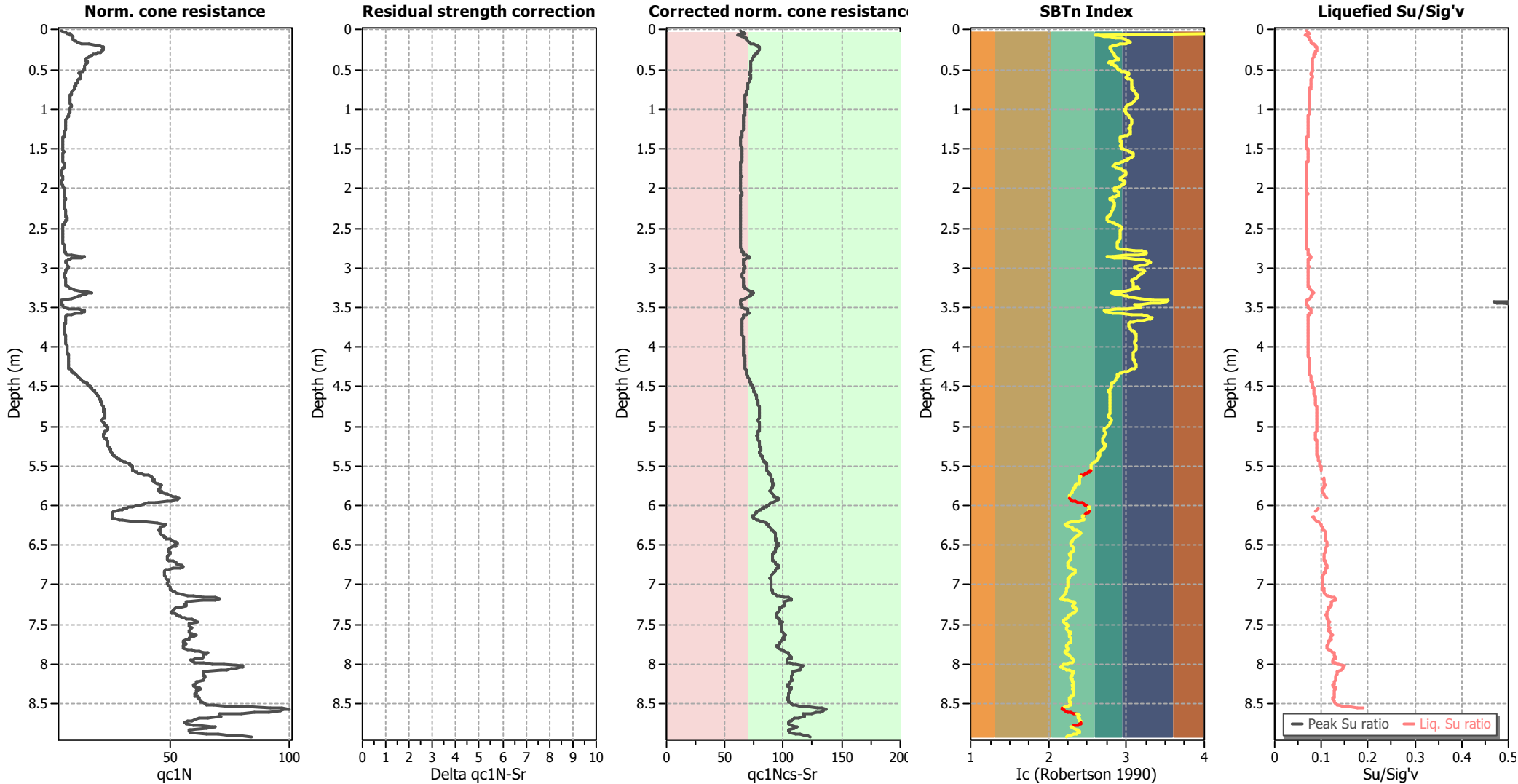
Liquefaction analysis summary plots



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: | Yes        |
| Points to test:                | Based on $I_c$ value | $I_c$ cut-off value:      | 2.60         | $K_o$ applied:              | Yes        |
| Earthquake magnitude $M_w$ :   | 6.50                 | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration:      | 0.05                 | Use fill:                 | No           | Limit depth applied:        | Yes        |
| Depth to water table (insitu): | 1.00 m               | Fill height:              | N/A          | Limit depth:                | 10.00 m    |

Check for strength loss plots (Idriss & Boulanger (2008))



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: | Yes        |
| Points to test:                       | Based on Ic value | Ic cut-off value:         | 2.60         | K <sub>o</sub> applied:     | Yes        |
| Earthquake magnitude M <sub>w</sub> : | 6.50              | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration:             | 0.05              | Use fill:                 | No           | Limit depth applied:        | Yes        |
| Depth to water table (insitu):        | 1.00 m            | Fill height:              | N/A          | Limit depth:                | 10.00 m    |

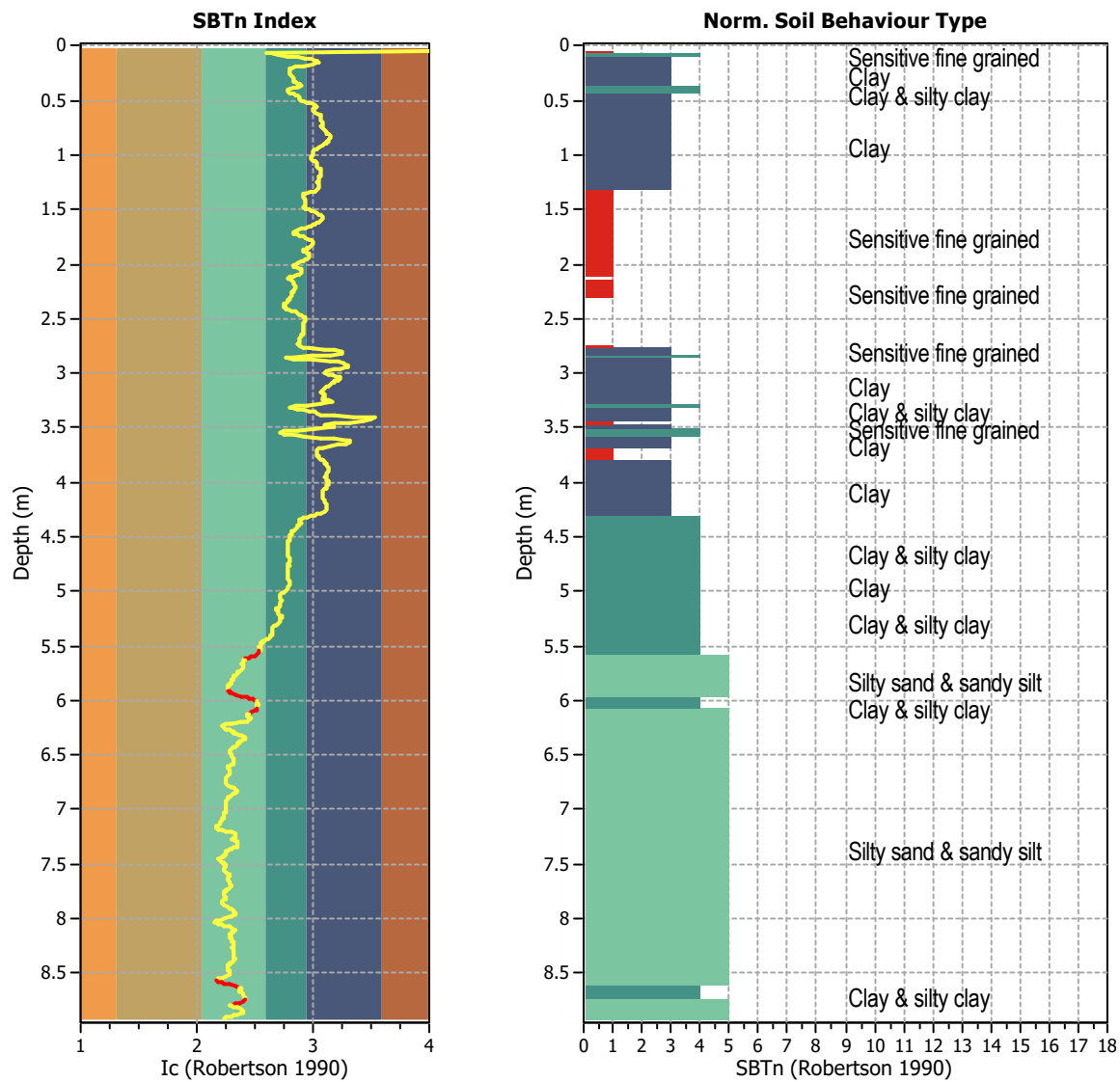
TRANSITION LAYER DETECTION ALGORITHM REPORT

Summary Details & Plots

Short description

The software will delete data when the cone is in transition from either clay to sand or vice-versa. To do this the software requires a range of  $I_c$  values over which the transition will be defined (typically somewhere between  $1.80 < I_c < 3.0$ ) and a rate of change of  $I_c$ . Transitions typically occur when the rate of change of  $I_c$  is fast (i.e.  $\Delta I_c$  is small).

The  $SBT_n$  plot below, displays in red the detected transition layers based on the parameters listed below the graphs.

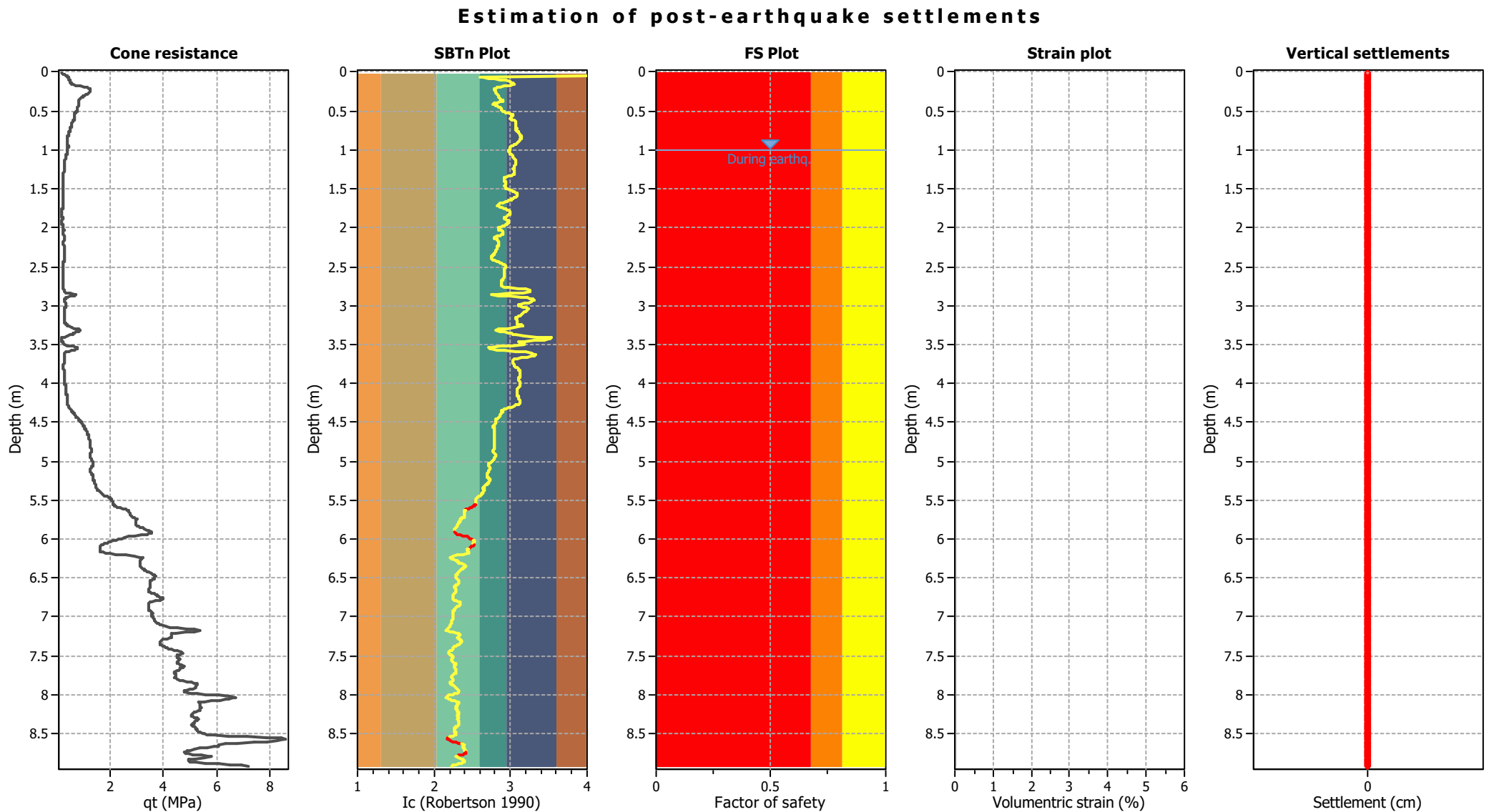


Transition layer algorithm properties

$I_c$  minimum check value: 1.70  
 $I_c$  maximum check value: 3.00  
 $I_c$  change ratio value: 0.0100  
Minimum number of points in layer: 4

General statistics

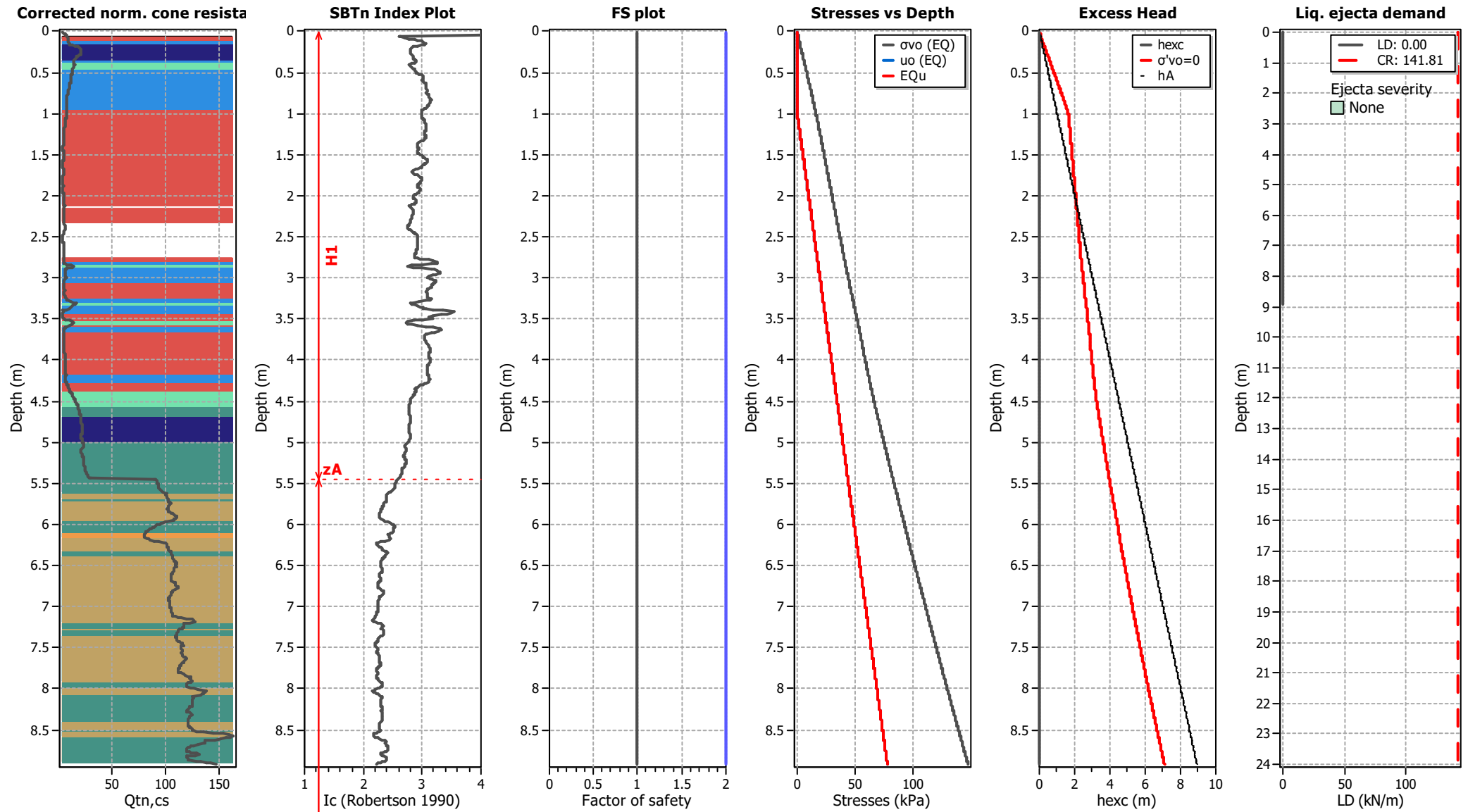
Total points in CPT file: 892  
Total points excluded: 40  
Exclusion percentage: 4.48%  
Number of layers detected: 5



Abbreviations

- q<sub>c</sub>: Total cone resistance (cone resistance q<sub>c</sub> corrected for pore water effects)
- I<sub>c</sub>: Soil Behaviour Type Index
- FS: Calculated Factor of Safety against liquefaction
- Volumetric strain: Post-liquefaction volumetric strain

## Ejecta Severity Estimation



## LIQUEFACTION ANALYSIS REPORT

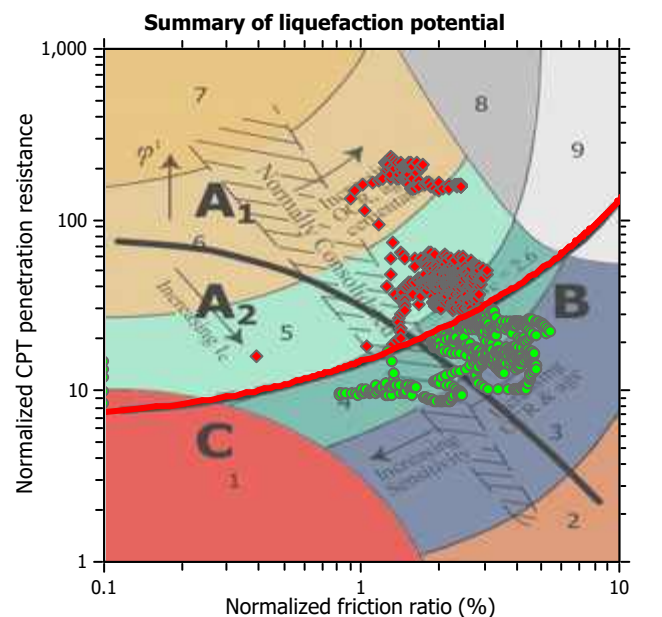
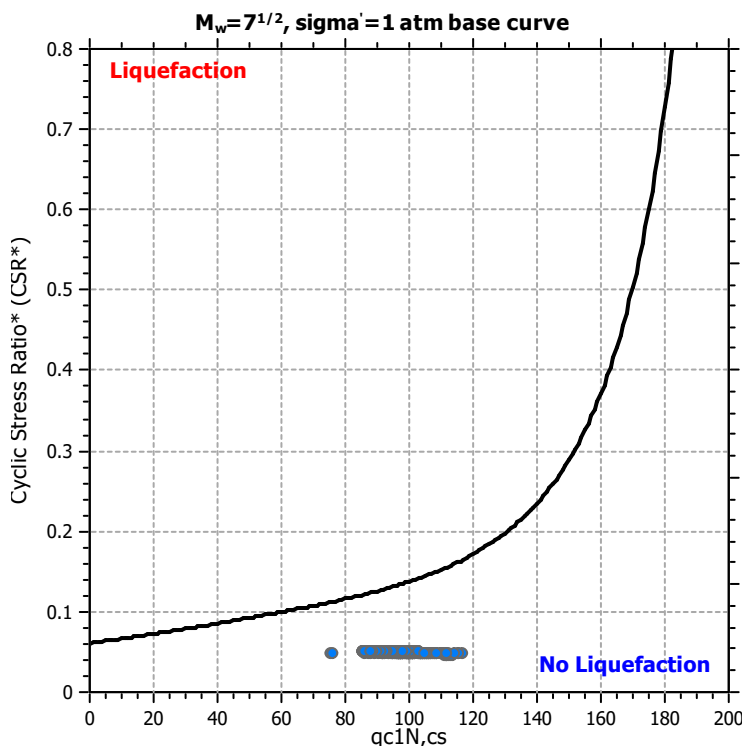
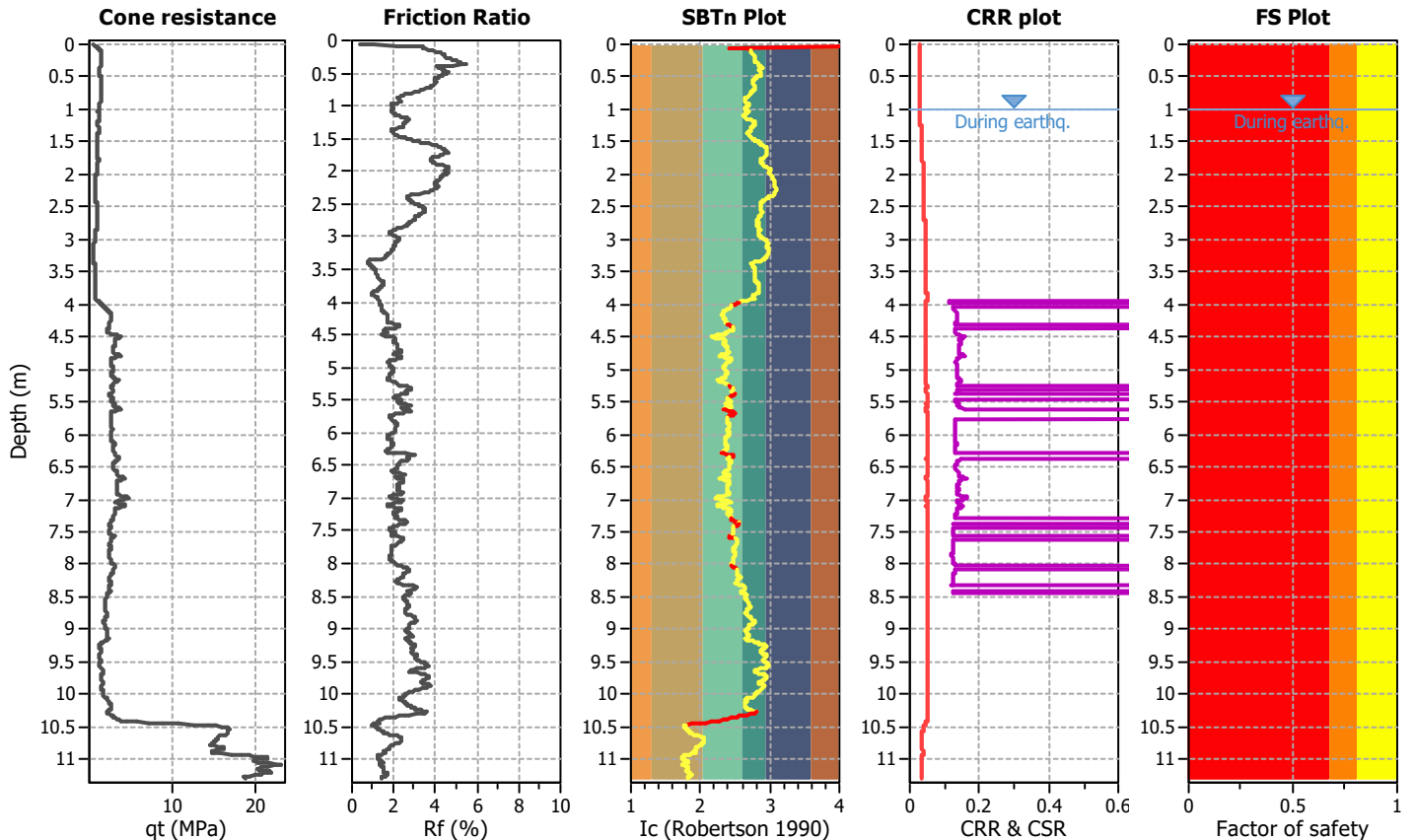
**Project title :**

**Location :**

**CPT file : CPT409**

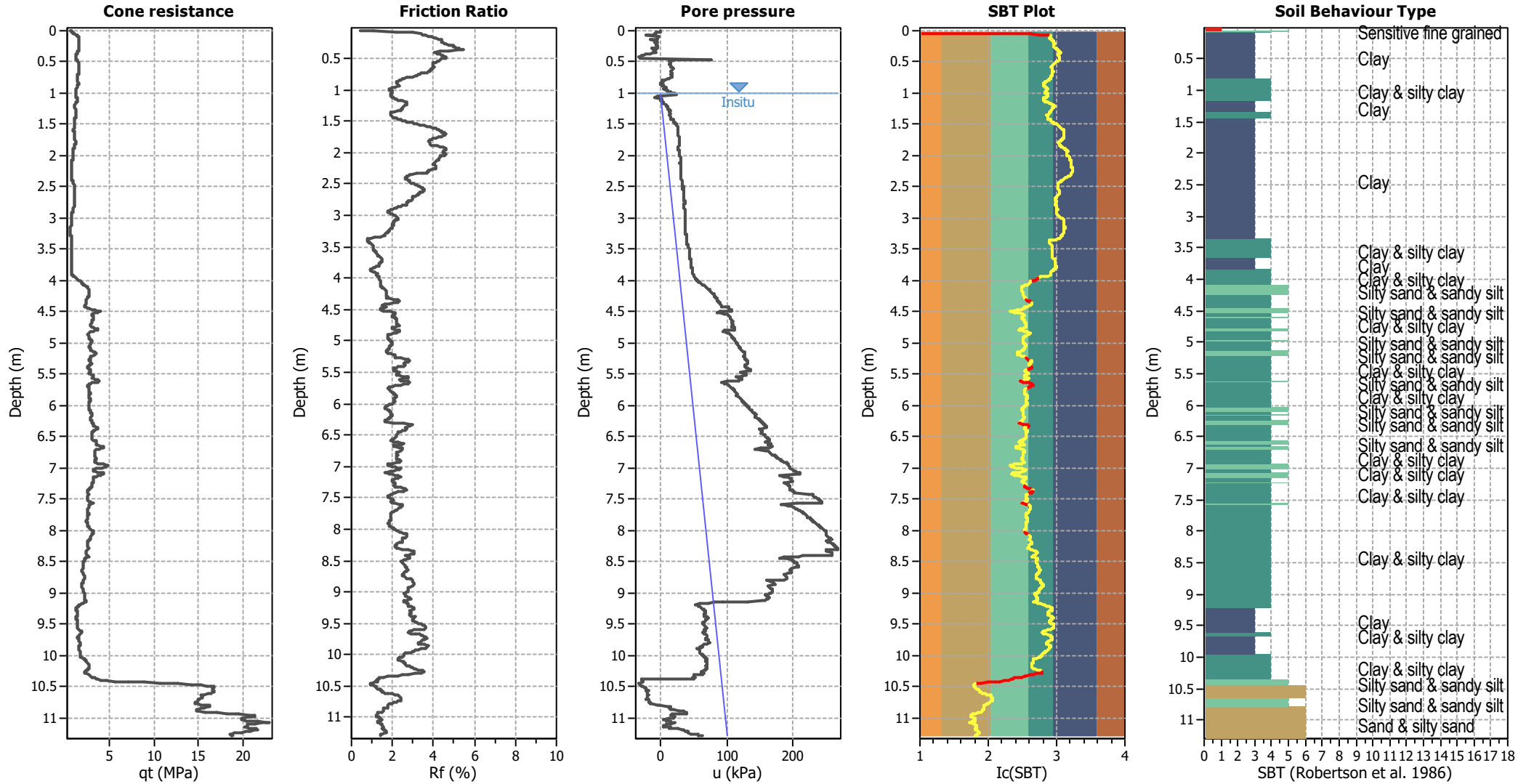
### Input parameters and analysis data

|                              |                   |                           |              |                         |     |                      |              |
|------------------------------|-------------------|---------------------------|--------------|-------------------------|-----|----------------------|--------------|
| Analysis method:             | B&I (2014)        | G.W.T. (in-situ):         | 1.00 m       | Use fill:               | No  | Clay like behavior   |              |
| Fines correction method:     | B&I (2014)        | G.W.T. (earthq.):         | 1.00 m       | Fill height:            | N/A | applied:             | Sands only   |
| Points to test:              | Based on Ic value | Average results interval: | 3            | Fill weight:            | N/A | Limit depth applied: | Yes          |
| Earthquake magnitude $M_w$ : | 6.50              | Ic cut-off value:         | 2.60         | Trans. detect. applied: | Yes | Limit depth:         | 10.00 m      |
| Peak ground acceleration:    | 0.05              | Unit weight calculation:  | Based on SBT | $K_\sigma$ applied:     | Yes | MSF method:          | Method based |



Zone A<sub>1</sub>: Cyclic liquefaction likely depending on size and duration of cyclic loading  
 Zone A<sub>2</sub>: Cyclic liquefaction and strength loss likely depending on loading and ground geometry  
 Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening  
 Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots

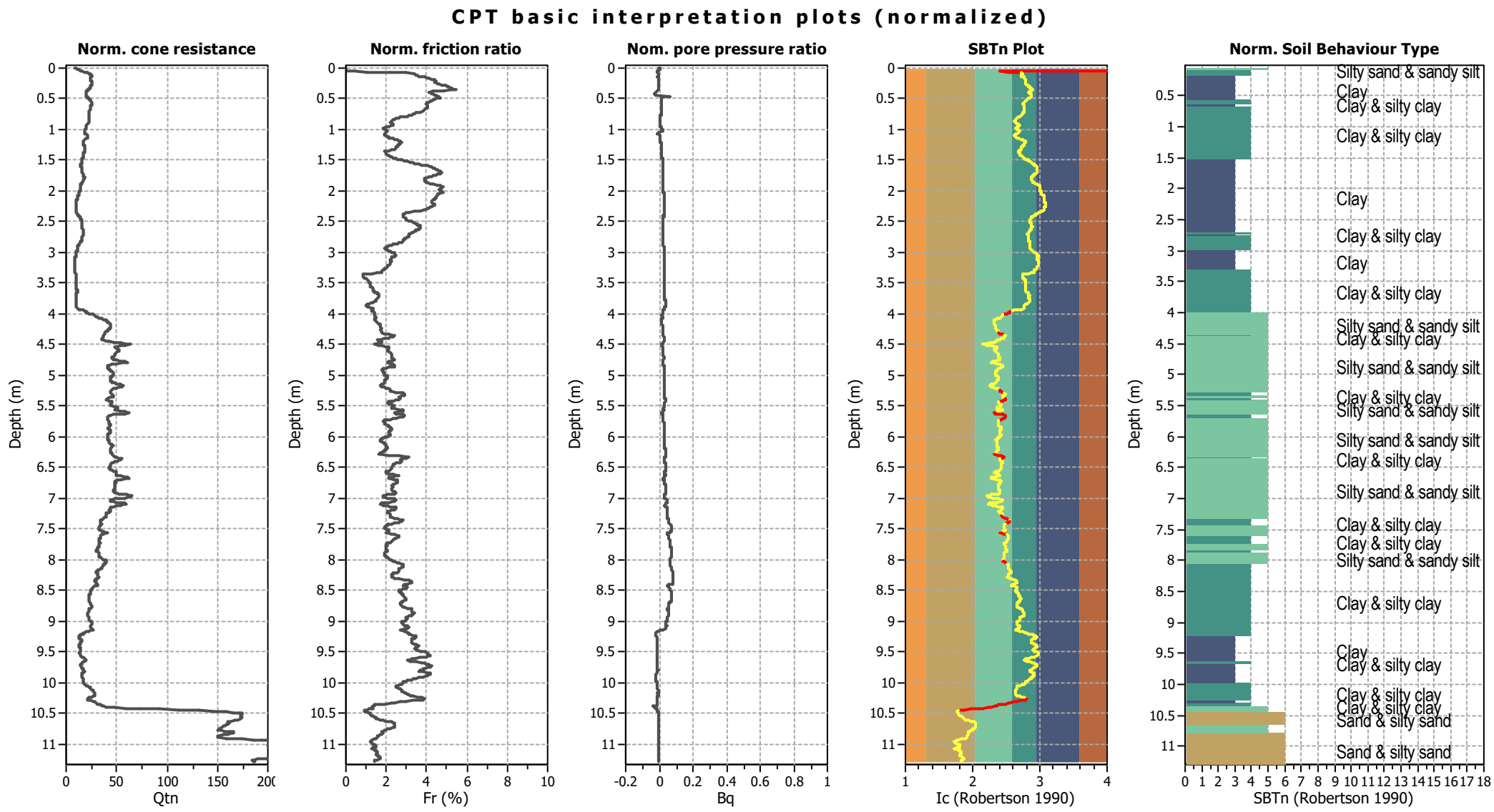


Input parameters and analysis data

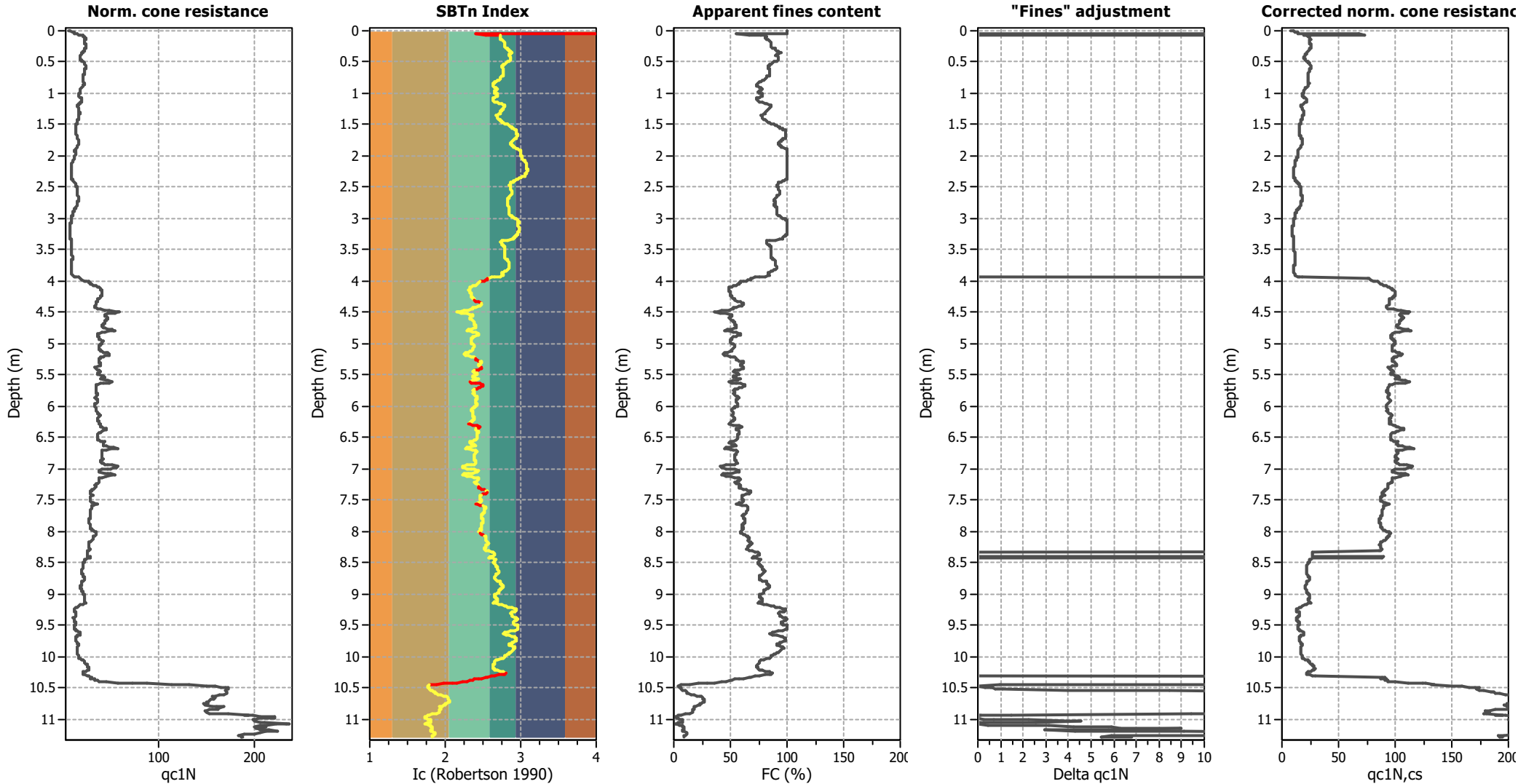
|                                |                      |                           |              |                             |            |
|--------------------------------|----------------------|---------------------------|--------------|-----------------------------|------------|
| Analysis method:               | 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: | Yes        |
| Points to test:                | Based on $I_c$ value | $I_c$ cut-off value:      | 2.60         | $K_o$ applied:              | Yes        |
| Earthquake magnitude $M_w$ :   | 6.50                 | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration:      | 0.05                 | 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 |



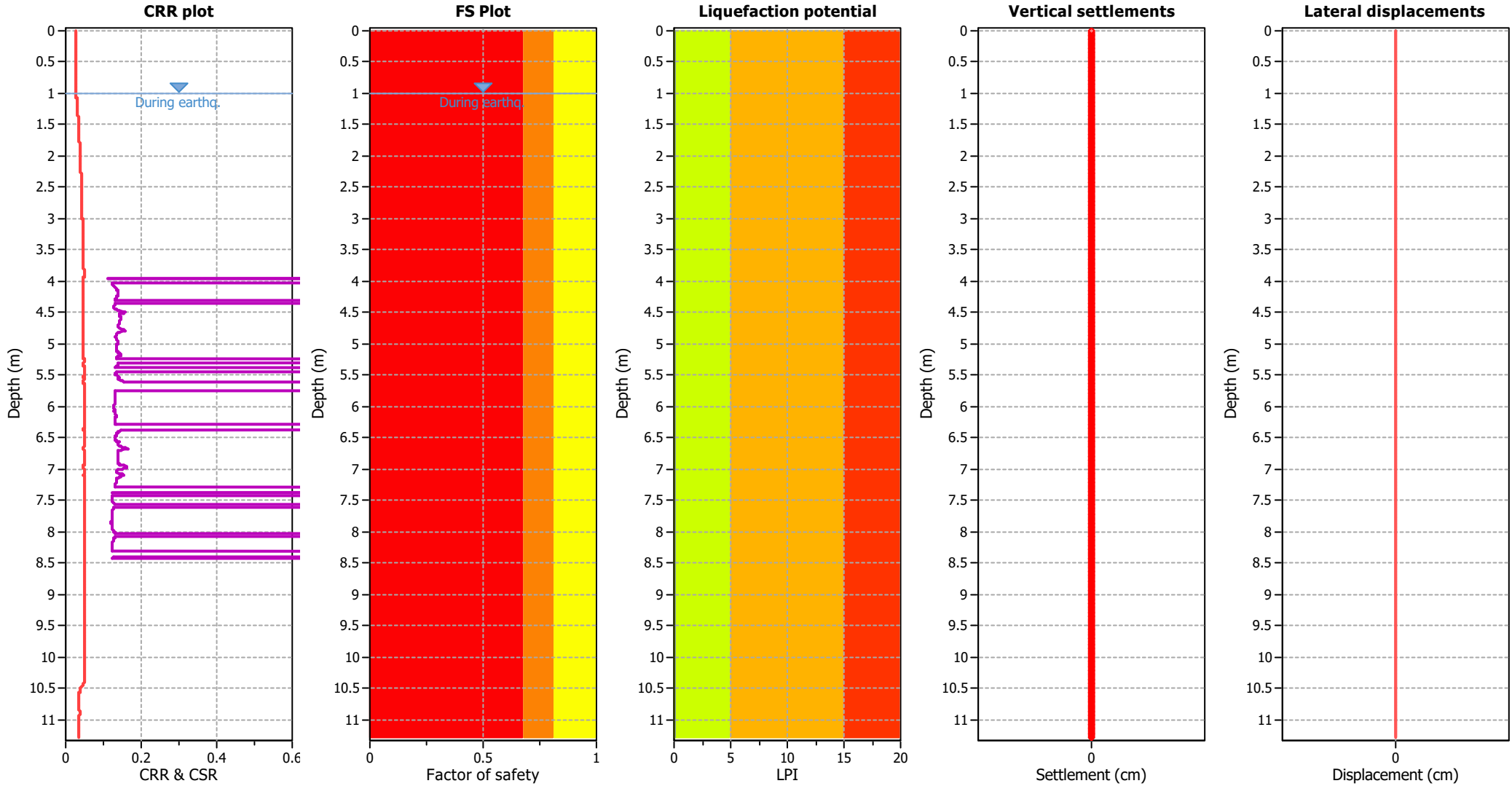
Liquefaction analysis overall plots (intermediate results)



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: | Yes        |
| 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> : | 6.50              | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration:             | 0.05              | Use fill:                 | No           | Limit depth applied:        | Yes        |
| Depth to water table (insitu):        | 1.00 m            | Fill height:              | N/A          | Limit depth:                | 10.00 m    |

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: | Yes        |
| Points to test:                       | Based on Ic value | Ic cut-off value:         | 2.60         | K <sub>o</sub> applied:     | Yes        |
| Earthquake magnitude M <sub>w</sub> : | 6.50              | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration:             | 0.05              | Use fill:                 | No           | Limit depth applied:        | Yes        |
| Depth to water table (insitu):        | 1.00 m            | Fill height:              | N/A          | Limit depth:                | 10.00 m    |

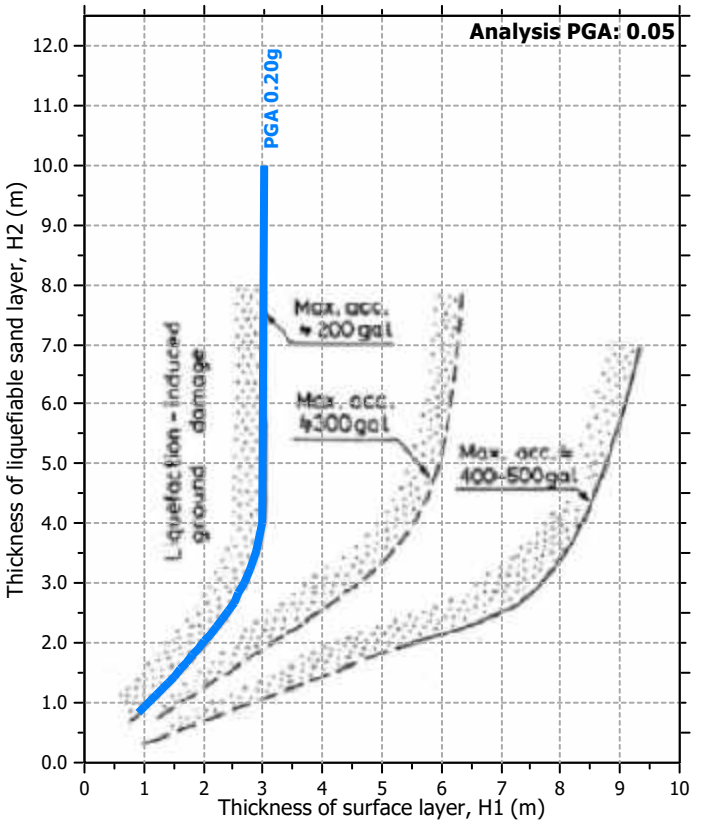
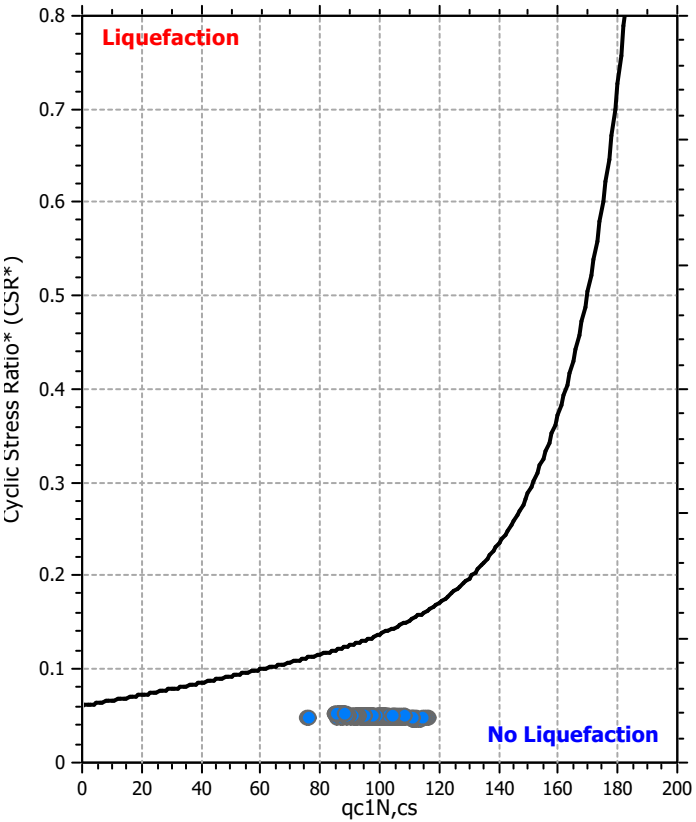
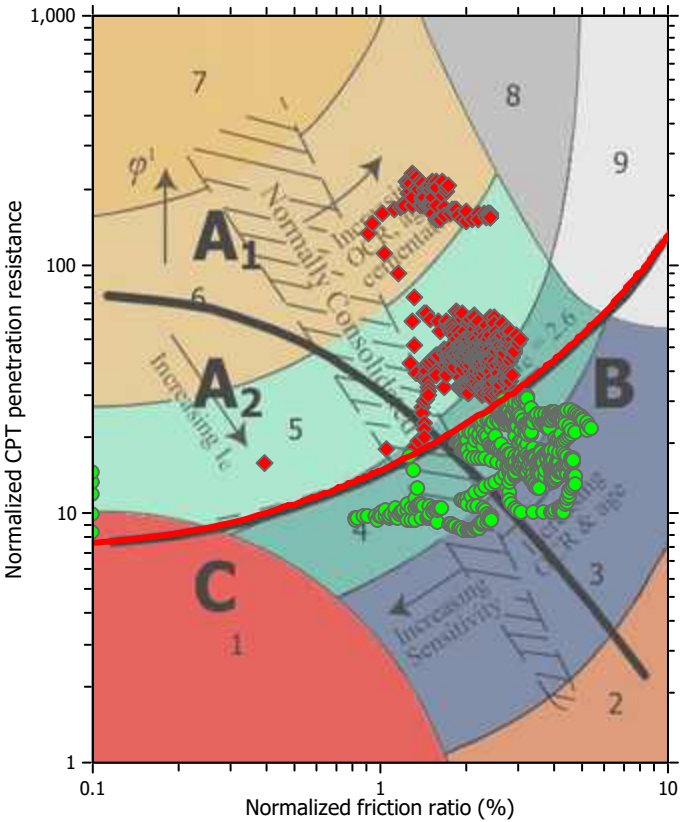
F.S. color scheme

|             |                                             |
|-------------|---------------------------------------------|
| Red         | Almost certain it will liquefy              |
| Orange      | Very likely to liquefy                      |
| Yellow      | Liquefaction and no liq. are equally likely |
| Light green | Unlike to liquefy                           |
| Dark green  | Almost certain it will not liquefy          |

LPI color scheme

|        |                |
|--------|----------------|
| Red    | Very high risk |
| Orange | High risk      |
| Yellow | Low risk       |

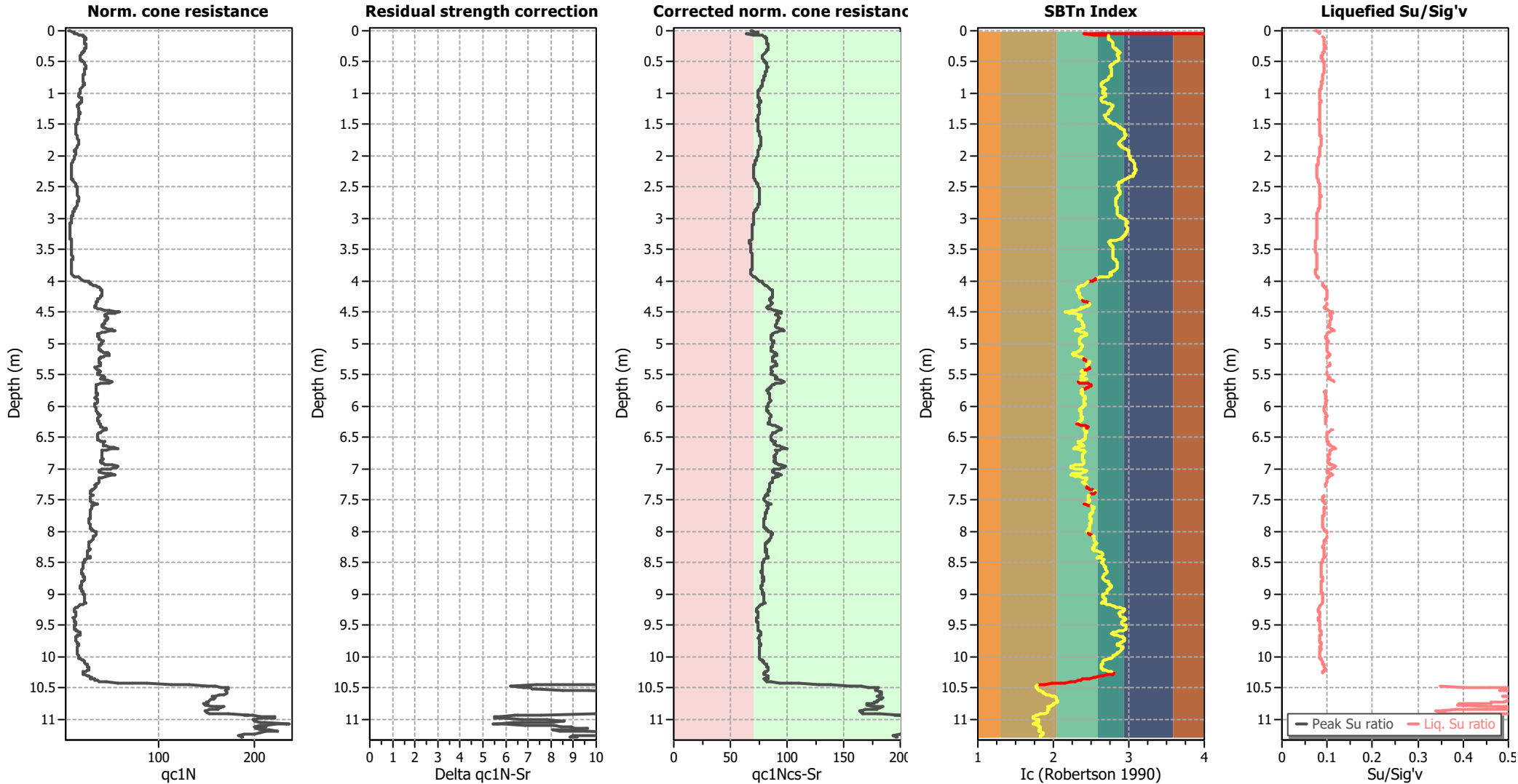
Liquefaction analysis summary plots



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: | Yes        |
| Points to test:                | Based on $I_c$ value | $I_c$ cut-off value:      | 2.60         | $K_o$ applied:              | Yes        |
| Earthquake magnitude $M_w$ :   | 6.50                 | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration:      | 0.05                 | Use fill:                 | No           | Limit depth applied:        | Yes        |
| Depth to water table (insitu): | 1.00 m               | Fill height:              | N/A          | Limit depth:                | 10.00 m    |

Check for strength loss plots (Idriss & Boulanger (2008))



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: | Yes        |
| Points to test:                       | Based on Ic value | Ic cut-off value:         | 2.60         | K <sub>o</sub> applied:     | Yes        |
| Earthquake magnitude M <sub>w</sub> : | 6.50              | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration:             | 0.05              | Use fill:                 | No           | Limit depth applied:        | Yes        |
| Depth to water table (insitu):        | 1.00 m            | Fill height:              | N/A          | Limit depth:                | 10.00 m    |

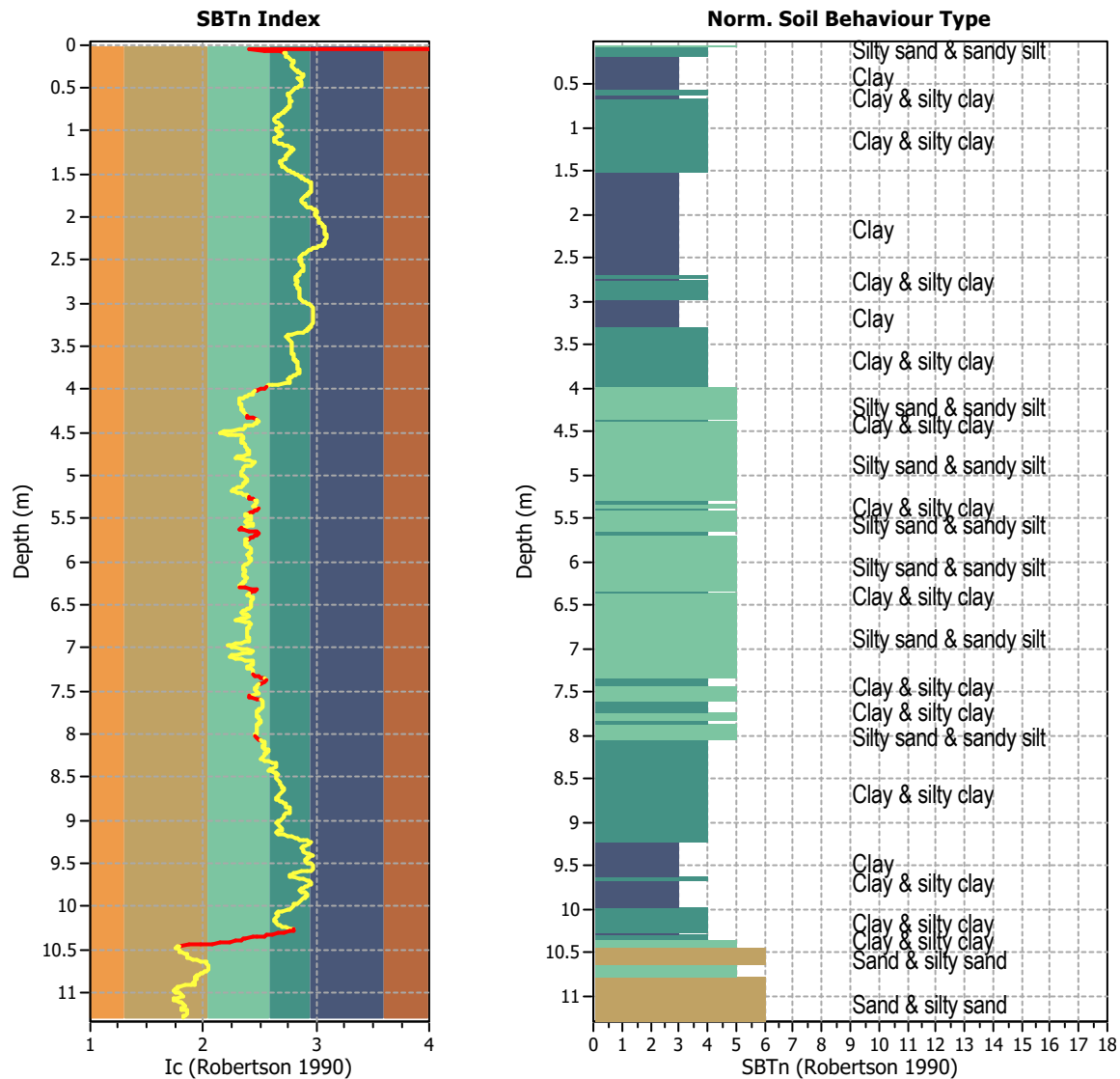
TRANSITION LAYER DETECTION ALGORITHM REPORT

Summary Details & Plots

Short description

The software will delete data when the cone is in transition from either clay to sand or vise-versa. To do this the software requires a range of  $I_c$  values over which the transition will be defined (typically somewhere between  $1.80 < I_c < 3.0$ ) and a rate of change of  $I_c$ . Transitions typically occur when the rate of change of  $I_c$  is fast (i.e.  $\Delta I_c$  is small).

The  $SBT_n$  plot below, displays in red the detected transition layers based on the parameters listed below the graphs.

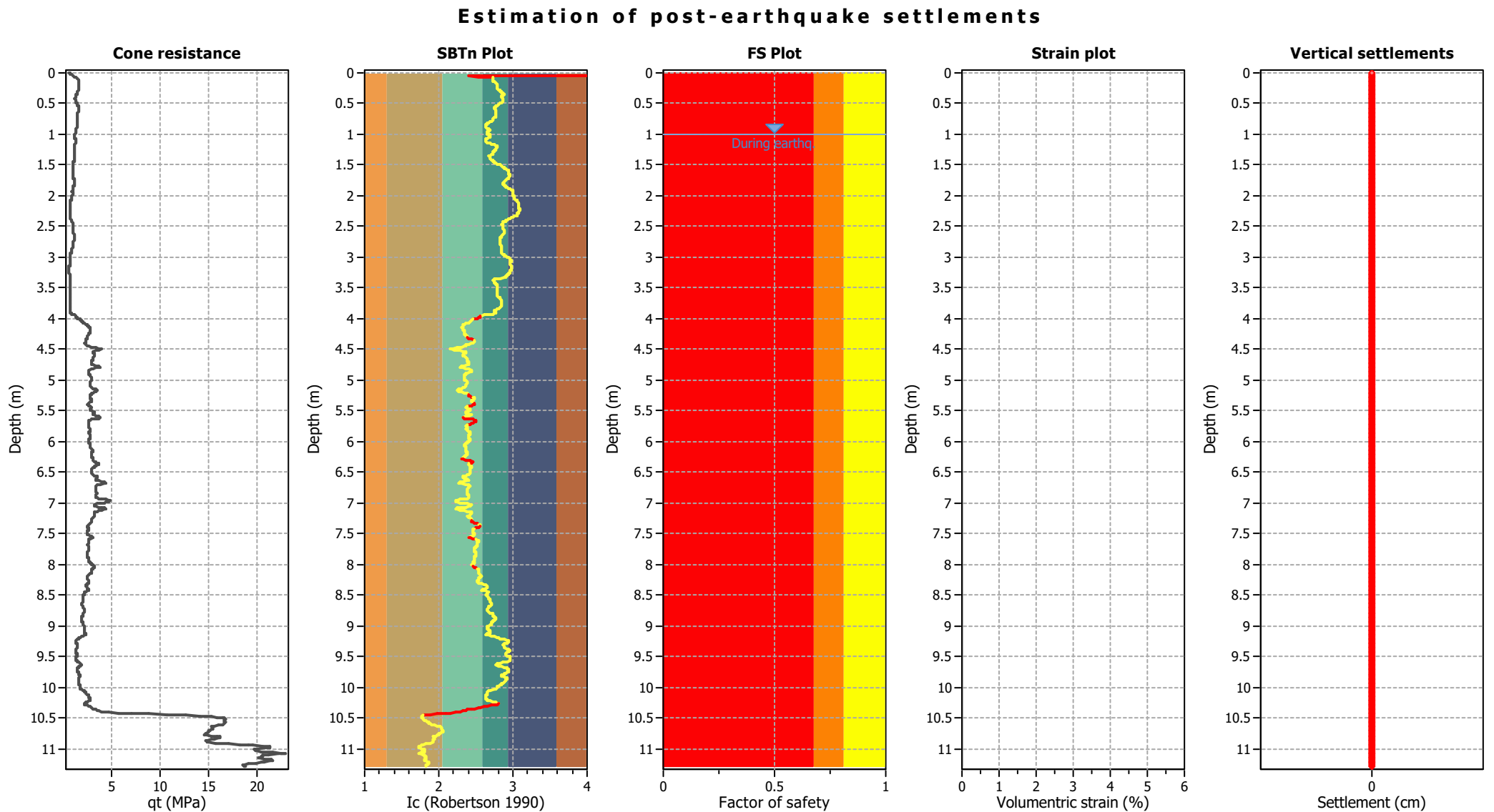


Transition layer algorithm properties

$I_c$  minimum check value: 1.70  
 $I_c$  maximum check value: 3.00  
 $I_c$  change ratio value: 0.0100  
Minimum number of points in layer: 4

General statistics

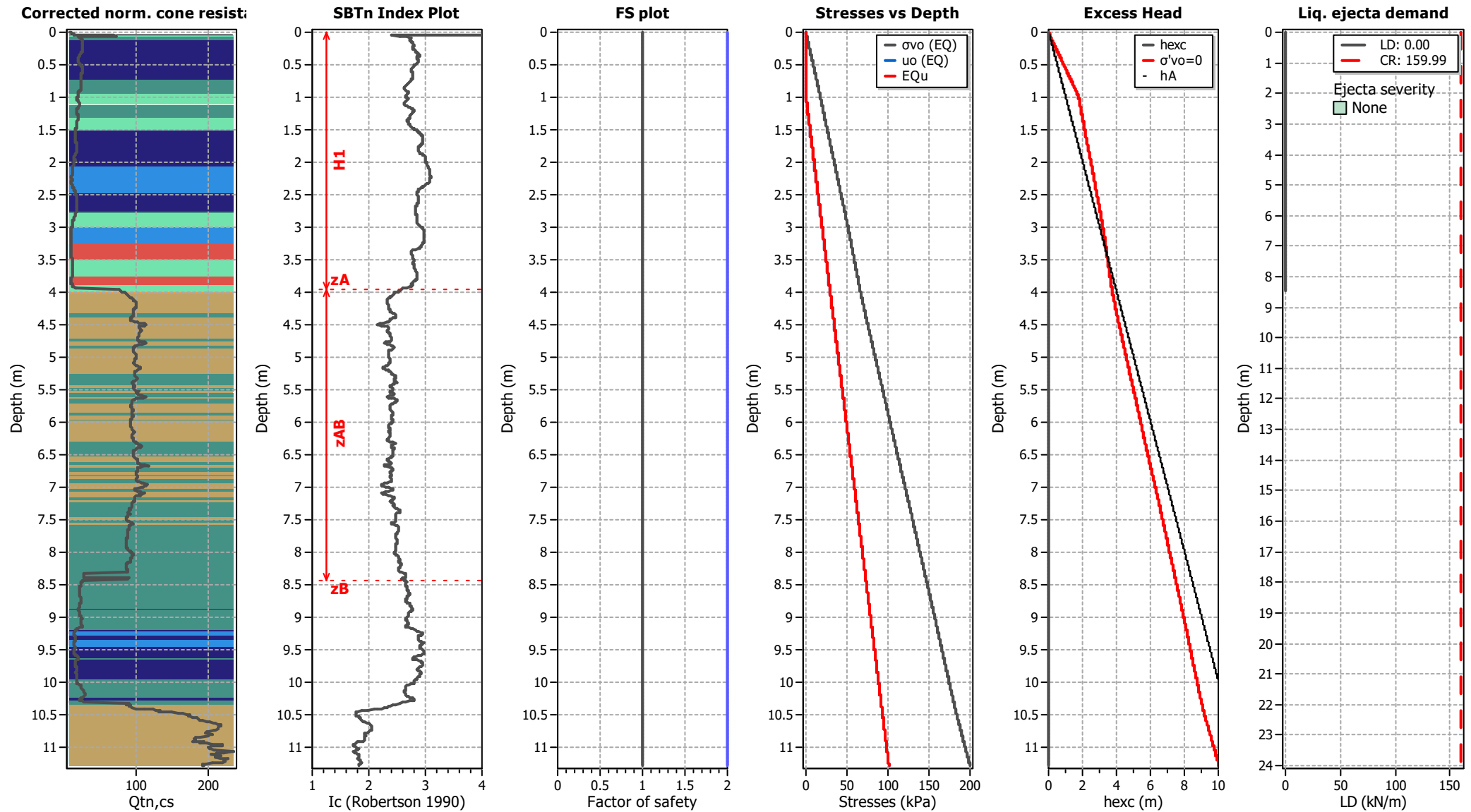
Total points in CPT file: 1129  
Total points excluded: 91  
Exclusion percentage: 8.06%  
Number of layers detected: 14



Abbreviations

- q<sub>c</sub>:
- Total cone resistance (cone resistance q<sub>c</sub> corrected for pore water effects)
- I<sub>c</sub>:
- Soil Behaviour Type Index
- FS:
- Calculated Factor of Safety against liquefaction
- Volumetric strain:
- Post-liquefaction volumetric strain

## Ejecta Severity Estimation



## LIQUEFACTION ANALYSIS REPORT

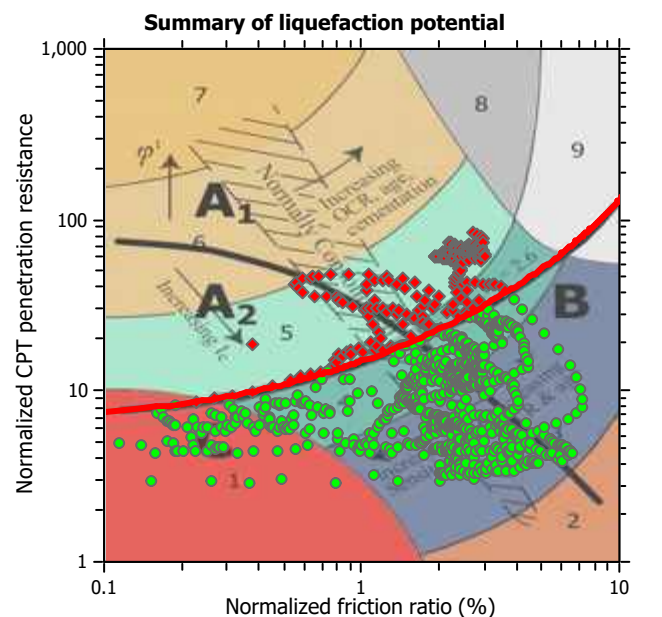
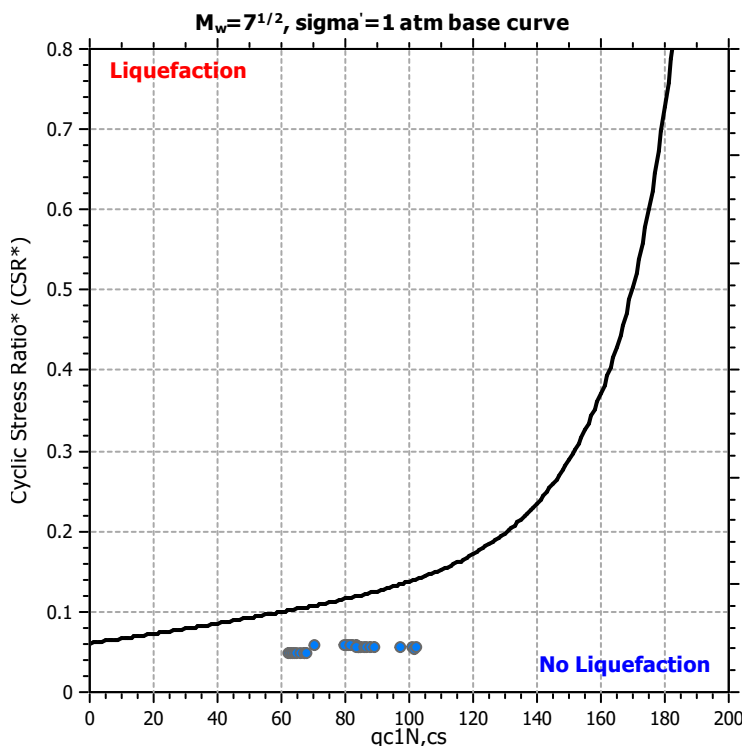
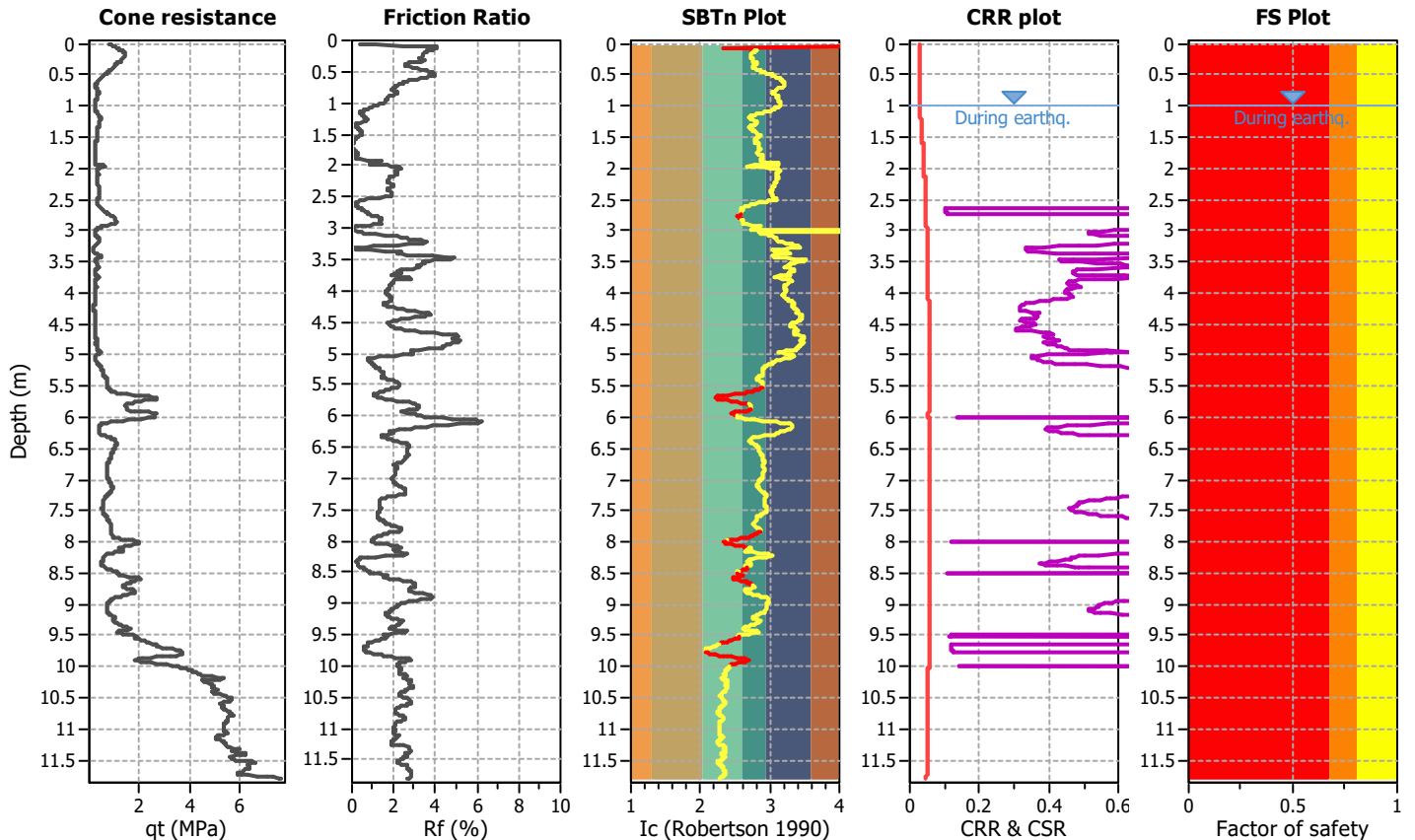
**Project title :**

**Location :**

**CPT file : CPT410**

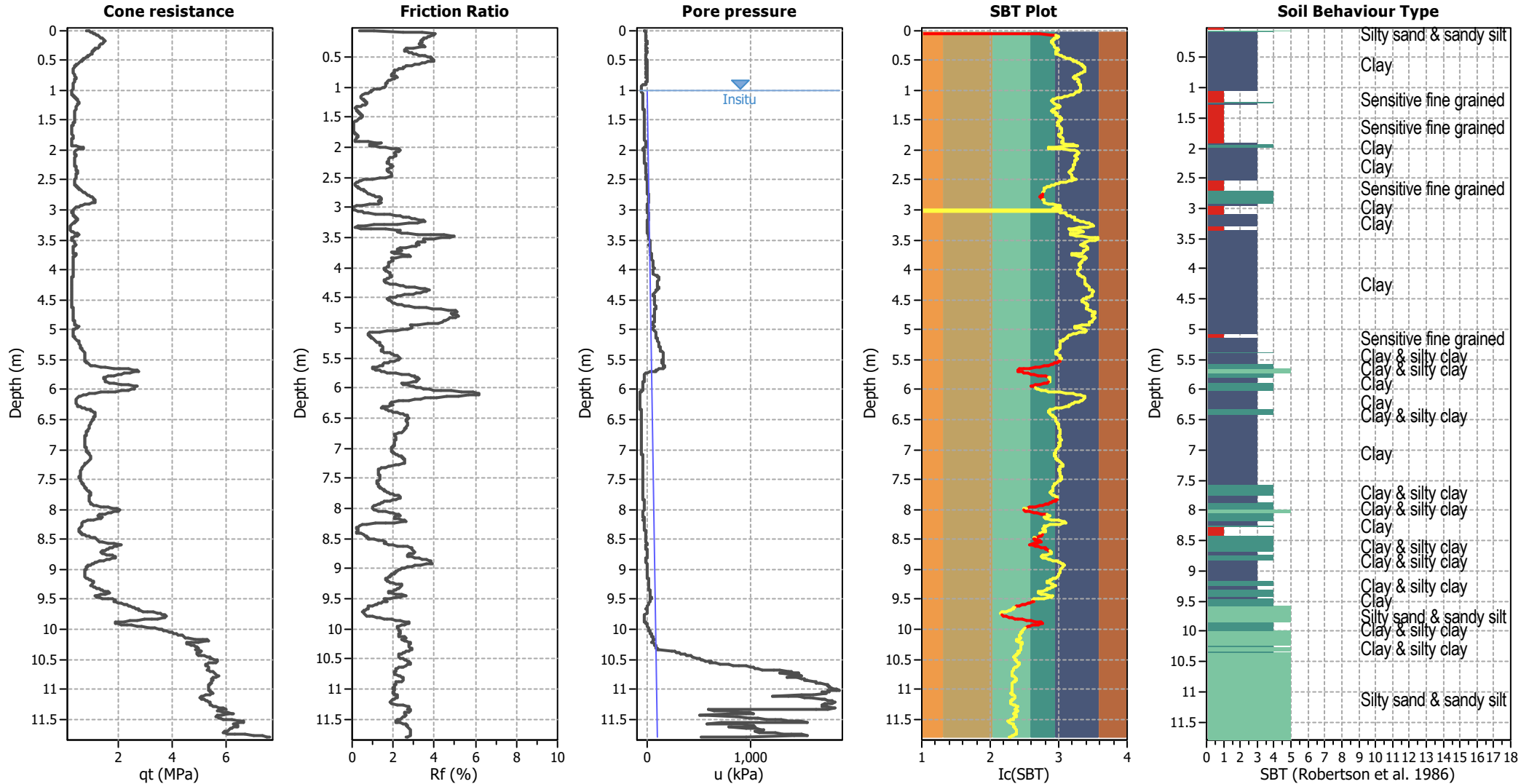
### Input parameters and analysis data

|                              |                   |                           |              |                         |     |                      |              |
|------------------------------|-------------------|---------------------------|--------------|-------------------------|-----|----------------------|--------------|
| Analysis method:             | B&I (2014)        | G.W.T. (in-situ):         | 1.00 m       | Use fill:               | No  | Clay like behavior   |              |
| Fines correction method:     | B&I (2014)        | G.W.T. (earthq.):         | 1.00 m       | Fill height:            | N/A | applied:             | Sand & Clay  |
| Points to test:              | Based on Ic value | Average results interval: | 3            | Fill weight:            | N/A | Limit depth applied: | Yes          |
| Earthquake magnitude $M_w$ : | 6.50              | Ic cut-off value:         | 2.60         | Trans. detect. applied: | Yes | Limit depth:         | 10.00 m      |
| Peak ground acceleration:    | 0.05              | Unit weight calculation:  | Based on SBT | $K_\sigma$ applied:     | Yes | MSF method:          | Method based |



Zone A<sub>1</sub>: Cyclic liquefaction likely depending on size and duration of cyclic loading  
Zone A<sub>2</sub>: Cyclic liquefaction and strength loss likely depending on loading and ground geometry  
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening  
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots

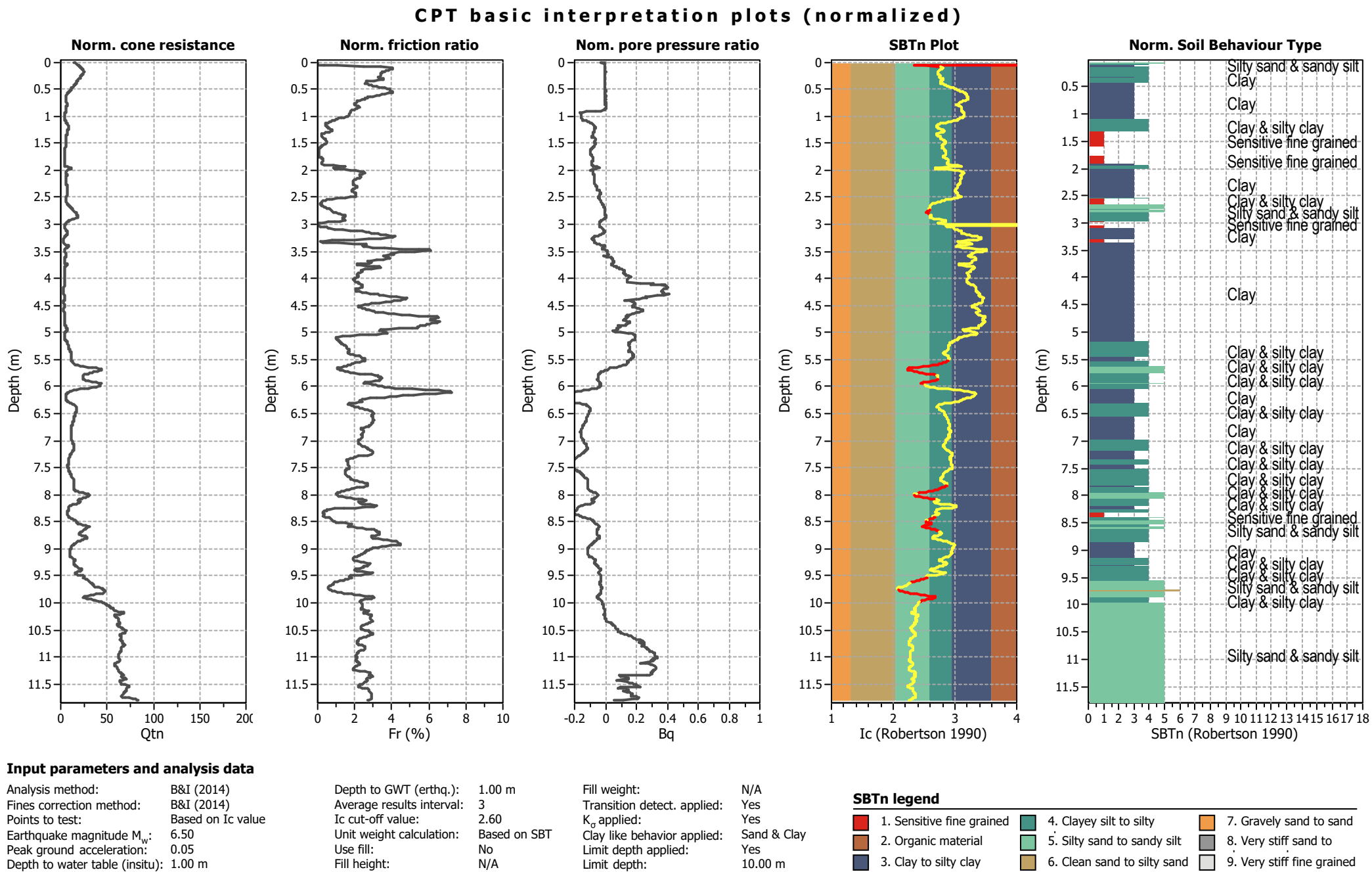


Input parameters and analysis data

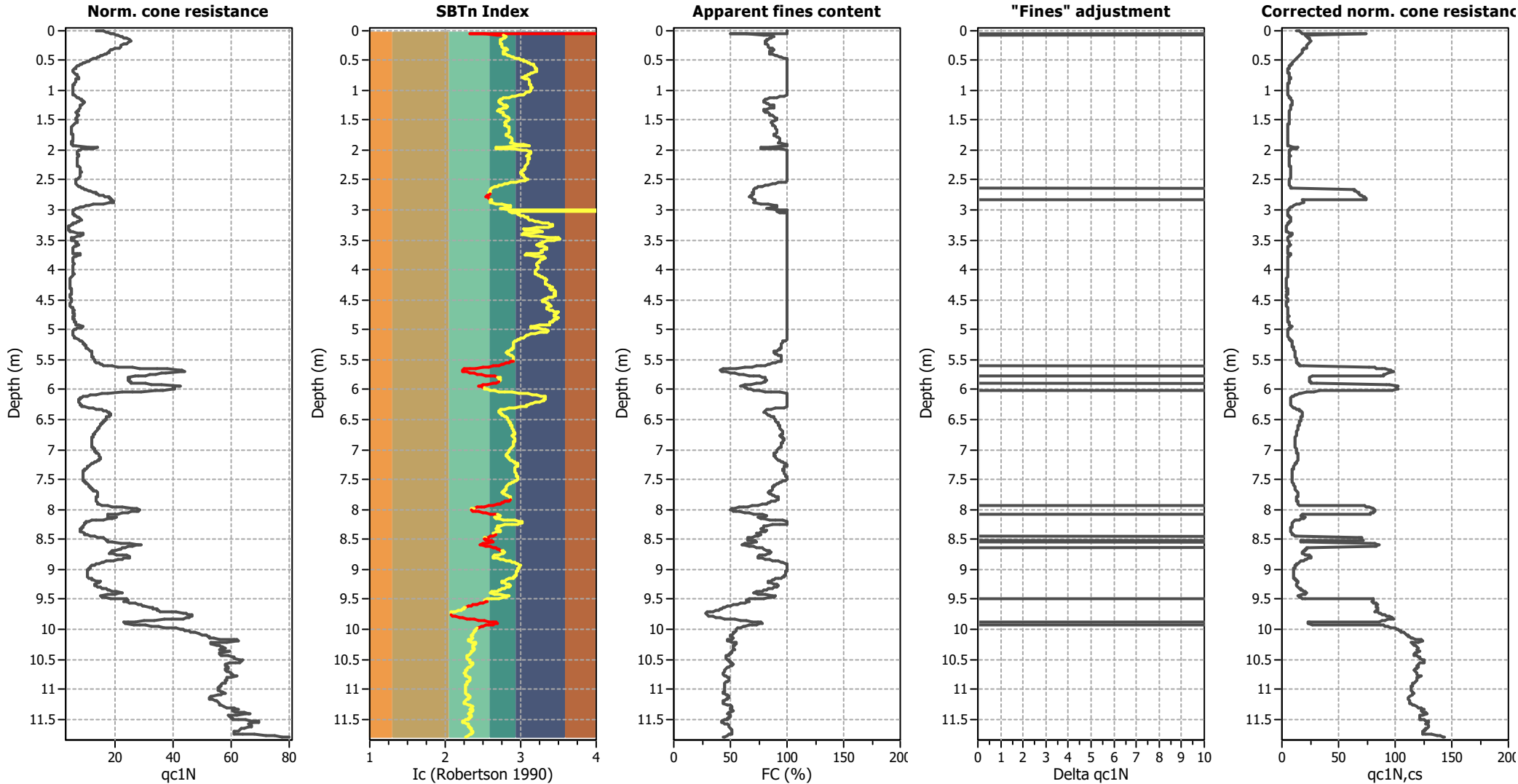
|                                       |                   |                           |              |                             |             |
|---------------------------------------|-------------------|---------------------------|--------------|-----------------------------|-------------|
| Analysis 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: | Yes         |
| 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> : | 6.50              | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sand & Clay |
| Peak ground acceleration:             | 0.05              | 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 |



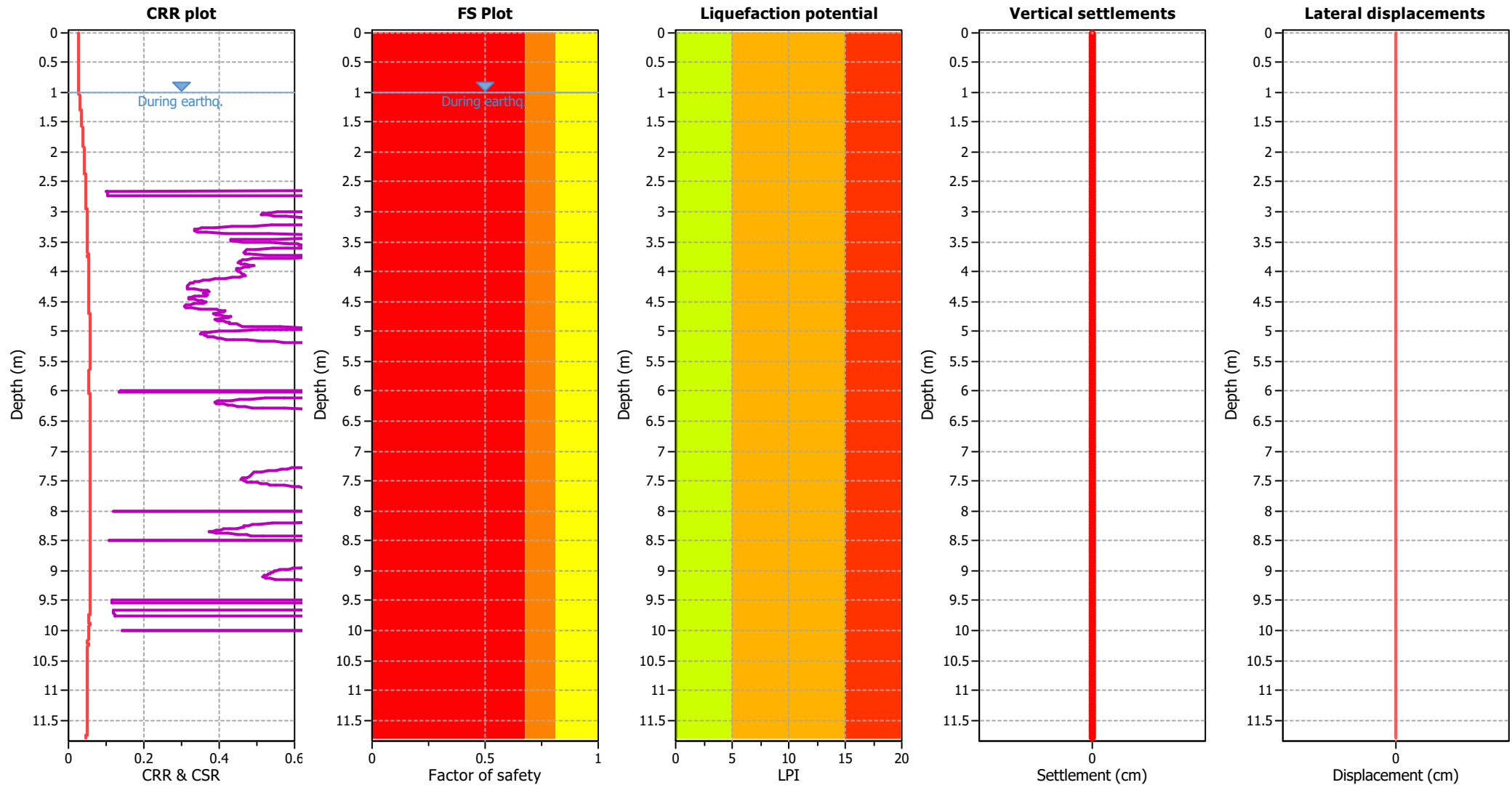
Liquefaction analysis overall plots (intermediate results)



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: | Yes         |
| Points to test:                       | Based on Ic value | Ic cut-off value:         | 2.60         | K <sub>o</sub> applied:     | Yes         |
| Earthquake magnitude M <sub>w</sub> : | 6.50              | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sand & Clay |
| Peak ground acceleration:             | 0.05              | Use fill:                 | No           | Limit depth applied:        | Yes         |
| Depth to water table (insitu):        | 1.00 m            | Fill height:              | N/A          | Limit depth:                | 10.00 m     |

## 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: | Yes         |
| Points to test:                | Based on Ic value | Ic cut-off value:         | 2.60         | $K_0$ applied:              | Yes         |
| Earthquake magnitude $M_w$ :   | 6.50              | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sand & Clay |
| Peak ground acceleration:      | 0.05              | Use fill:                 | No           | Limit depth applied:        | Yes         |
| Depth to water table (insitu): | 1.00 m            | Fill height:              | N/A          | Limit depth:                | 10.00 m     |

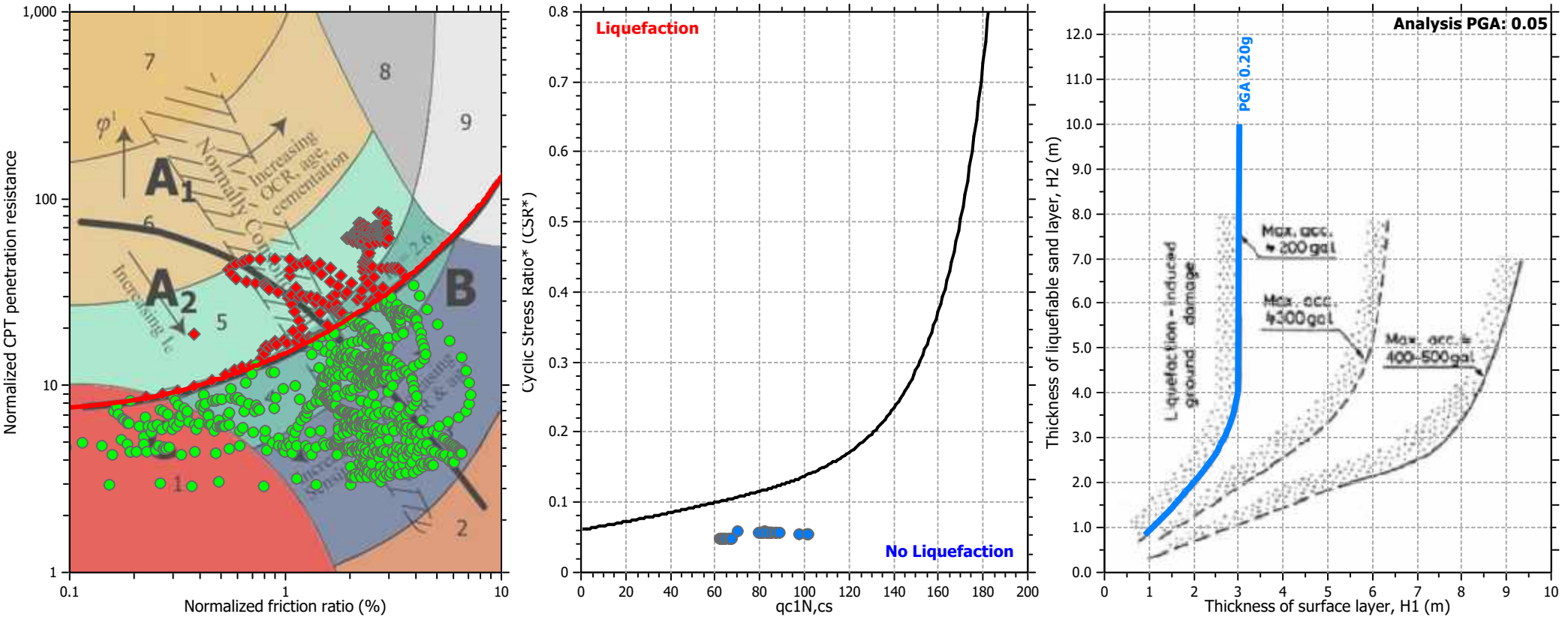
### F.S. color scheme

|                                           |                                             |
|-------------------------------------------|---------------------------------------------|
| <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          |

### LPI color scheme

|                                       |                |
|---------------------------------------|----------------|
| <span style="color: red;">■</span>    | Very high risk |
| <span style="color: orange;">■</span> | High risk      |
| <span style="color: yellow;">■</span> | Low risk       |

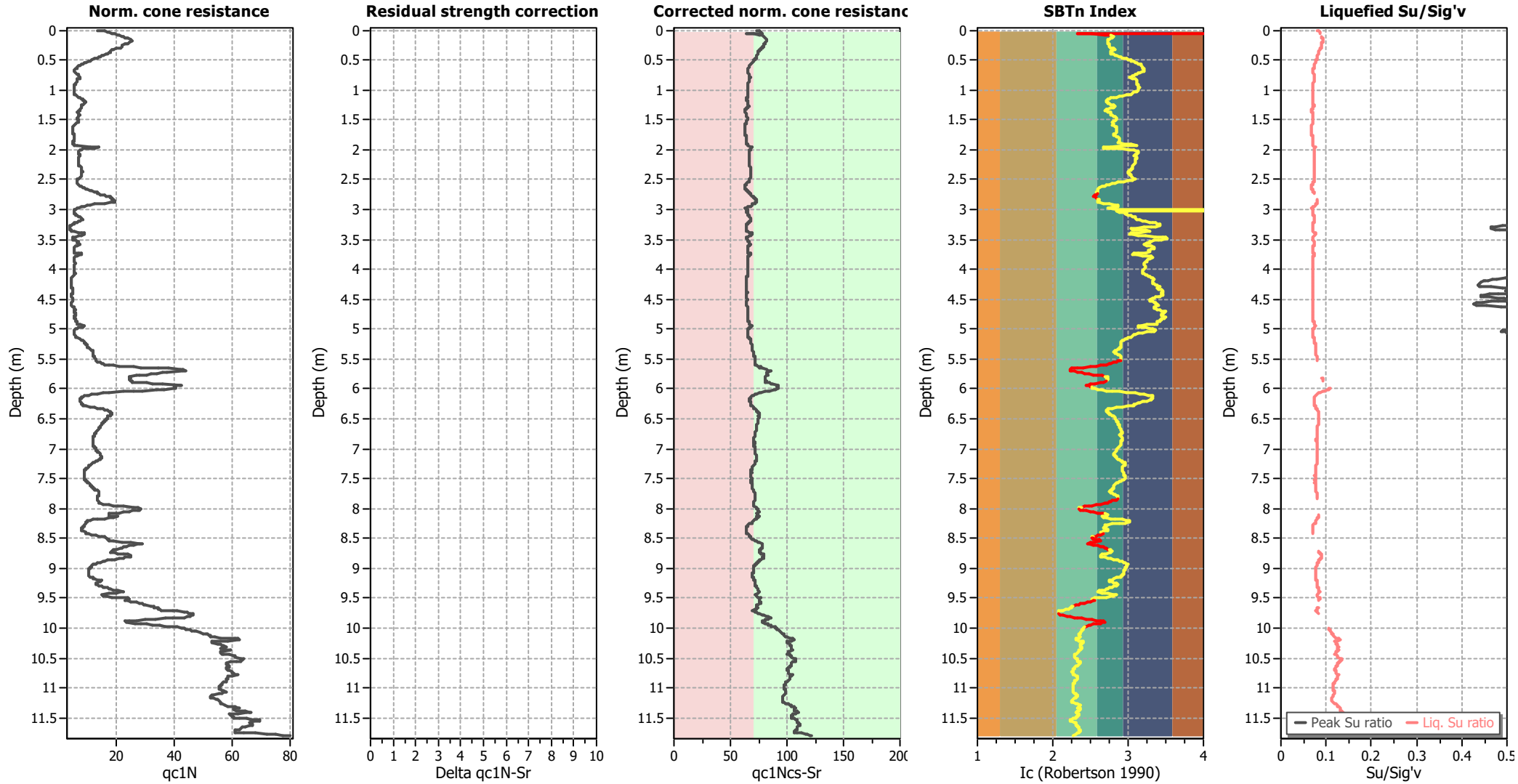
Liquefaction analysis summary plots



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: | Yes         |
| Points to test:                | Based on $I_c$ value | $I_c$ cut-off value:      | 2.60         | $K_o$ applied:              | Yes         |
| Earthquake magnitude $M_w$ :   | 6.50                 | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sand & Clay |
| Peak ground acceleration:      | 0.05                 | Use fill:                 | No           | Limit depth applied:        | Yes         |
| Depth to water table (insitu): | 1.00 m               | Fill height:              | N/A          | Limit depth:                | 10.00 m     |

Check for strength loss plots (Idriss & Boulanger (2008))



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: | Yes         |
| Points to test:                       | Based on Ic value | Ic cut-off value:         | 2.60         | K <sub>o</sub> applied:     | Yes         |
| Earthquake magnitude M <sub>w</sub> : | 6.50              | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sand & Clay |
| Peak ground acceleration:             | 0.05              | Use fill:                 | No           | Limit depth applied:        | Yes         |
| Depth to water table (insitu):        | 1.00 m            | Fill height:              | N/A          | Limit depth:                | 10.00 m     |

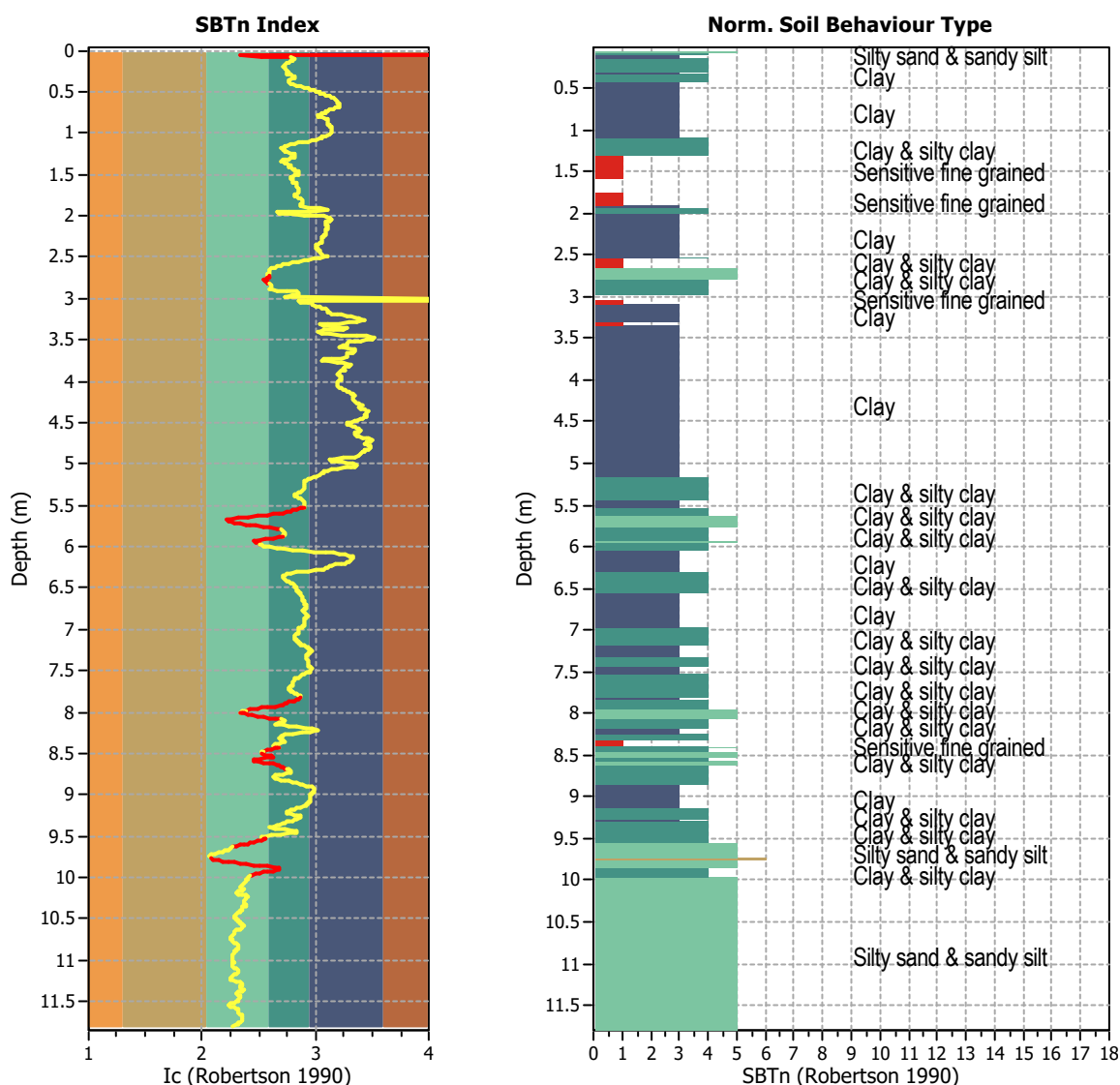
## TRANSITION LAYER DETECTION ALGORITHM REPORT

### Summary Details & Plots

#### Short description

The software will delete data when the cone is in transition from either clay to sand or vice-versa. To do this the software requires a range of  $I_c$  values over which the transition will be defined (typically somewhere between  $1.80 < I_c < 3.0$ ) and a rate of change of  $I_c$ . Transitions typically occur when the rate of change of  $I_c$  is fast (i.e.  $\Delta I_c$  is small).

The  $SBT_n$  plot below, displays in red the detected transition layers based on the parameters listed below the graphs.

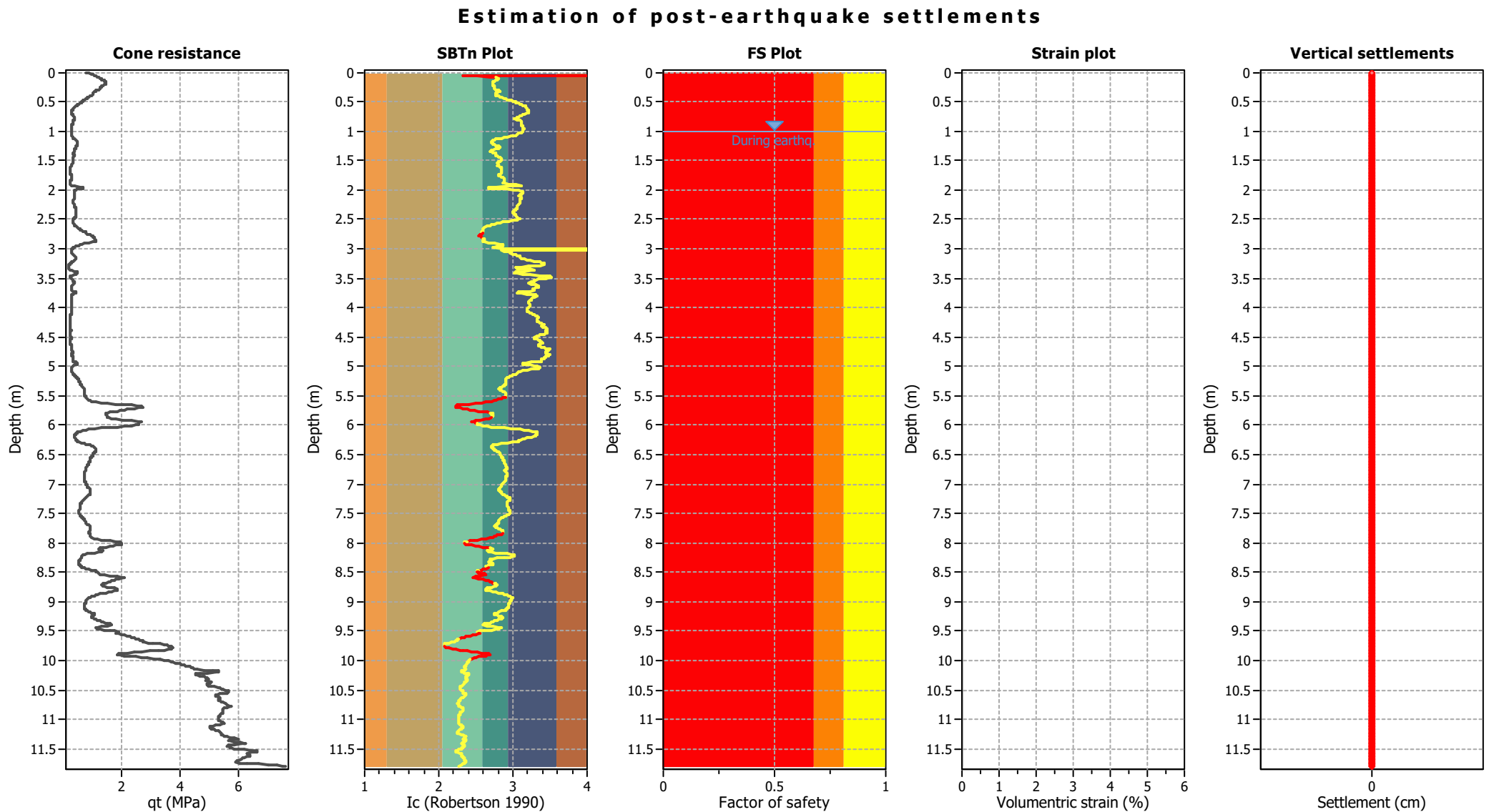


#### Transition layer algorithm properties

$I_c$  minimum check value: 1.70  
 $I_c$  maximum check value: 3.00  
 $I_c$  change ratio value: 0.0100  
 Minimum number of points in layer: 4

#### General statistics

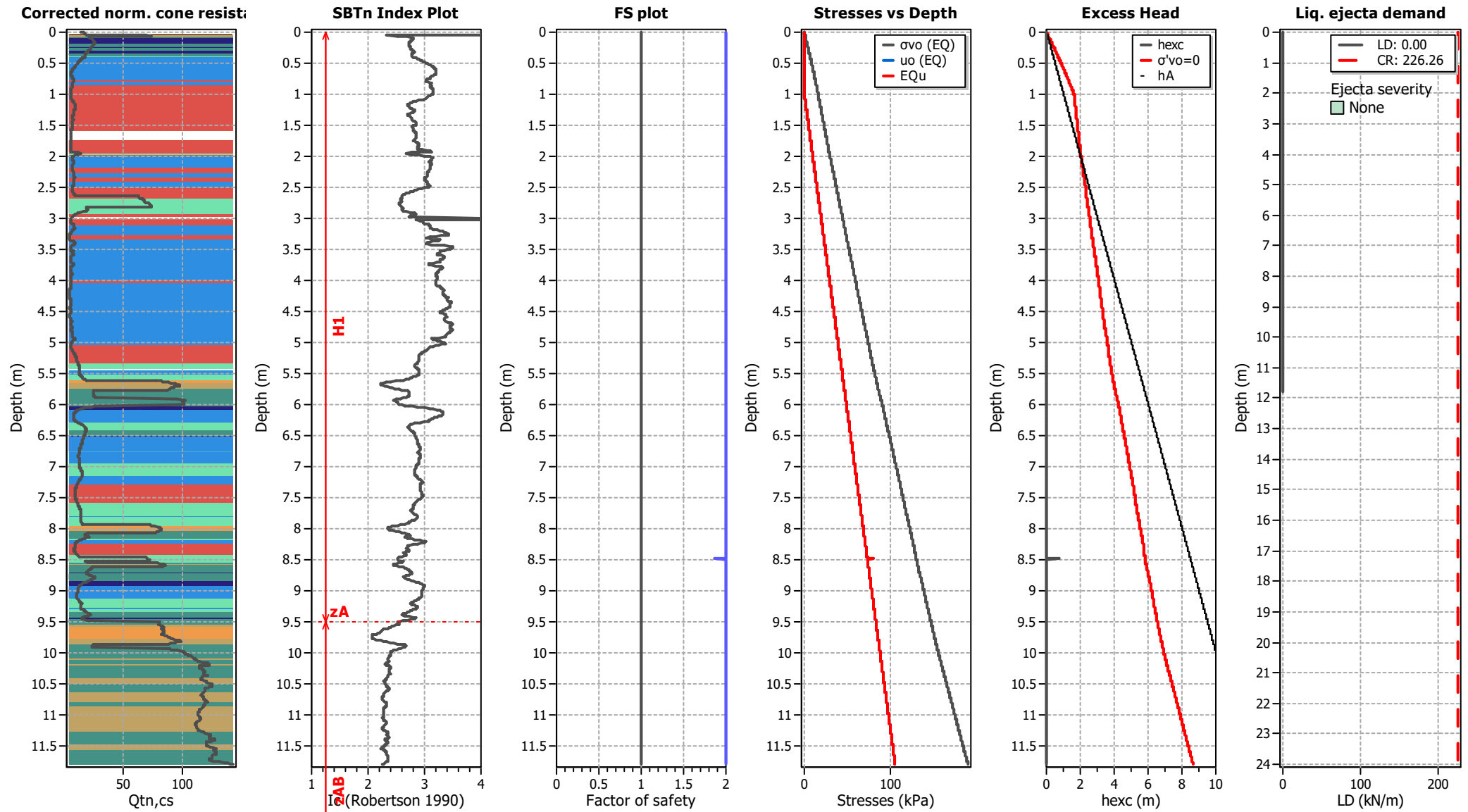
Total points in CPT file: 1180  
 Total points excluded: 143  
 Exclusion percentage: 12.12%  
 Number of layers detected: 16



Abbreviations

- q<sub>t</sub>: Total cone resistance (cone resistance q<sub>c</sub> corrected for pore water effects)
- I<sub>c</sub>: Soil Behaviour Type Index
- FS: Calculated Factor of Safety against liquefaction
- Volumetric strain: Post-liquefaction volumetric strain

## Ejecta Severity Estimation



## LIQUEFACTION ANALYSIS REPORT

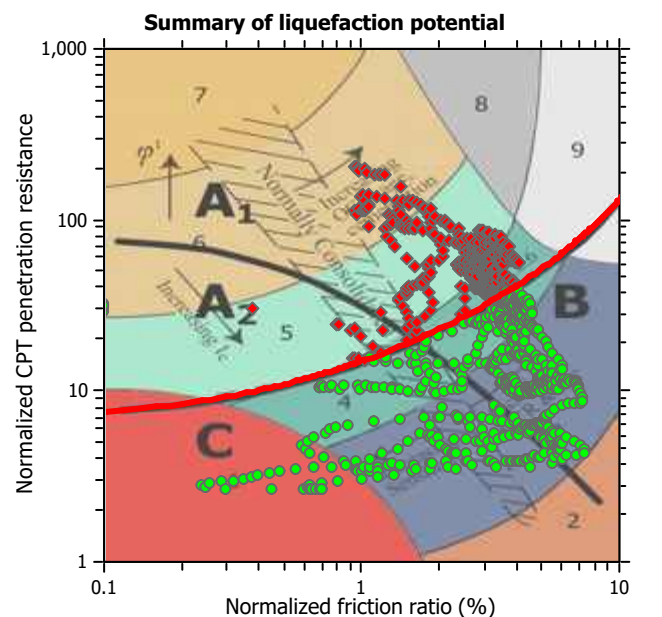
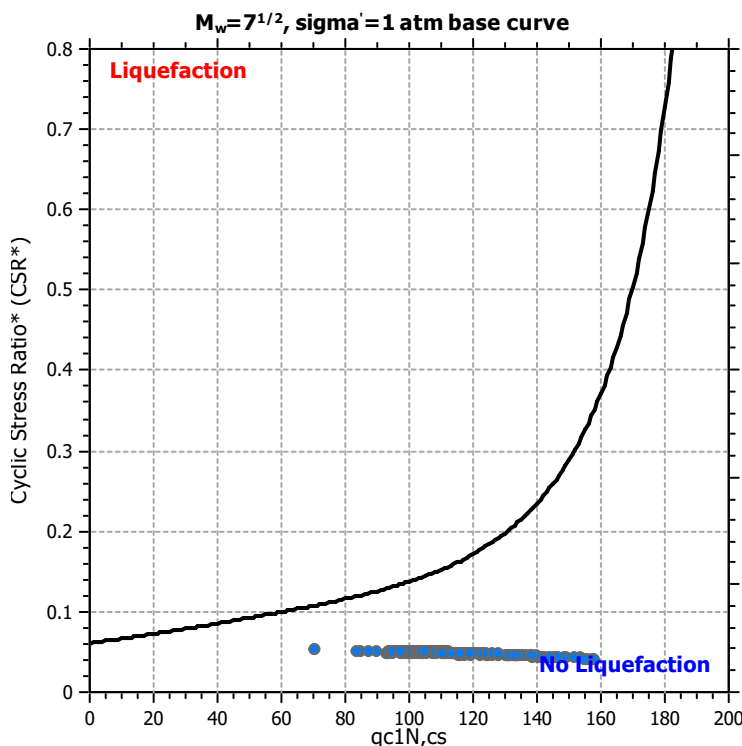
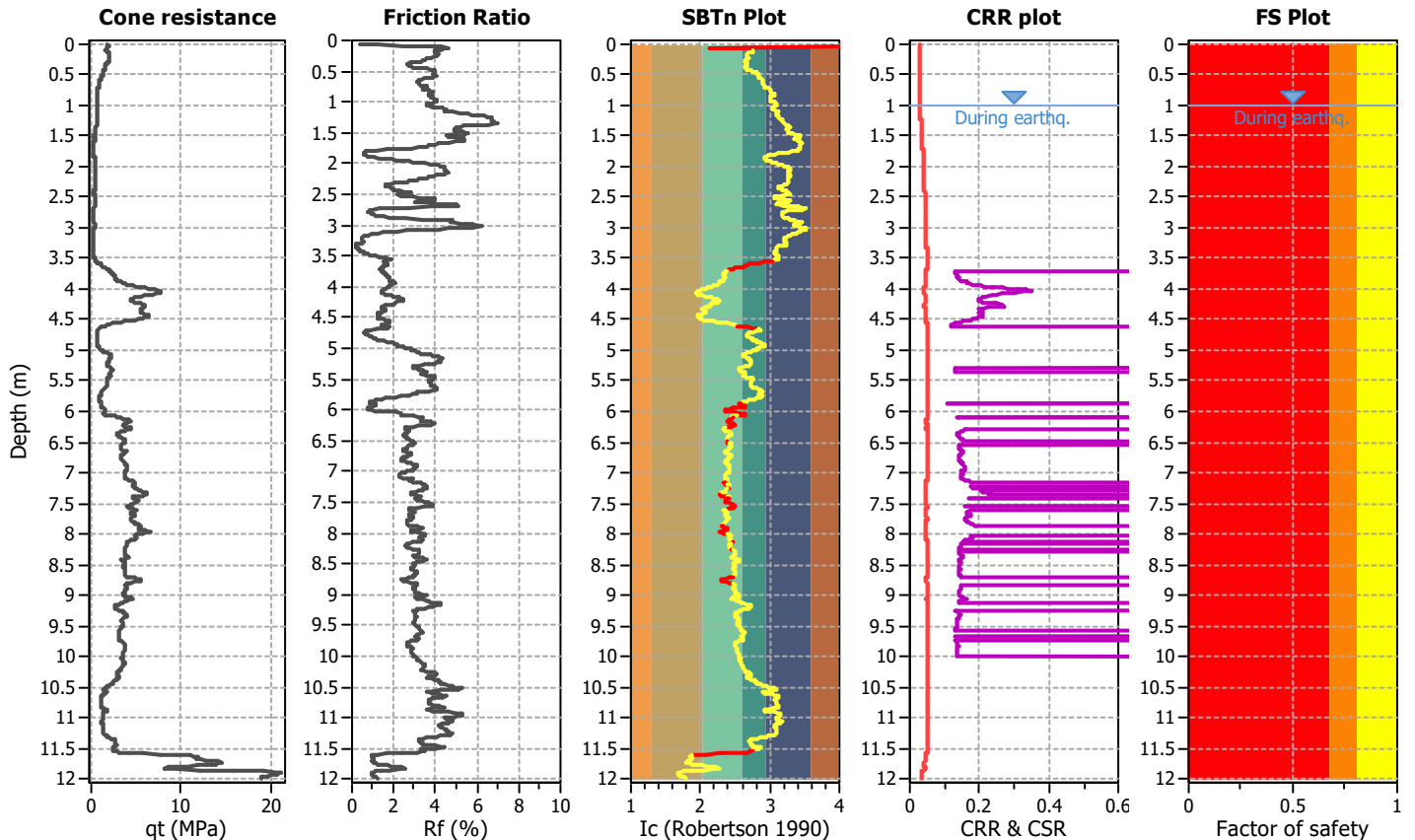
**Project title :**

**Location :**

**CPT file : CPT411**

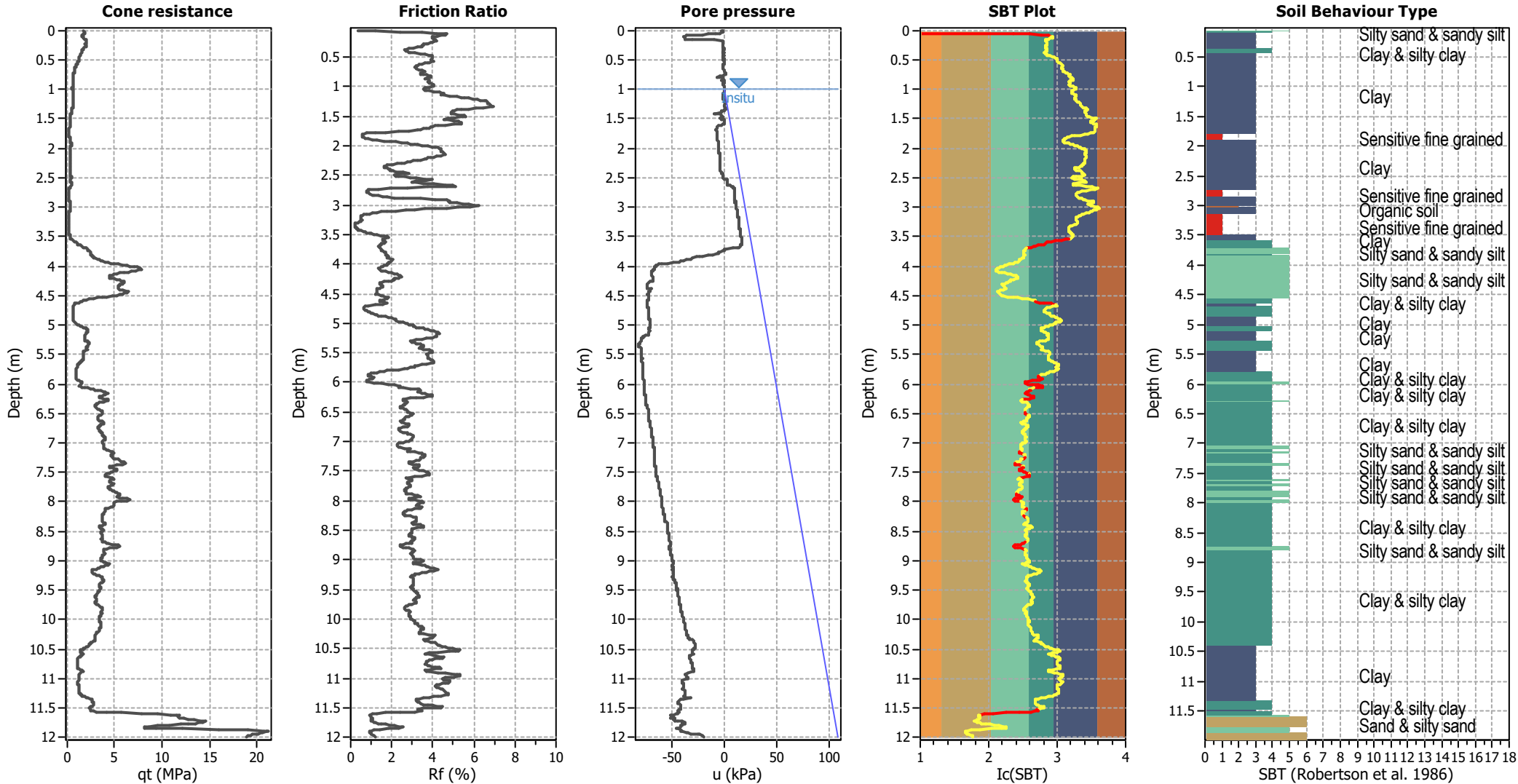
### Input parameters and analysis data

|                              |                   |                           |              |                         |     |                      |              |
|------------------------------|-------------------|---------------------------|--------------|-------------------------|-----|----------------------|--------------|
| Analysis method:             | B&I (2014)        | G.W.T. (in-situ):         | 1.00 m       | Use fill:               | No  | Clay like behavior   |              |
| Fines correction method:     | B&I (2014)        | G.W.T. (earthq.):         | 1.00 m       | Fill height:            | N/A | applied:             | Sands only   |
| Points to test:              | Based on Ic value | Average results interval: | 3            | Fill weight:            | N/A | Limit depth applied: | Yes          |
| Earthquake magnitude $M_w$ : | 6.50              | Ic cut-off value:         | 2.60         | Trans. detect. applied: | Yes | Limit depth:         | 10.00 m      |
| Peak ground acceleration:    | 0.05              | Unit weight calculation:  | Based on SBT | $K_\sigma$ applied:     | Yes | MSF method:          | Method based |



Zone A<sub>1</sub>: Cyclic liquefaction likely depending on size and duration of cyclic loading  
Zone A<sub>2</sub>: Cyclic liquefaction and strength loss likely depending on loading and ground geometry  
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening  
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots

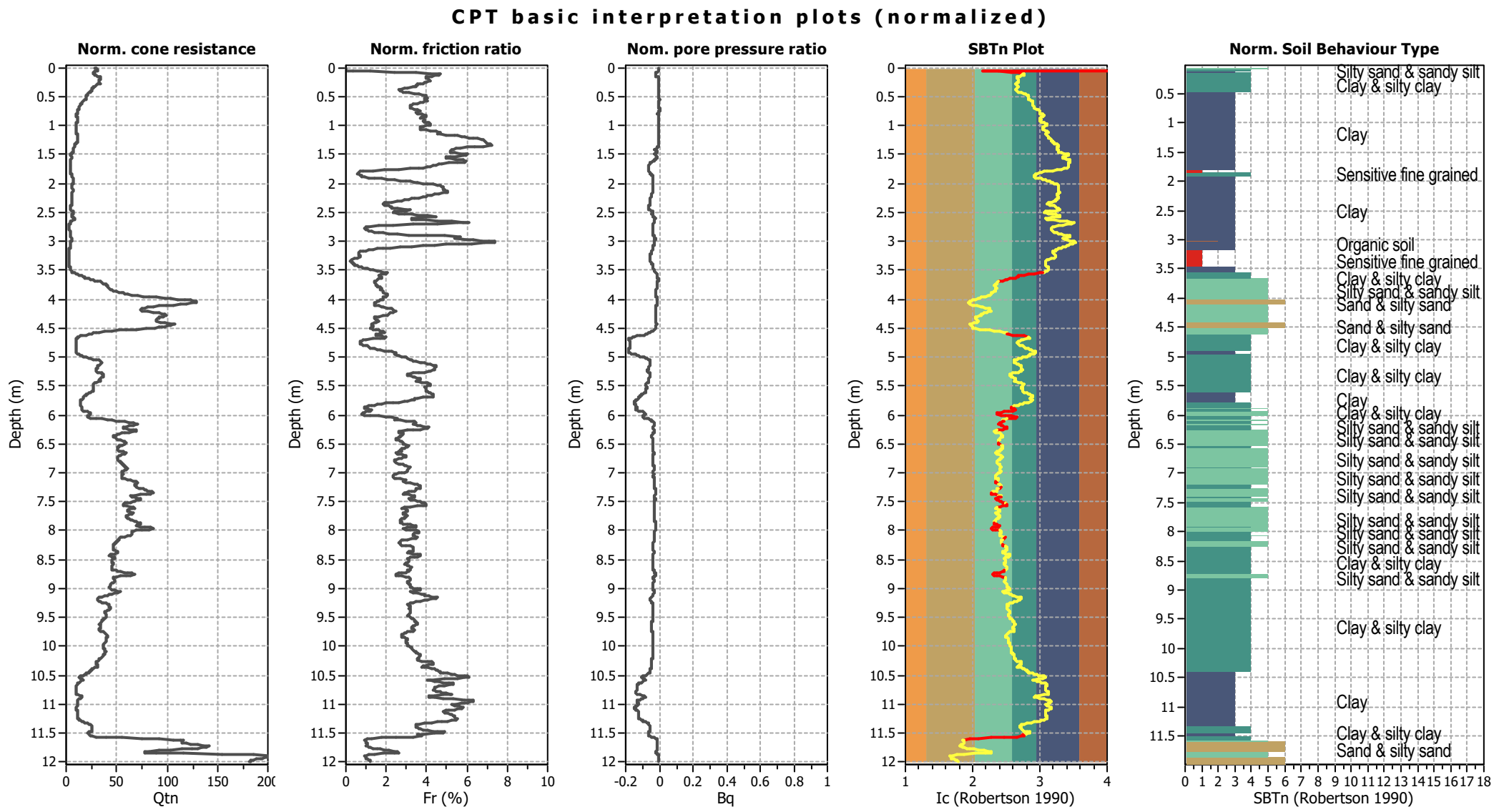


Input parameters and analysis data

|                                       |                   |                           |              |                             |            |
|---------------------------------------|-------------------|---------------------------|--------------|-----------------------------|------------|
| 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: | Yes        |
| 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> : | 6.50              | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration:             | 0.05              | 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 |



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: | Yes        |
| Points to test:                       | Based on Ic value | Ic cut-off value:         | 2.60         | K <sub>o</sub> applied:     | Yes        |
| Earthquake magnitude M <sub>w</sub> : | 6.50              | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration:             | 0.05              | Use fill:                 | No           | Limit depth applied:        | Yes        |
| Depth to water table (insitu):        | 1.00 m            | Fill height:              | N/A          | Limit depth:                | 10.00 m    |

SBTn legend

1. Sensitive fine grained

2. Organic material

3. Clay to silty clay

4. Clayey silt to silty

5. Silty sand to sandy silt

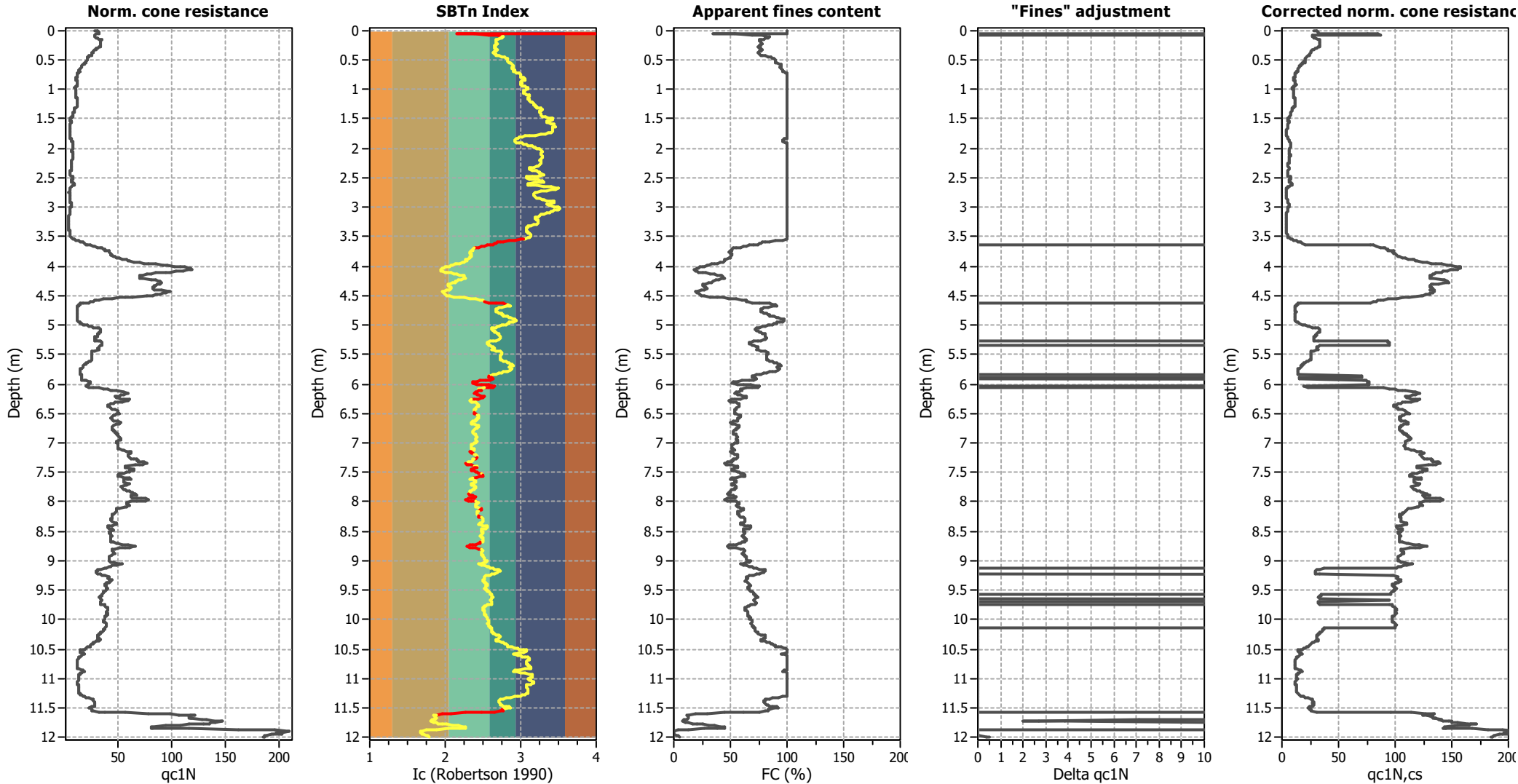
6. Clean sand to silty sand

7. Gravely sand to sand

8. Very stiff sand to

9. Very stiff fine grained

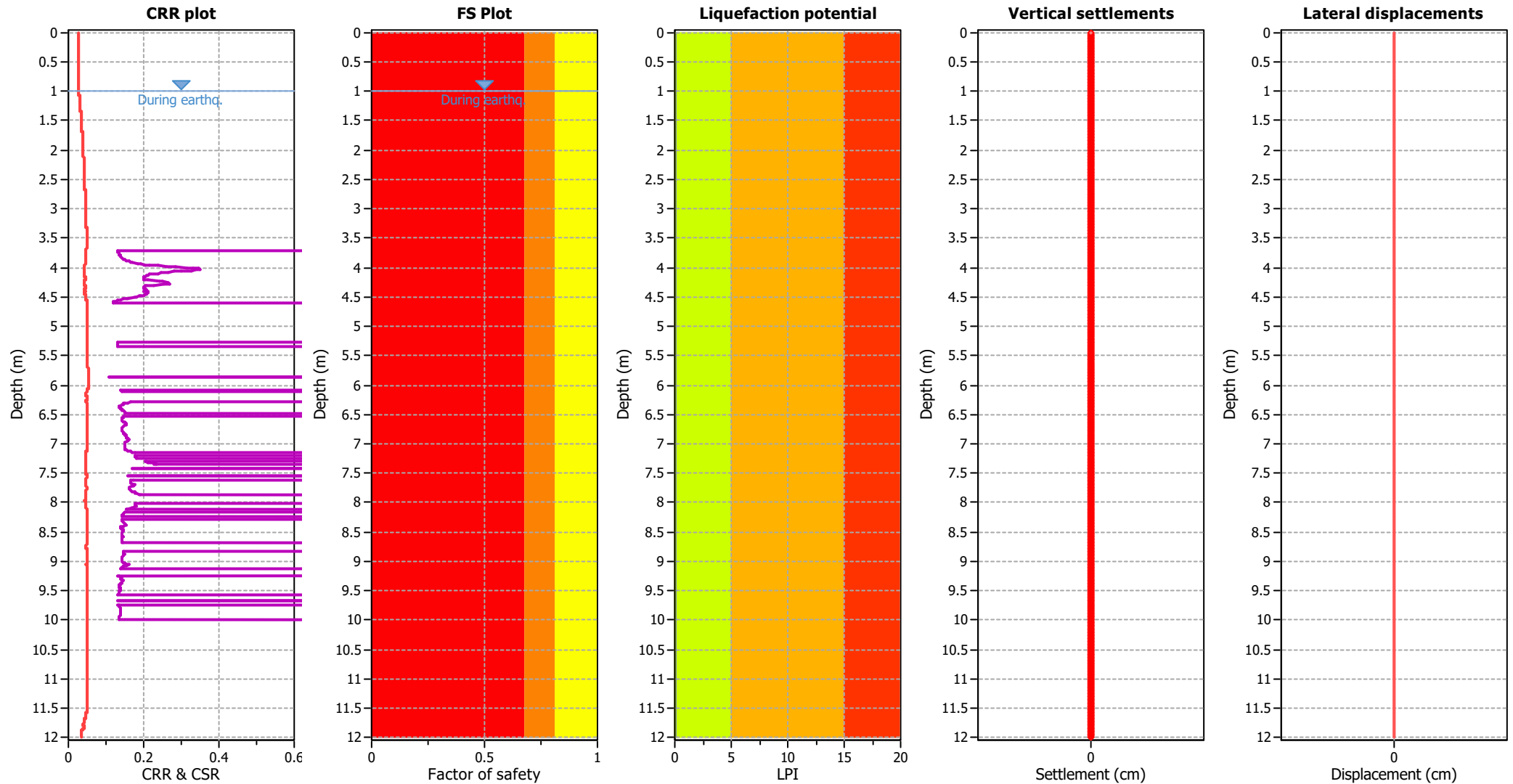
Liquefaction analysis overall plots (intermediate results)



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: | Yes        |
| Points to test:                       | Based on Ic value | Ic cut-off value:         | 2.60         | K <sub>o</sub> applied:     | Yes        |
| Earthquake magnitude M <sub>w</sub> : | 6.50              | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration:             | 0.05              | Use fill:                 | No           | Limit depth applied:        | Yes        |
| Depth to water table (insitu):        | 1.00 m            | Fill height:              | N/A          | Limit depth:                | 10.00 m    |

## 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: | Yes        |
| Points to test:                | Based on Ic value | Ic cut-off value:         | 2.60         | $K_0$ applied:              | Yes        |
| Earthquake magnitude $M_w$ :   | 6.50              | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration:      | 0.05              | Use fill:                 | No           | Limit depth applied:        | Yes        |
| Depth to water table (insitu): | 1.00 m            | Fill height:              | N/A          | Limit depth:                | 10.00 m    |

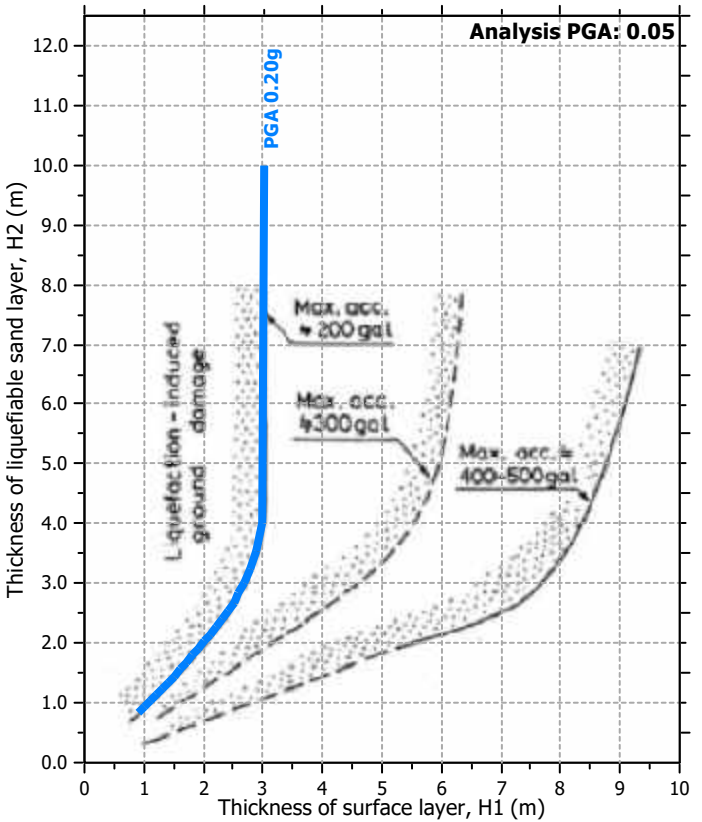
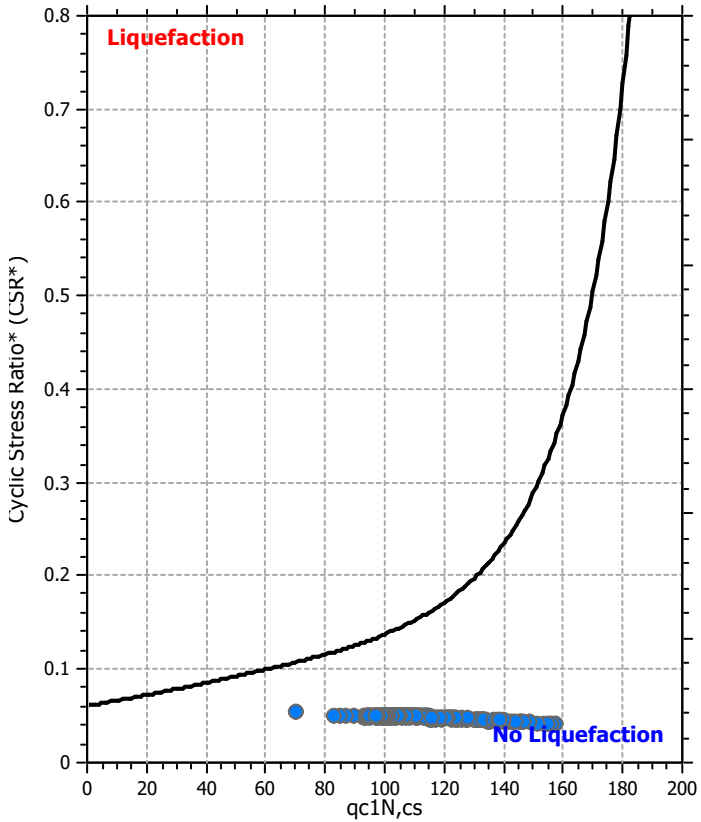
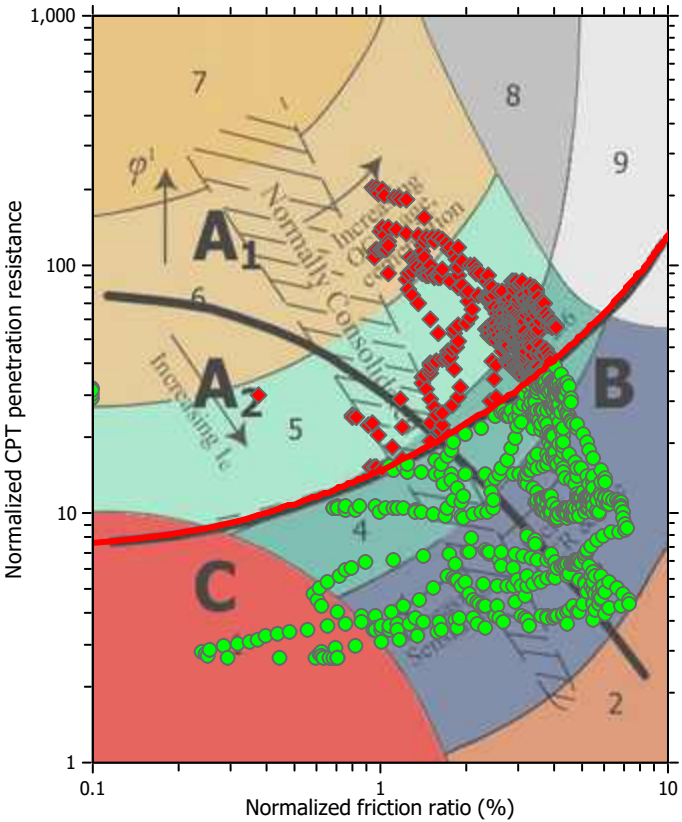
### F.S. color scheme

|                                           |                                             |
|-------------------------------------------|---------------------------------------------|
| <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          |

### LPI color scheme

|                                       |                |
|---------------------------------------|----------------|
| <span style="color: red;">■</span>    | Very high risk |
| <span style="color: orange;">■</span> | High risk      |
| <span style="color: yellow;">■</span> | Low risk       |

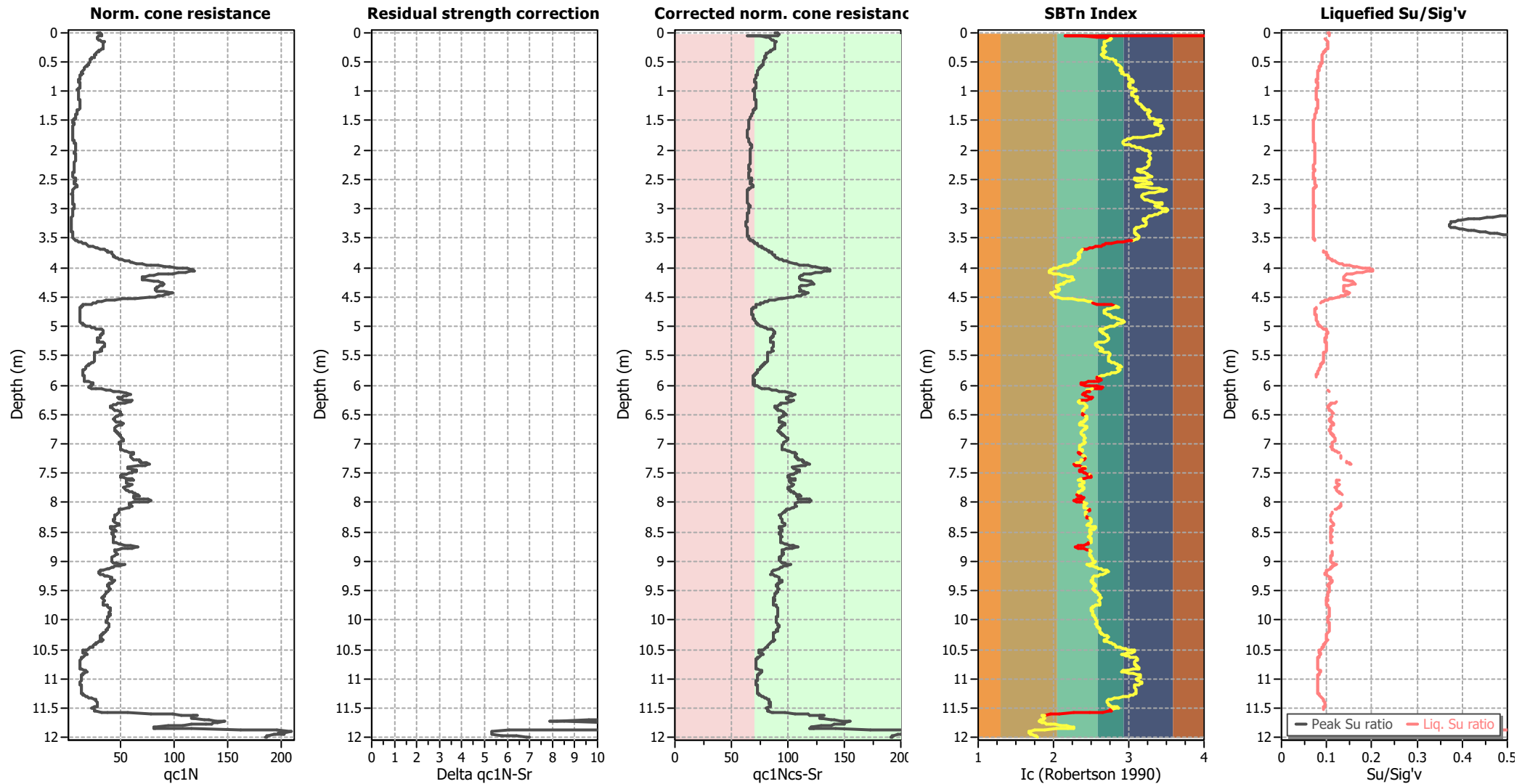
Liquefaction analysis summary plots



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: | Yes        |
| Points to test:                | Based on $I_c$ value | $I_c$ cut-off value:      | 2.60         | $K_0$ applied:              | Yes        |
| Earthquake magnitude $M_w$ :   | 6.50                 | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration:      | 0.05                 | Use fill:                 | No           | Limit depth applied:        | Yes        |
| Depth to water table (insitu): | 1.00 m               | Fill height:              | N/A          | Limit depth:                | 10.00 m    |

## Check for strength loss plots (Idriss & Boulanger (2008))



### 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: | Yes        |
| Points to test:                       | Based on Ic value | Ic cut-off value:         | 2.60         | K <sub>o</sub> applied:     | Yes        |
| Earthquake magnitude M <sub>w</sub> : | 6.50              | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration:             | 0.05              | Use fill:                 | No           | Limit depth applied:        | Yes        |
| Depth to water table (insitu):        | 1.00 m            | Fill height:              | N/A          | Limit depth:                | 10.00 m    |

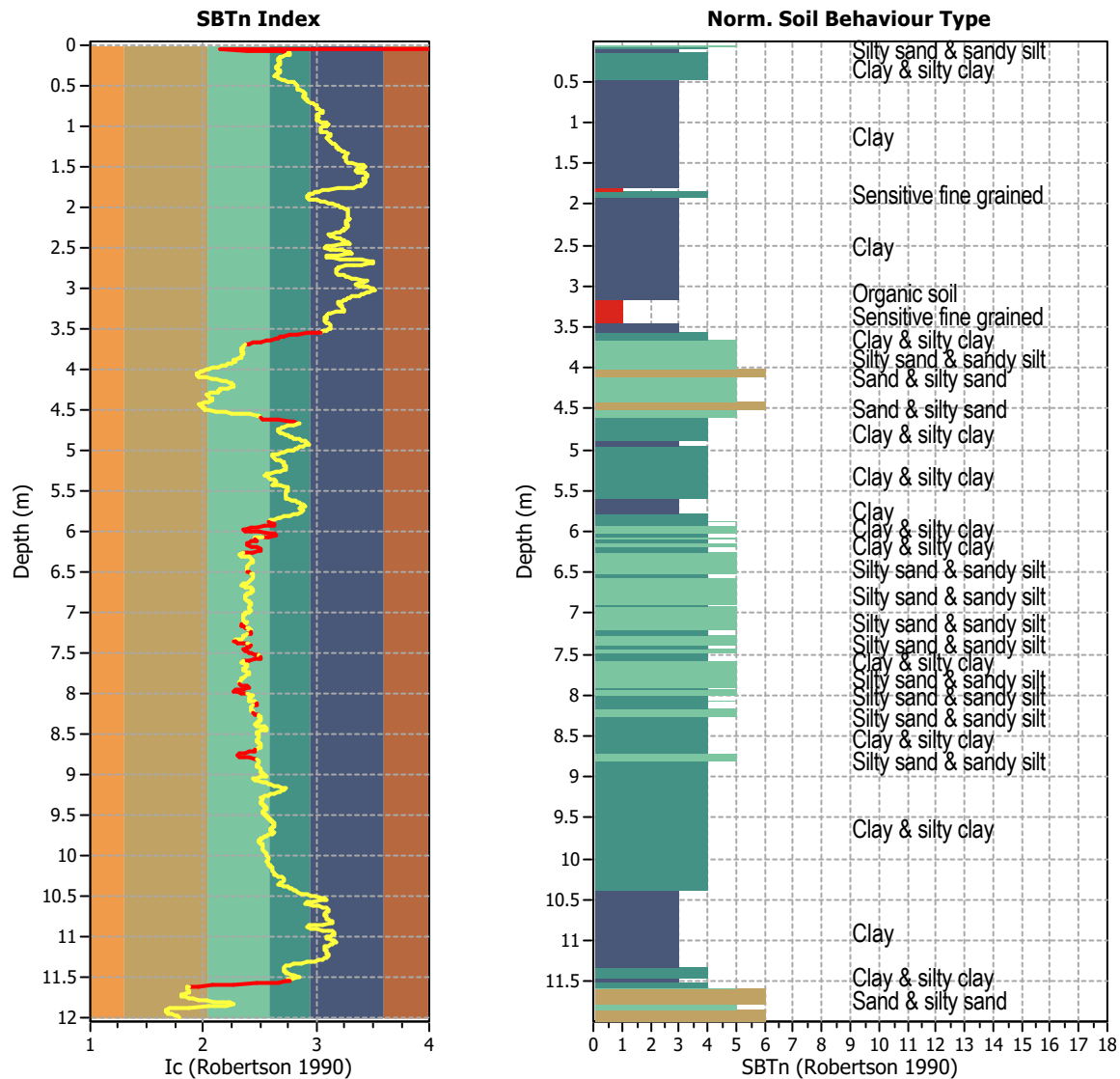
TRANSITION LAYER DETECTION ALGORITHM REPORT

Summary Details & Plots

Short description

The software will delete data when the cone is in transition from either clay to sand or vise-versa. To do this the software requires a range of  $I_c$  values over which the transition will be defined (typically somewhere between  $1.80 < I_c < 3.0$ ) and a rate of change of  $I_c$ . Transitions typically occur when the rate of change of  $I_c$  is fast (i.e.  $\Delta I_c$  is small).

The  $SBT_n$  plot below, displays in red the detected transition layers based on the parameters listed below the graphs.



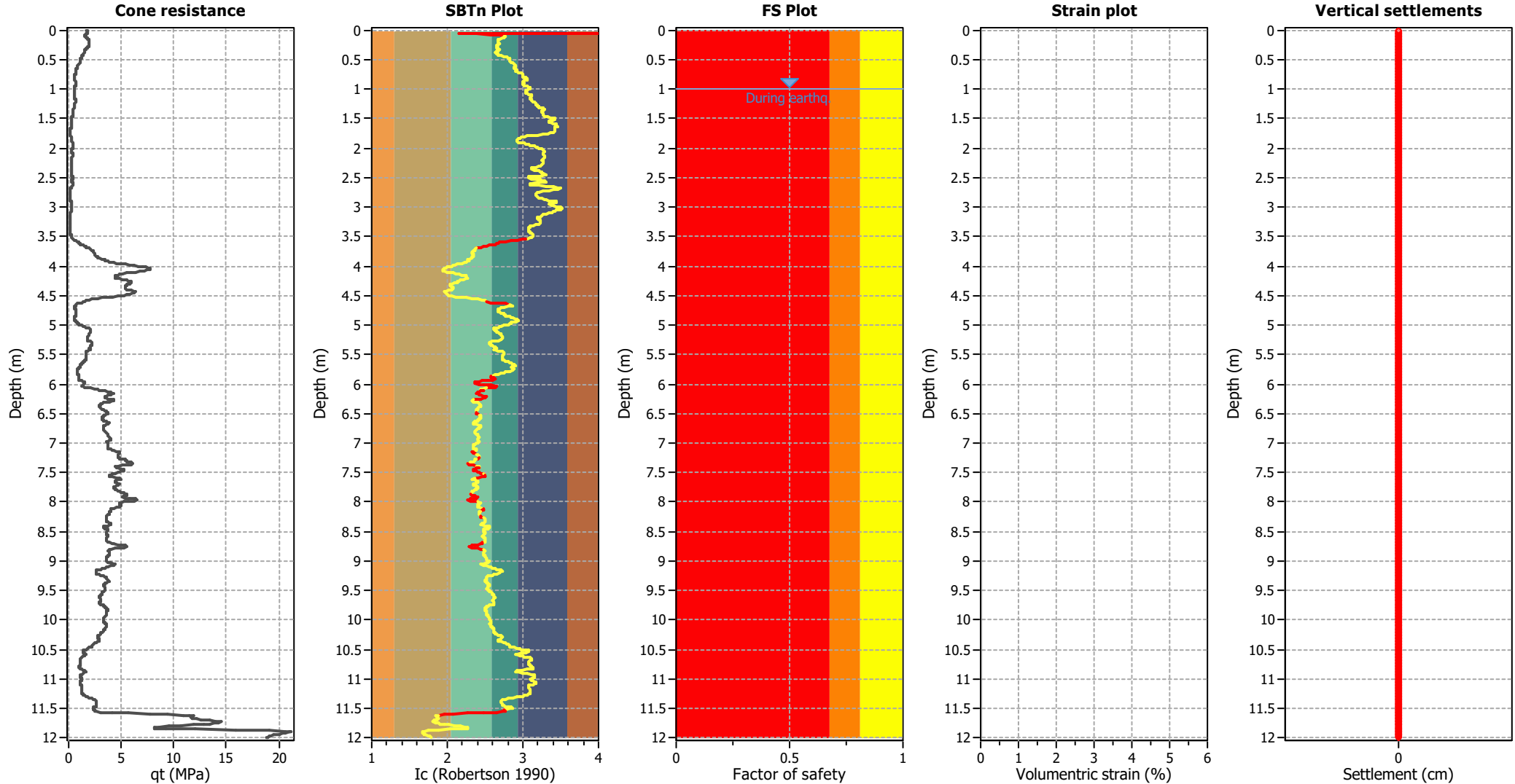
Transition layer algorithm properties

$I_c$  minimum check value: 1.70  
 $I_c$  maximum check value: 3.00  
 $I_c$  change ratio value: 0.0100  
Minimum number of points in layer: 4

General statistics

Total points in CPT file: 1199  
Total points excluded: 152  
Exclusion percentage: 12.68%  
Number of layers detected: 25

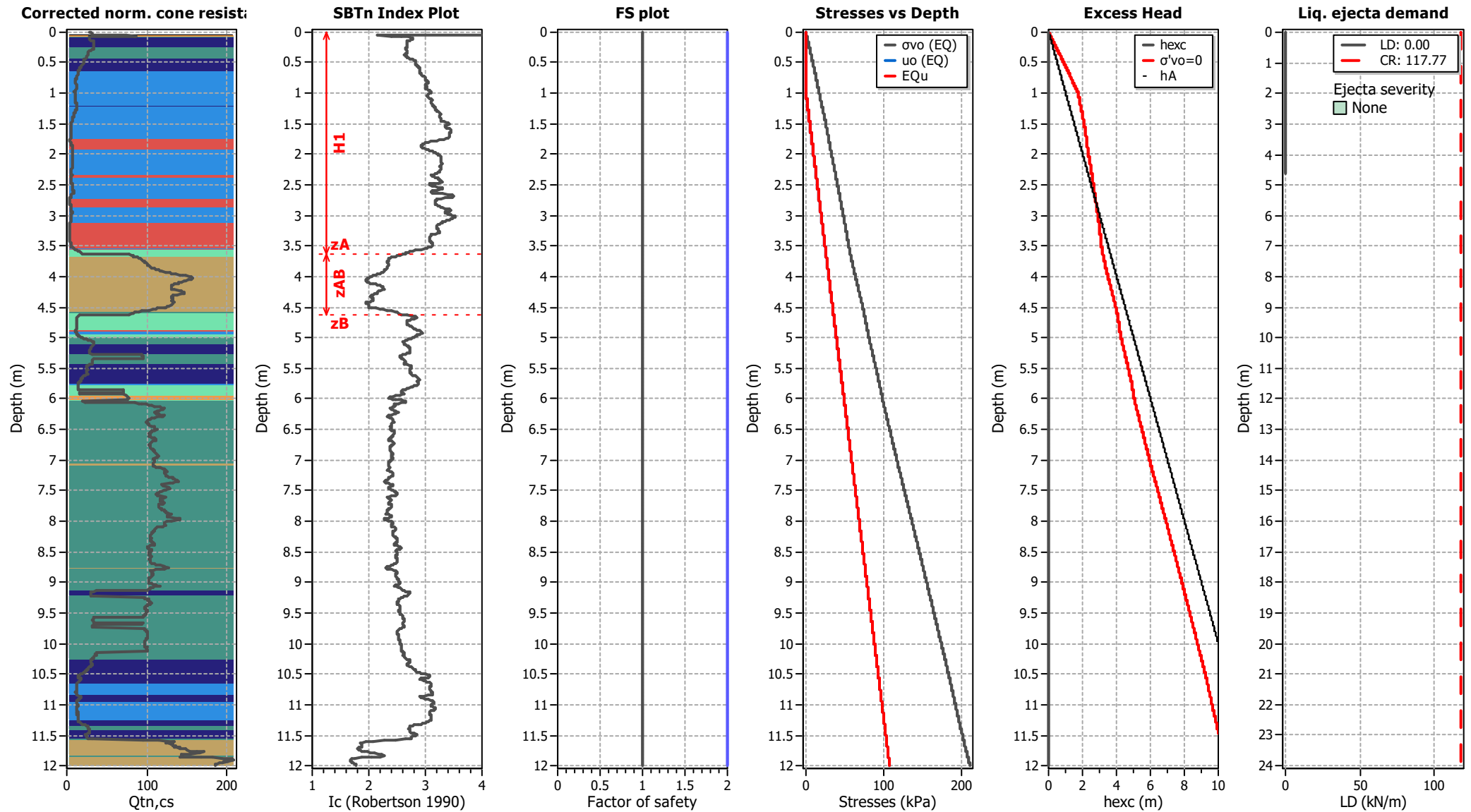
Estimation of post-earthquake settlements



Abbreviations

- q<sub>t</sub>: Total cone resistance (cone resistance q<sub>c</sub> corrected for pore water effects)
- I<sub>c</sub>: Soil Behaviour Type Index
- FS: Calculated Factor of Safety against liquefaction
- Volumetric strain: Post-liquefaction volumetric strain

## Ejecta Severity Estimation



## LIQUEFACTION ANALYSIS REPORT

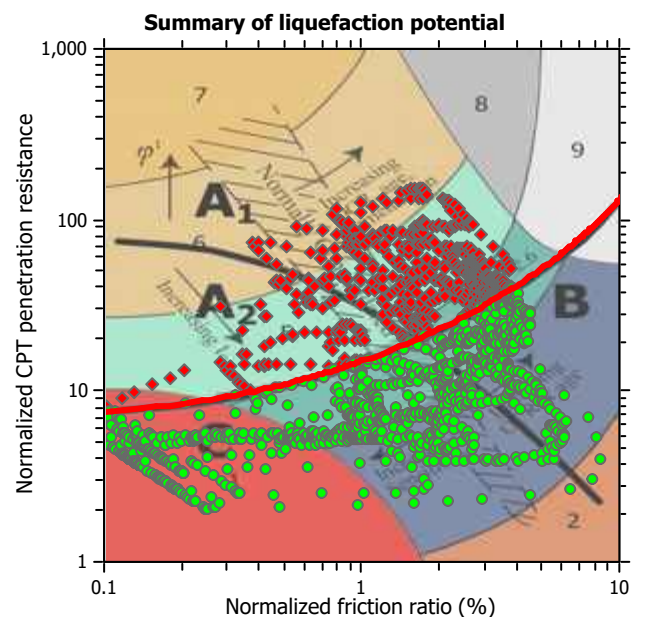
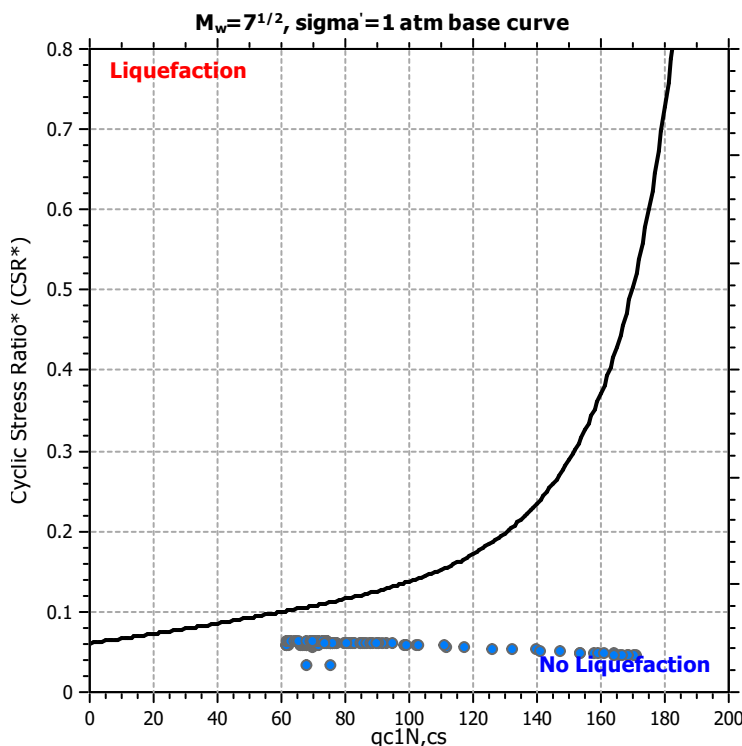
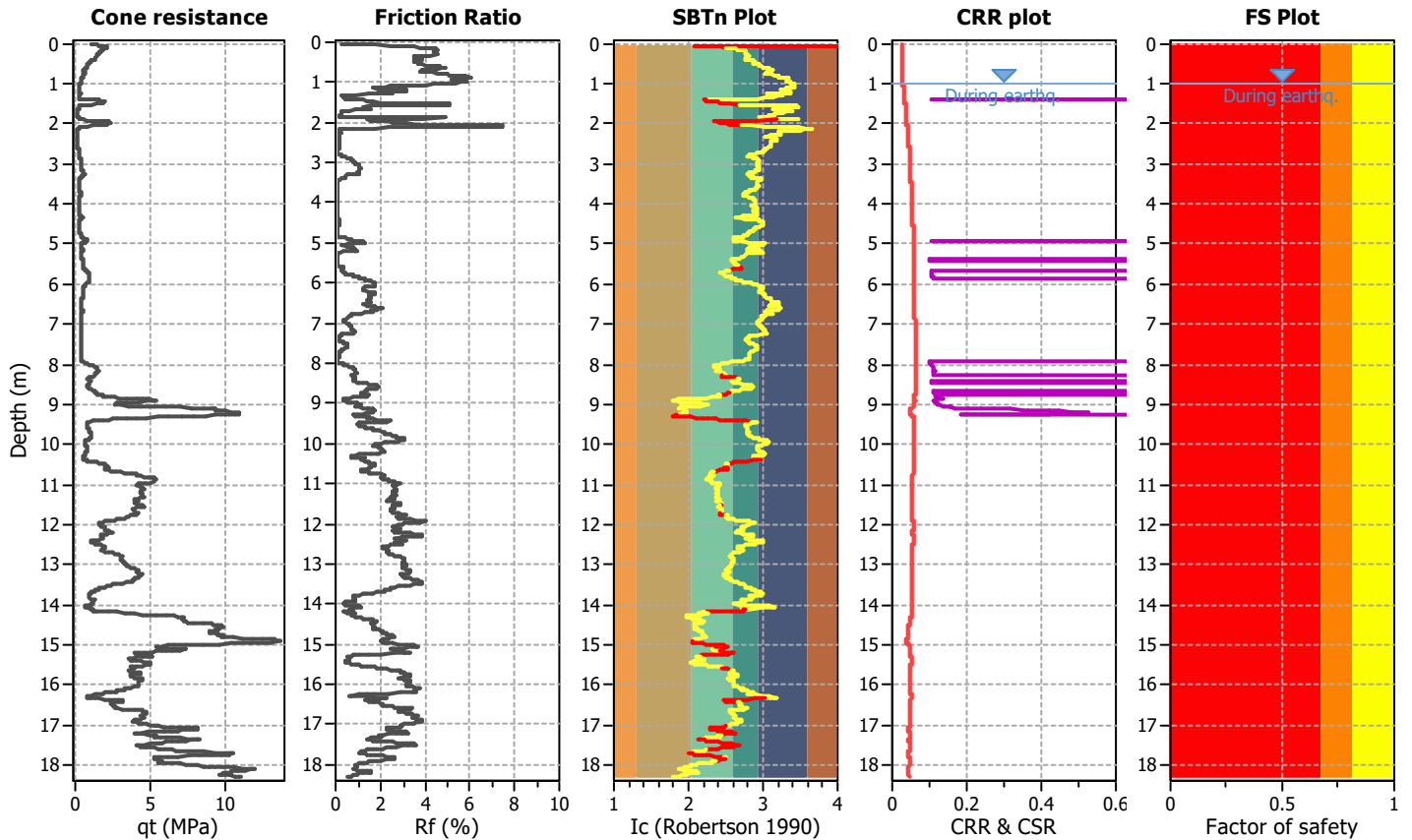
**Project title :**

**Location :**

**CPT file : CPT412**

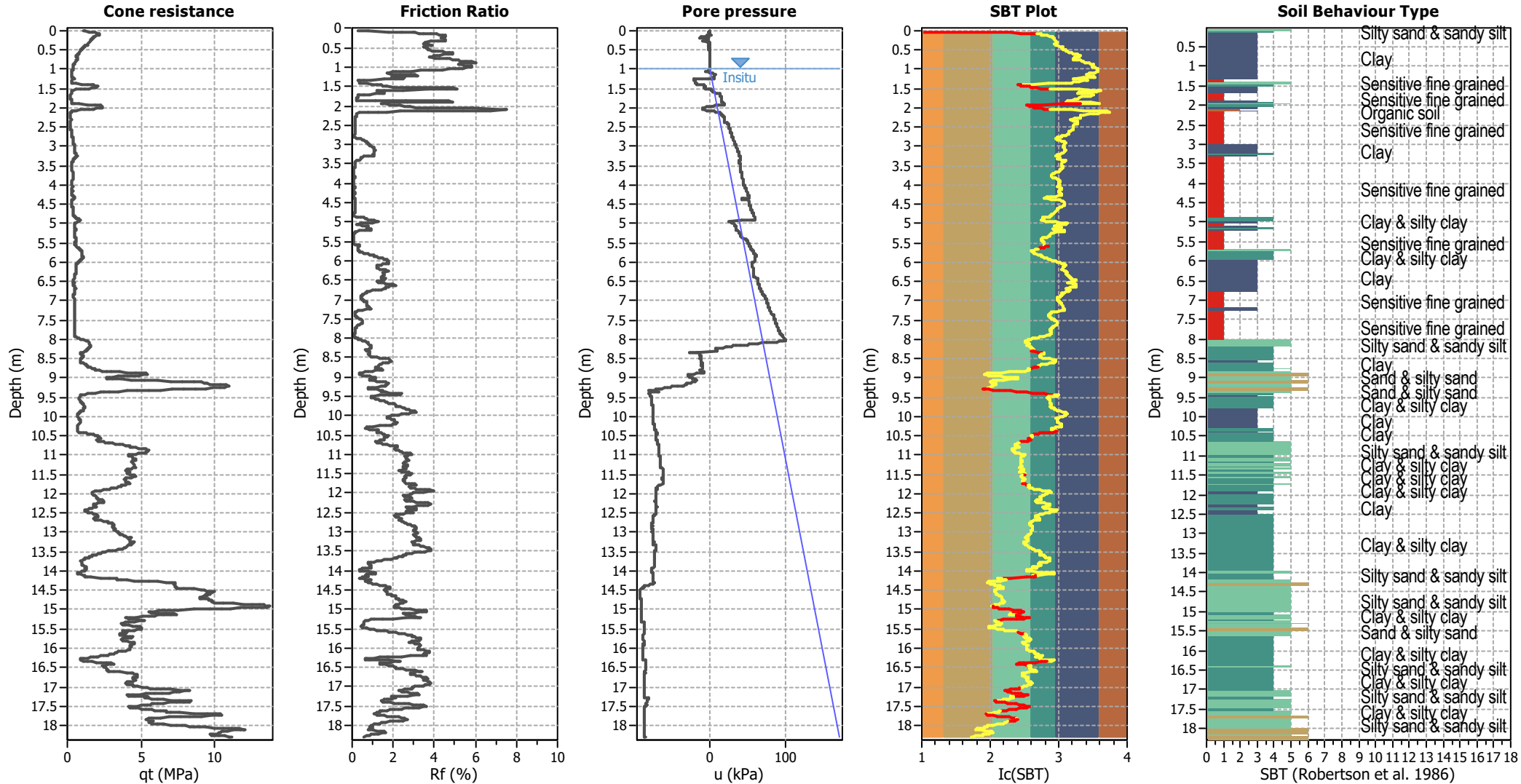
### Input parameters and analysis data

|                              |                   |                           |              |                         |     |                             |              |
|------------------------------|-------------------|---------------------------|--------------|-------------------------|-----|-----------------------------|--------------|
| Analysis method:             | B&I (2014)        | G.W.T. (in-situ):         | 1.00 m       | Use fill:               | No  | Clay like behavior applied: | Sands only   |
| Fines correction method:     | B&I (2014)        | G.W.T. (earthq.):         | 1.00 m       | Fill height:            | N/A | Limit depth applied:        | Yes          |
| Points to test:              | Based on Ic value | Average results interval: | 3            | Fill weight:            | N/A | Limit depth:                | 10.00 m      |
| Earthquake magnitude $M_w$ : | 6.50              | Ic cut-off value:         | 2.60         | Trans. detect. applied: | Yes | MSF method:                 | Method based |
| Peak ground acceleration:    | 0.05              | Unit weight calculation:  | Based on SBT | $K_\sigma$ applied:     | Yes |                             |              |



Zone A<sub>1</sub>: Cyclic liquefaction likely depending on size and duration of cyclic loading  
Zone A<sub>2</sub>: Cyclic liquefaction and strength loss likely depending on loading and ground geometry  
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening  
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



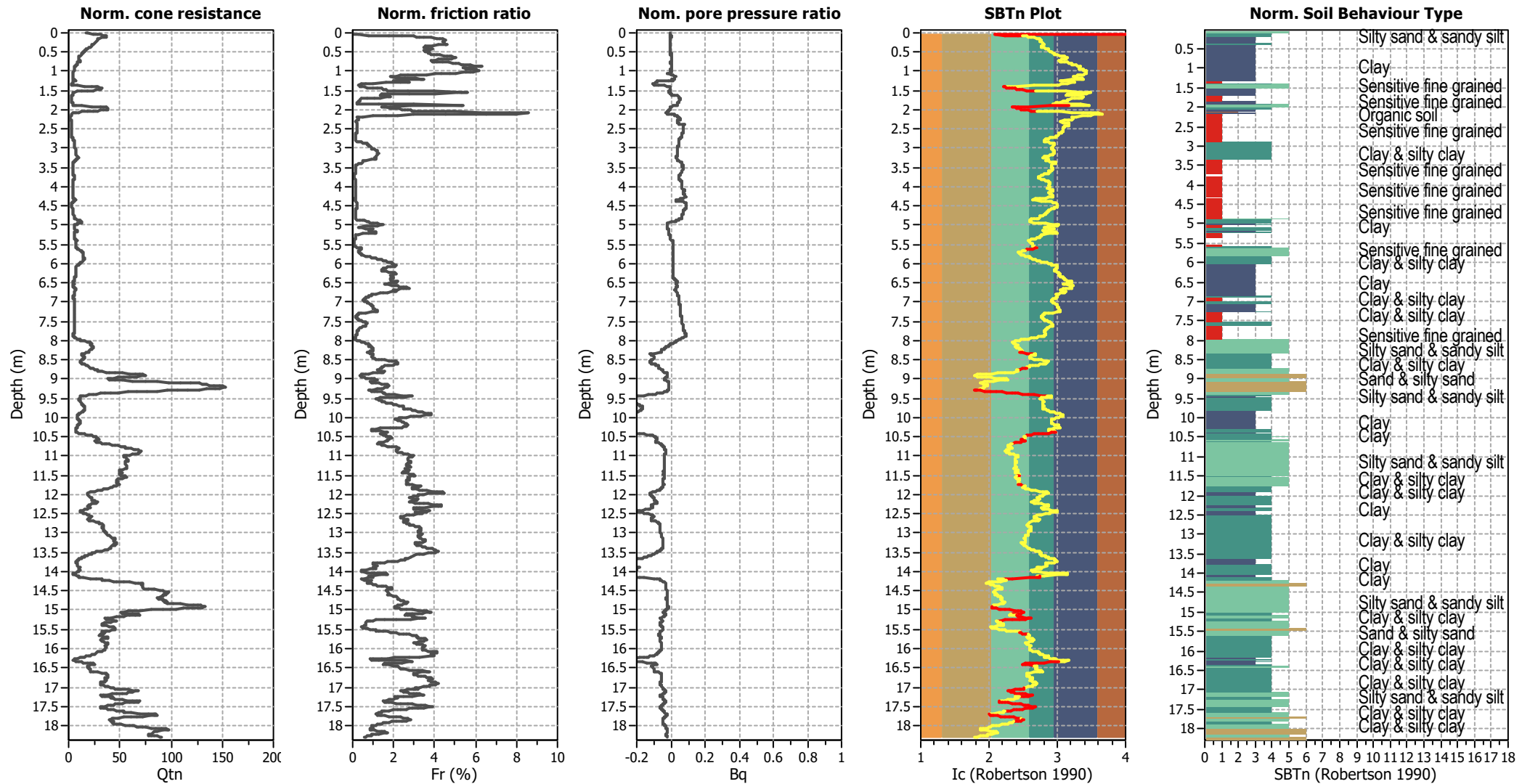
Input parameters and analysis data

|                                       |                   |                           |              |                             |            |
|---------------------------------------|-------------------|---------------------------|--------------|-----------------------------|------------|
| 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: | Yes        |
| 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> : | 6.50              | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration:             | 0.05              | 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 |

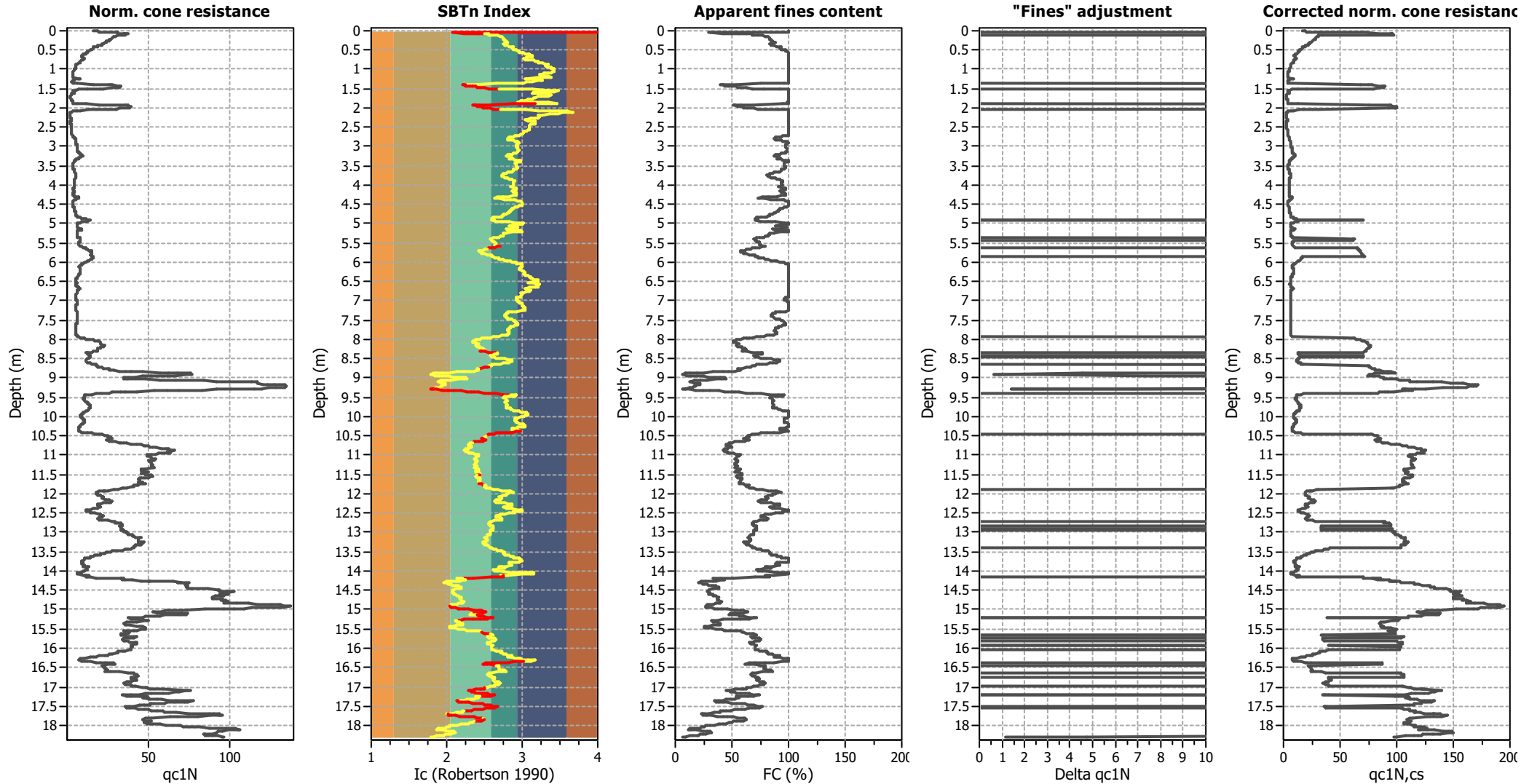
### CPT basic interpretation plots (normalized)



#### 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: | Yes        |
| 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> : | 6.50              | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration:             | 0.05              | Use fill:                 | No           | Limit depth applied:        | Yes        |
| Depth to water table (insitu):        | 1.00 m            | Fill height:              | N/A          | Limit depth:                | 10.00 m    |

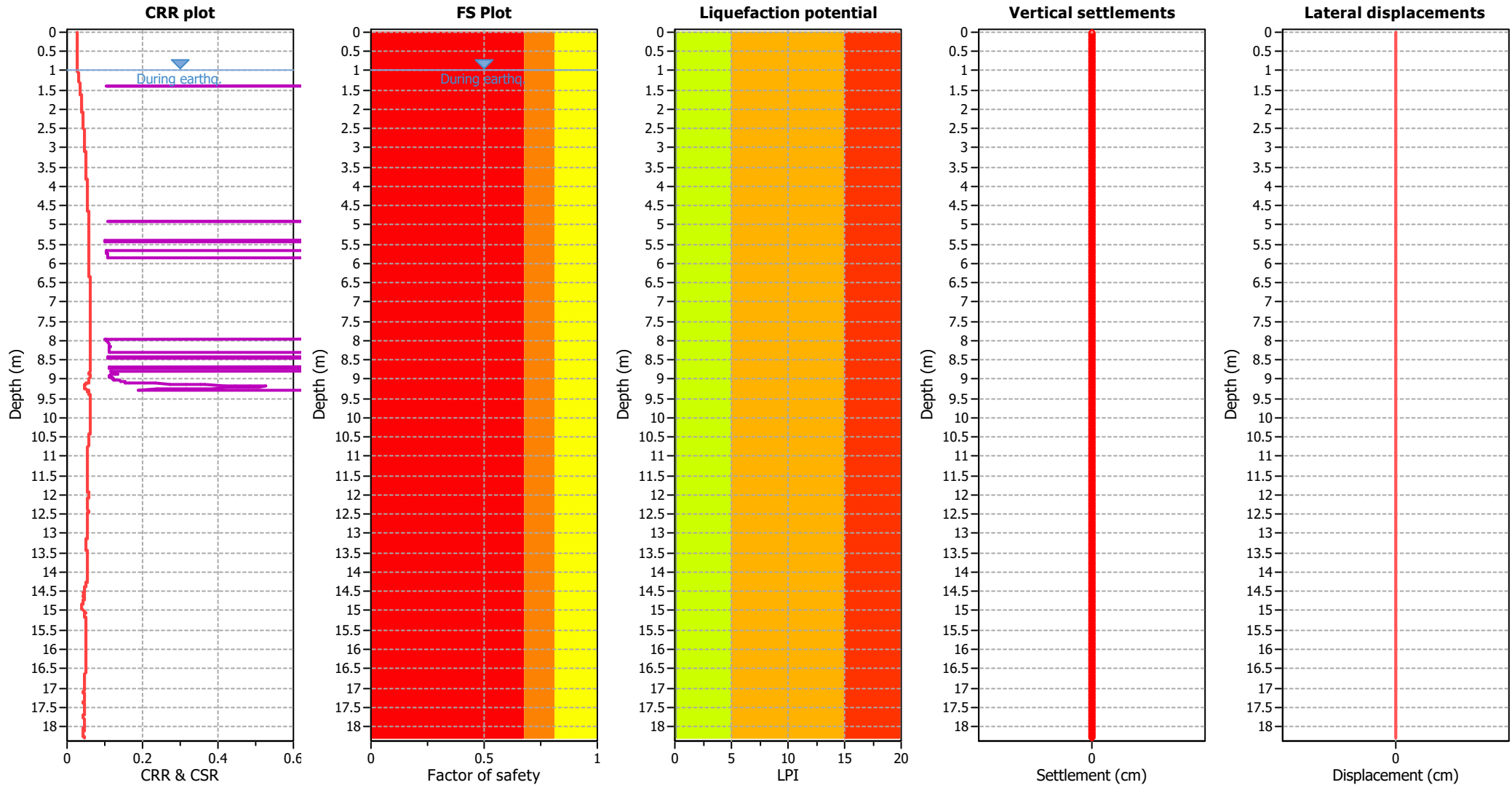
Liquefaction analysis overall plots (intermediate results)



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: | Yes        |
| Points to test:                       | Based on Ic value | Ic cut-off value:         | 2.60         | K <sub>o</sub> applied:     | Yes        |
| Earthquake magnitude M <sub>w</sub> : | 6.50              | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration:             | 0.05              | Use fill:                 | No           | Limit depth applied:        | Yes        |
| Depth to water table (insitu):        | 1.00 m            | Fill height:              | N/A          | Limit depth:                | 10.00 m    |

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: | Yes        |
| 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> : | 6.50              | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration:             | 0.05              | Use fill:                 | No           | Limit depth applied:        | Yes        |
| Depth to water table (insitu):        | 1.00 m            | Fill height:              | N/A          | Limit depth:                | 10.00 m    |

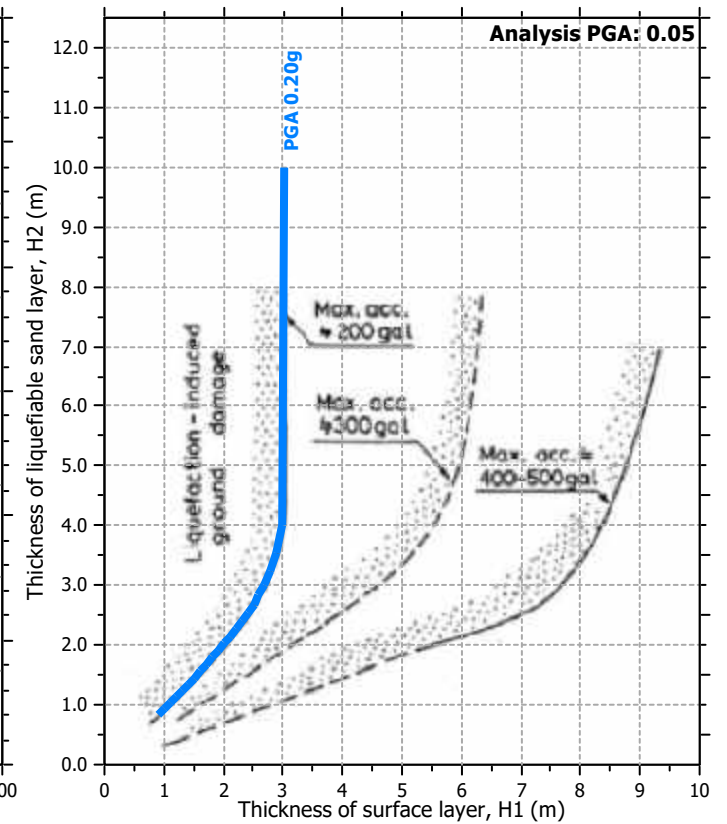
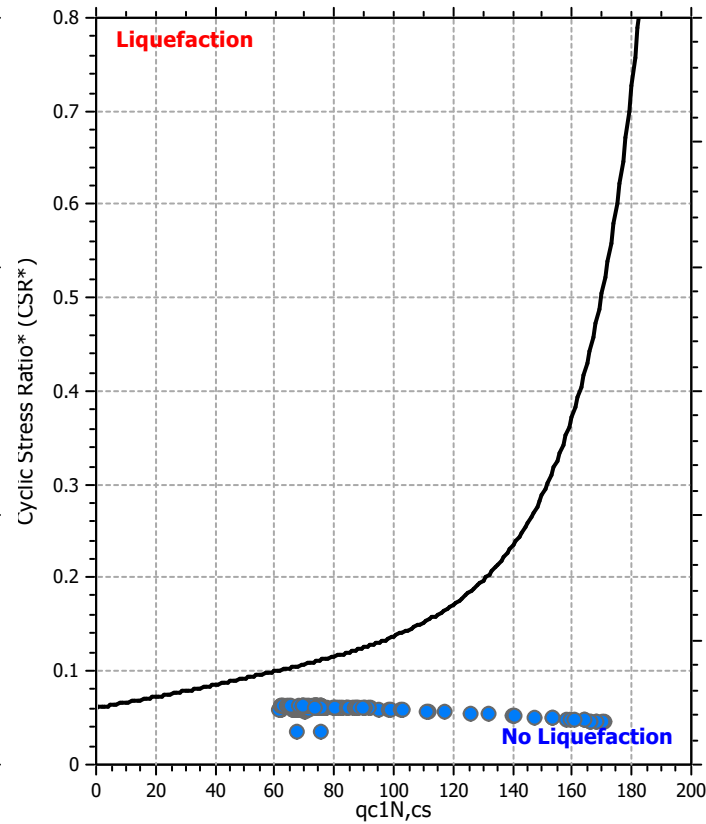
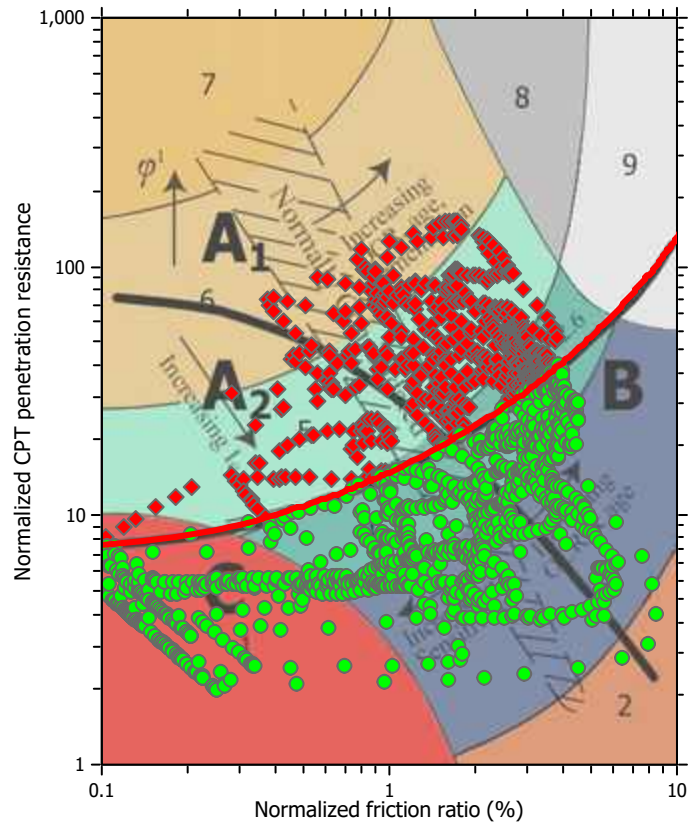
F.S. color scheme

|             |                                             |
|-------------|---------------------------------------------|
| Red         | Almost certain it will liquefy              |
| Orange      | Very likely to liquefy                      |
| Yellow      | Liquefaction and no liq. are equally likely |
| Light green | Unlike to liquefy                           |
| Dark green  | Almost certain it will not liquefy          |

LPI color scheme

|        |                |
|--------|----------------|
| Red    | Very high risk |
| Orange | High risk      |
| Yellow | Low risk       |

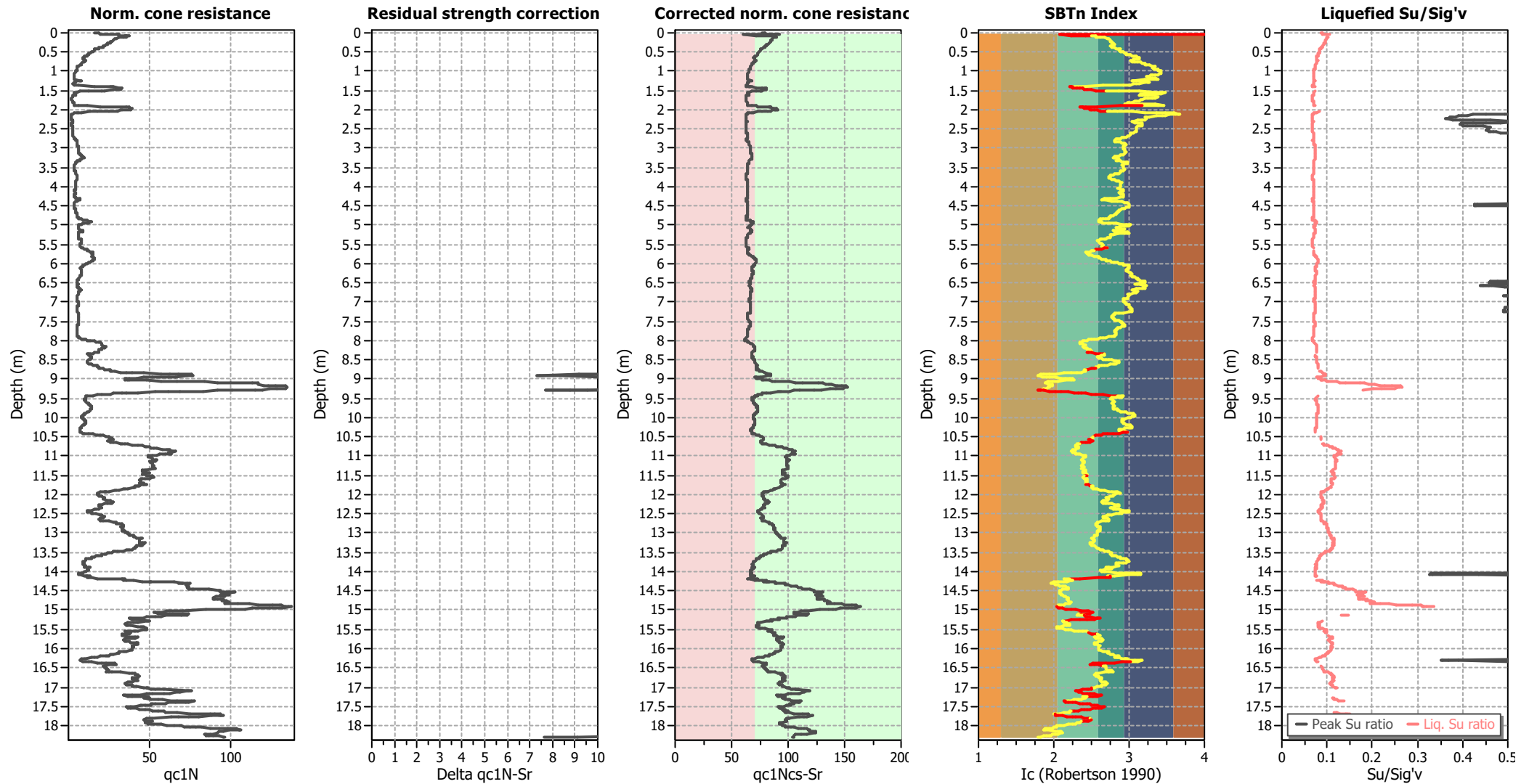
### Liquefaction analysis summary plots



### 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: | Yes        |
| Points to test:                       | Based on Ic value | Ic cut-off value:         | 2.60         | K <sub>o</sub> applied:     | Yes        |
| Earthquake magnitude M <sub>w</sub> : | 6.50              | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration:             | 0.05              | Use fill:                 | No           | Limit depth applied:        | Yes        |
| Depth to water table (insitu):        | 1.00 m            | Fill height:              | N/A          | Limit depth:                | 10.00 m    |

## Check for strength loss plots (Idriss & Boulanger (2008))



### 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: | Yes        |
| Points to test:                | Based on $I_c$ value | $I_c$ cut-off value:      | 2.60         | $K_g$ applied:              | Yes        |
| Earthquake magnitude $M_w$ :   | 6.50                 | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration:      | 0.05                 | Use fill:                 | No           | Limit depth applied:        | Yes        |
| Depth to water table (insitu): | 1.00 m               | Fill height:              | N/A          | Limit depth:                | 10.00 m    |

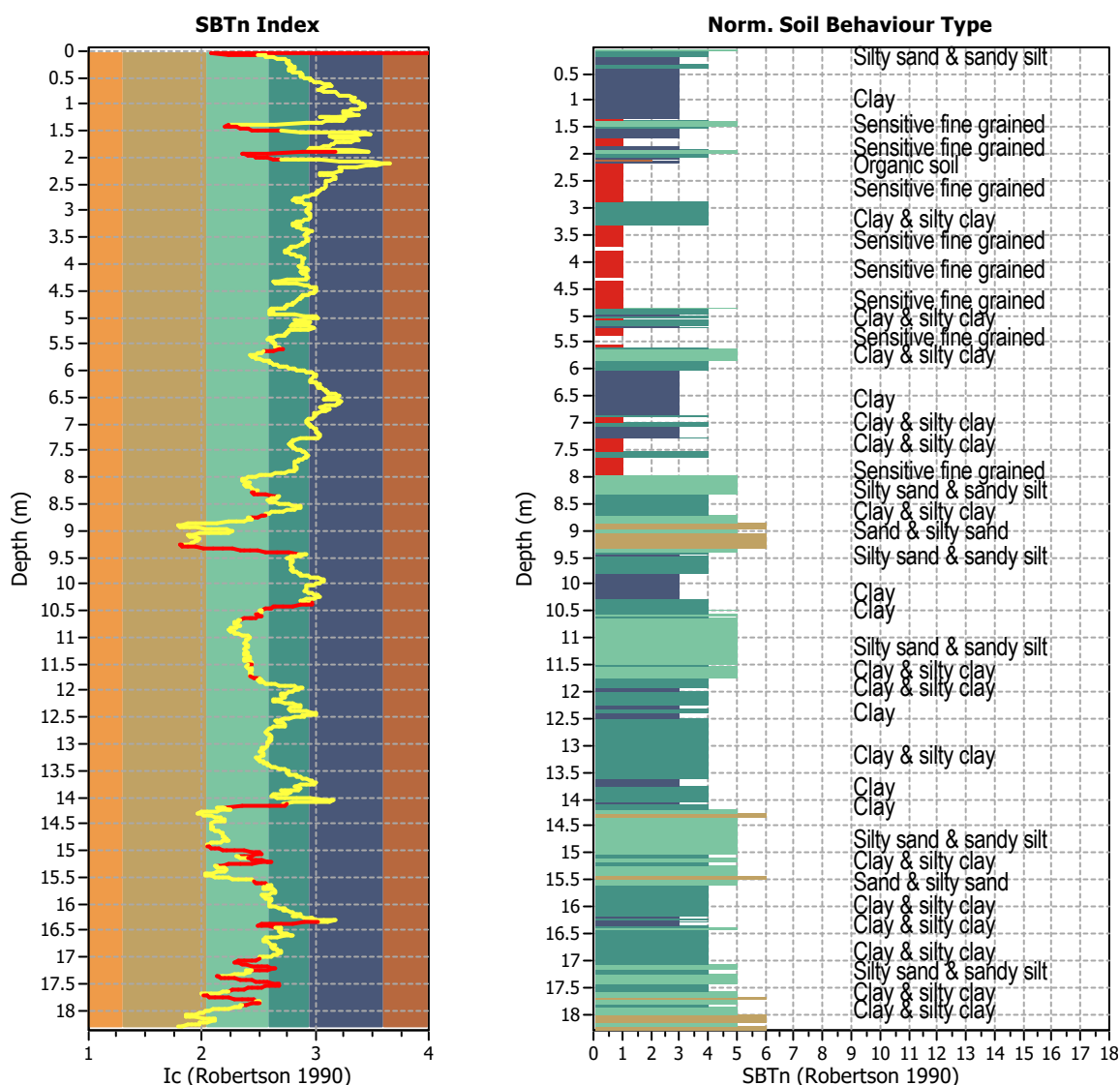
## TRANSITION LAYER DETECTION ALGORITHM REPORT

### Summary Details & Plots

#### Short description

The software will delete data when the cone is in transition from either clay to sand or vice-versa. To do this the software requires a range of  $I_c$  values over which the transition will be defined (typically somewhere between  $1.80 < I_c < 3.0$ ) and a rate of change of  $I_c$ . Transitions typically occur when the rate of change of  $I_c$  is fast (i.e.  $\Delta I_c$  is small).

The  $SBT_n$  plot below, displays in red the detected transition layers based on the parameters listed below the graphs.

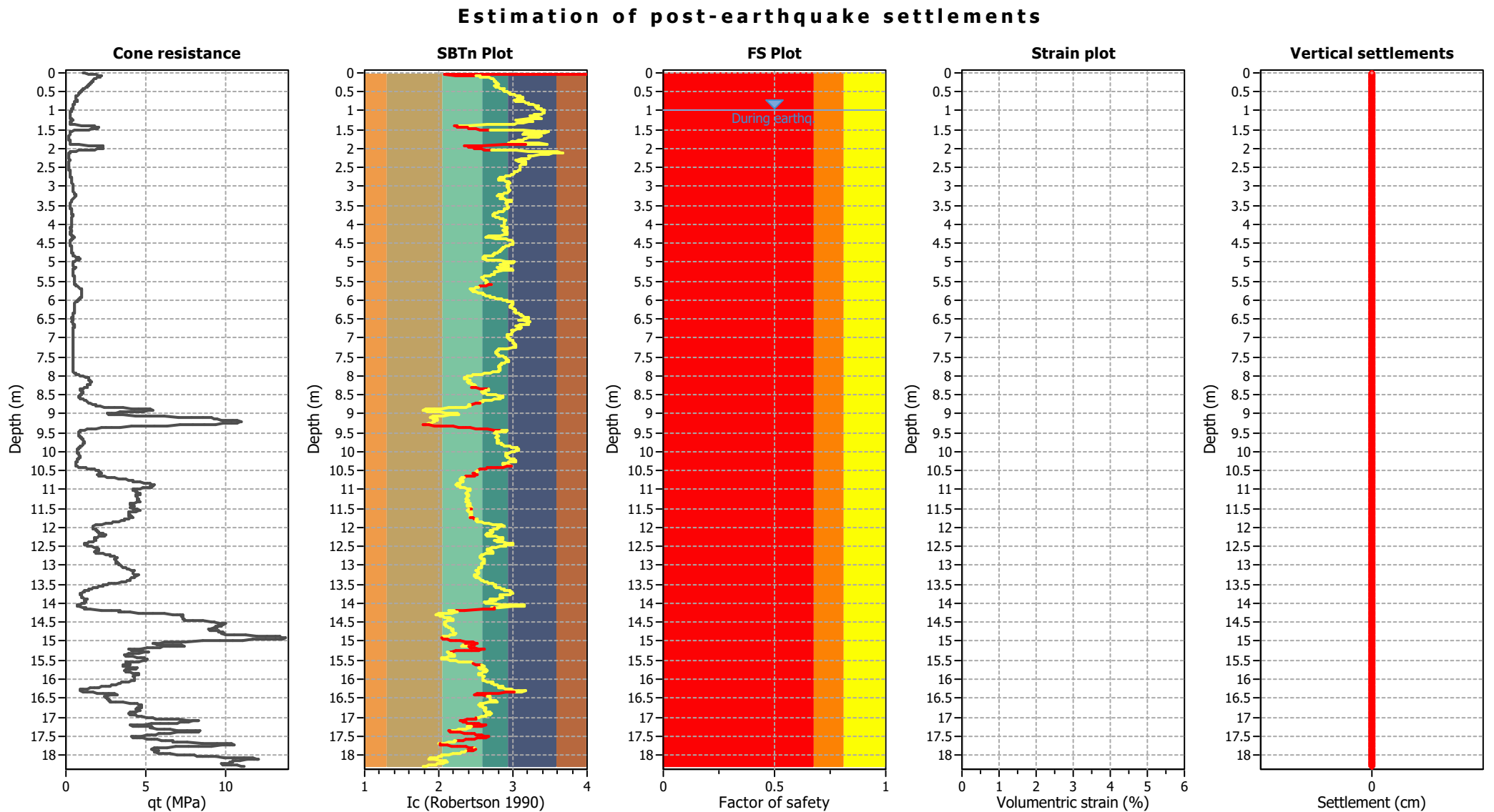


#### Transition layer algorithm properties

$I_c$  minimum check value: 1.70  
 $I_c$  maximum check value: 3.00  
 $I_c$  change ratio value: 0.0100  
 Minimum number of points in layer: 4

#### General statistics

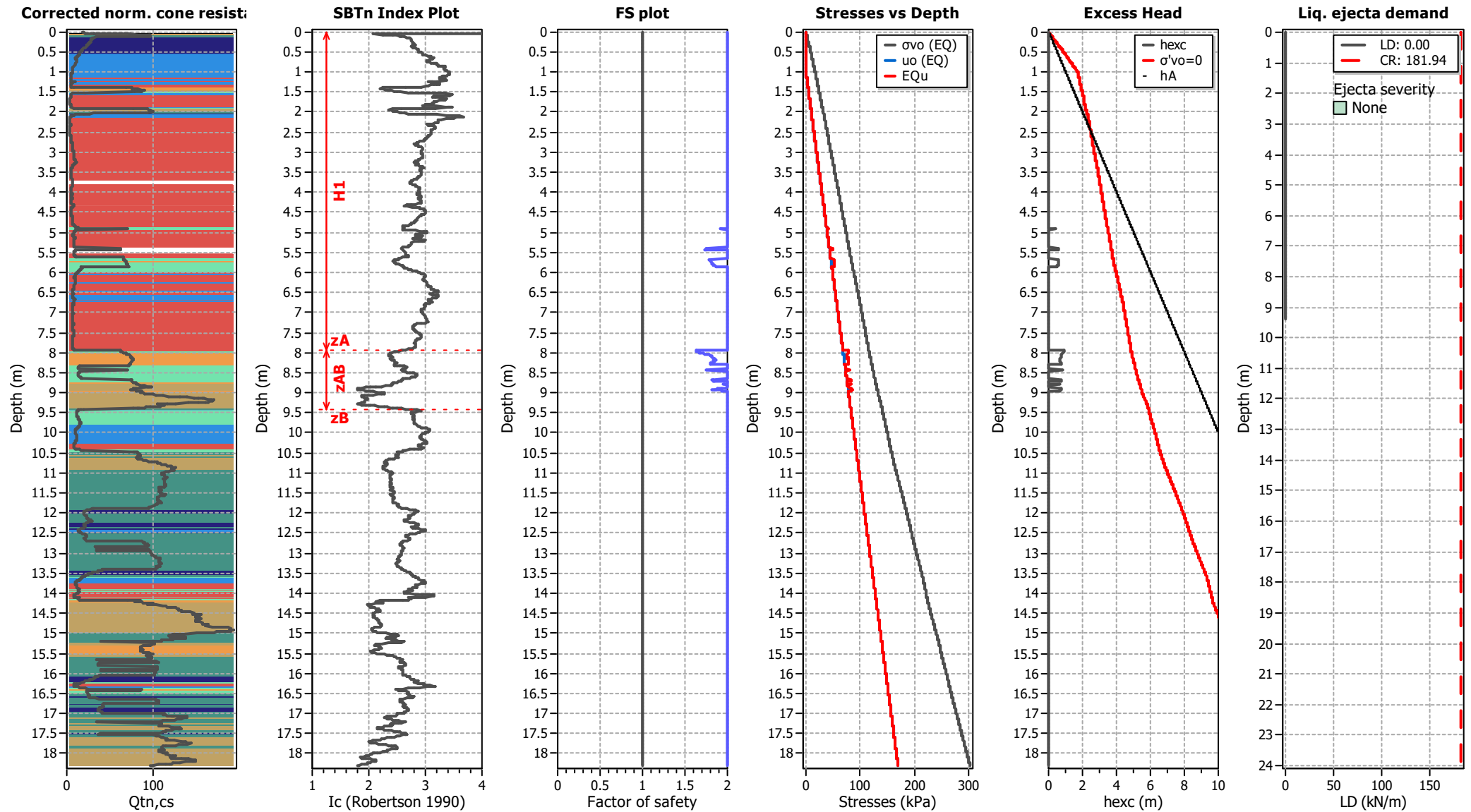
Total points in CPT file: 1830  
 Total points excluded: 234  
 Exclusion percentage: 12.79%  
 Number of layers detected: 28



Abbreviations

- q<sub>c</sub>: Total cone resistance (cone resistance q<sub>c</sub> corrected for pore water effects)
- I<sub>c</sub>: Soil Behaviour Type Index
- FS: Calculated Factor of Safety against liquefaction
- Volumetric strain: Post-liquefaction volumetric strain

## Ejecta Severity Estimation



## LIQUEFACTION ANALYSIS REPORT

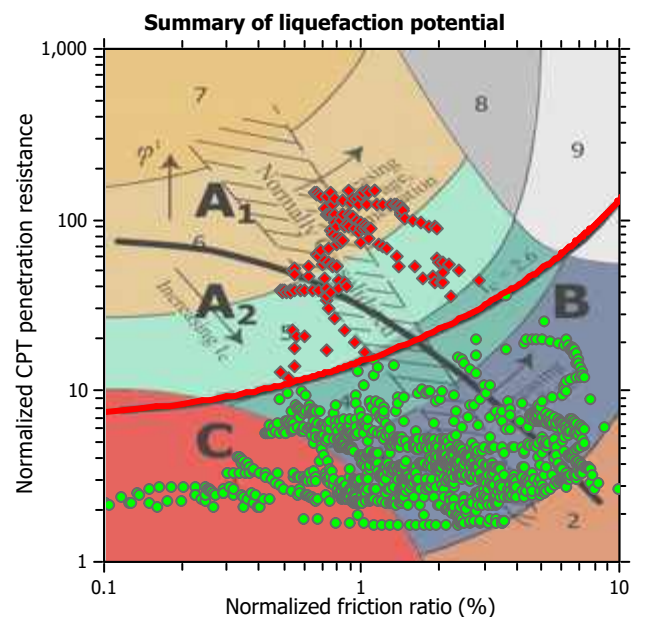
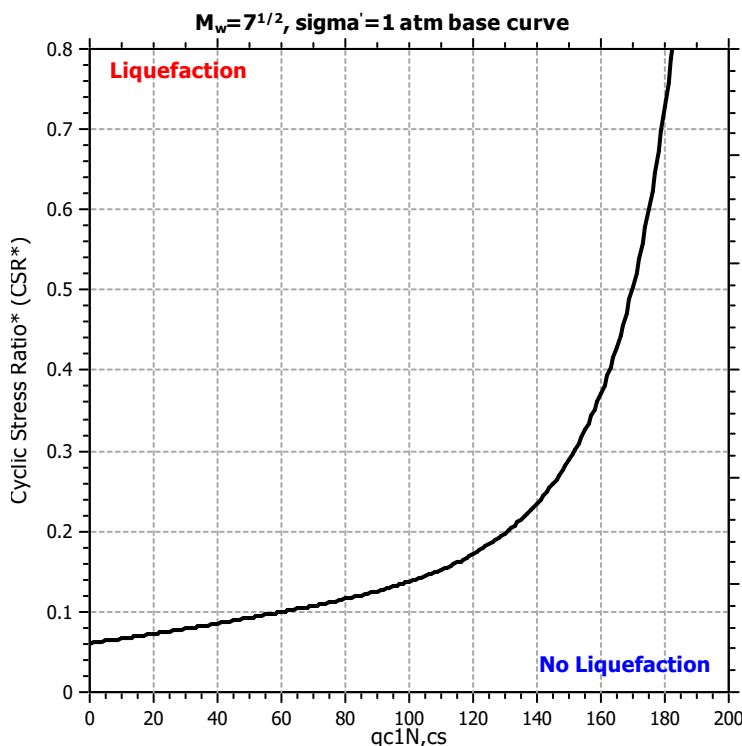
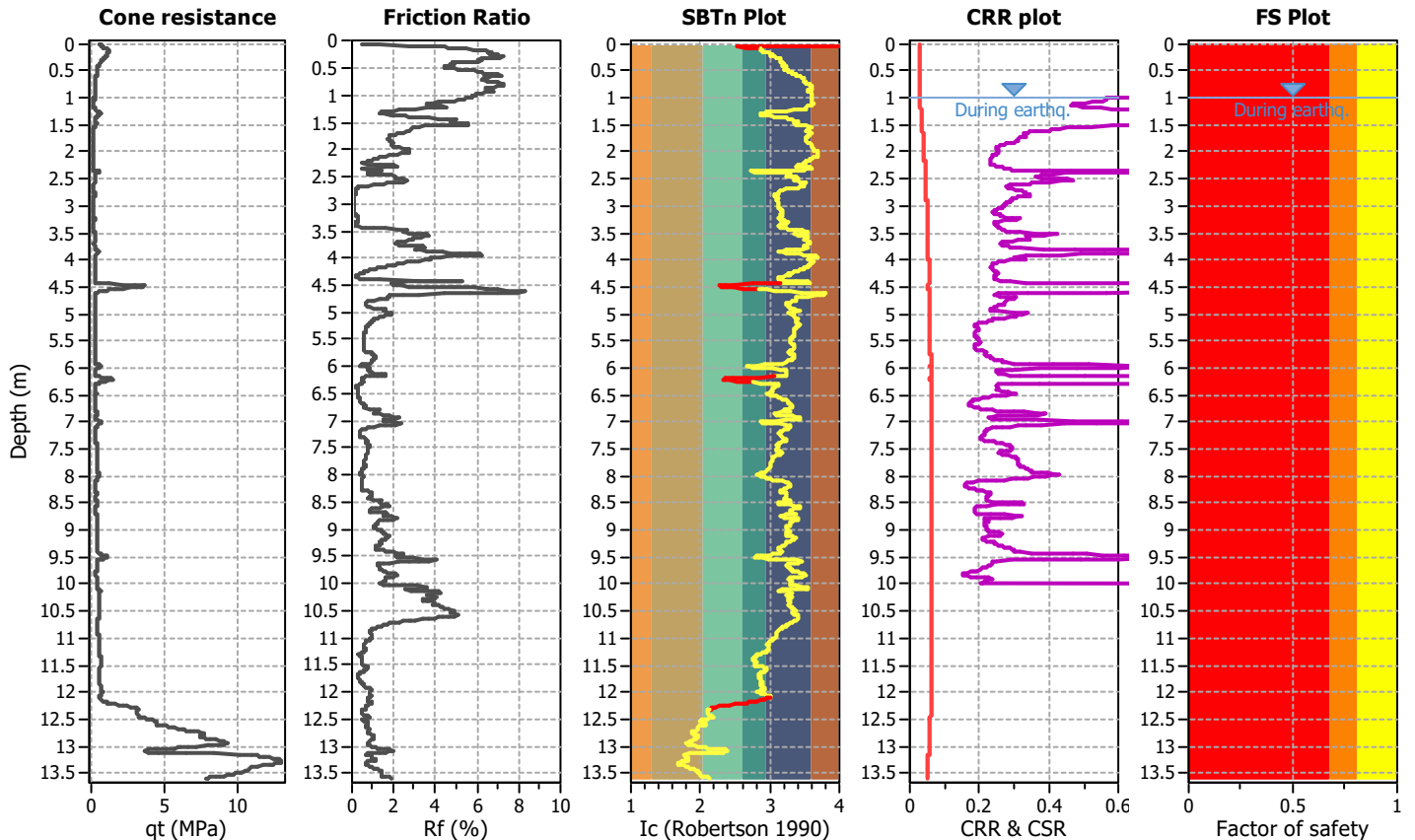
**Project title :**

**Location :**

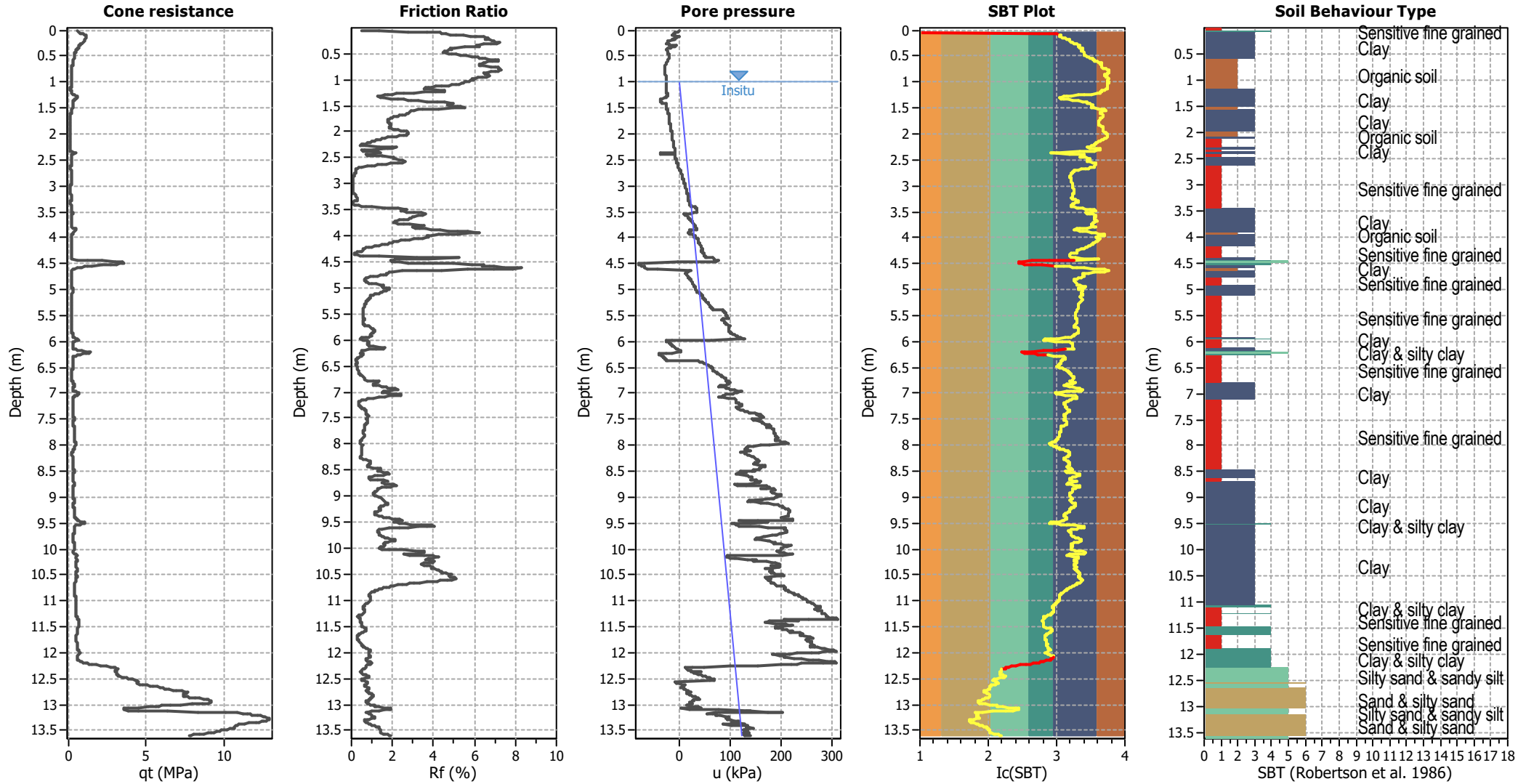
**CPT file : CPT413**

### Input parameters and analysis data

|                              |                   |                           |              |                         |     |                      |              |
|------------------------------|-------------------|---------------------------|--------------|-------------------------|-----|----------------------|--------------|
| Analysis method:             | B&I (2014)        | G.W.T. (in-situ):         | 1.00 m       | Use fill:               | No  | Clay like behavior   |              |
| Fines correction method:     | B&I (2014)        | G.W.T. (earthq.):         | 1.00 m       | Fill height:            | N/A | applied:             | Sand & Clay  |
| Points to test:              | Based on Ic value | Average results interval: | 3            | Fill weight:            | N/A | Limit depth applied: | Yes          |
| Earthquake magnitude $M_w$ : | 6.50              | Ic cut-off value:         | 2.60         | Trans. detect. applied: | Yes | Limit depth:         | 10.00 m      |
| Peak ground acceleration:    | 0.05              | Unit weight calculation:  | Based on SBT | $K_\sigma$ applied:     | Yes | MSF method:          | Method based |



CPT basic interpretation plots



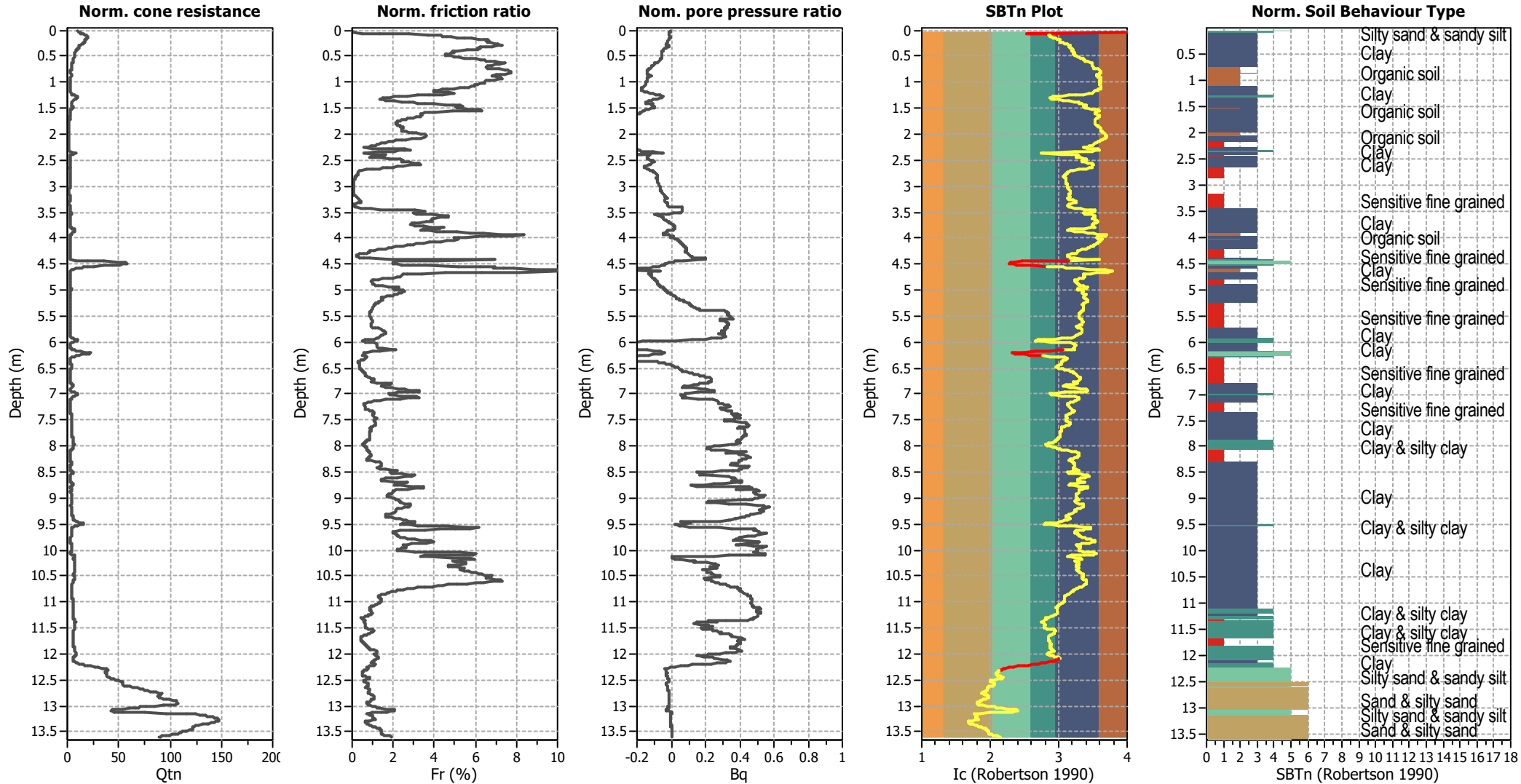
Input parameters and analysis data

|                                       |                   |                           |              |                             |             |
|---------------------------------------|-------------------|---------------------------|--------------|-----------------------------|-------------|
| 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: | Yes         |
| Points to test:                       | Based on Ic value | Ic cut-off value:         | 2.60         | K <sub>o</sub> applied:     | Yes         |
| Earthquake magnitude M <sub>w</sub> : | 6.50              | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sand & Clay |
| Peak ground acceleration:             | 0.05              | 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 (normalized)



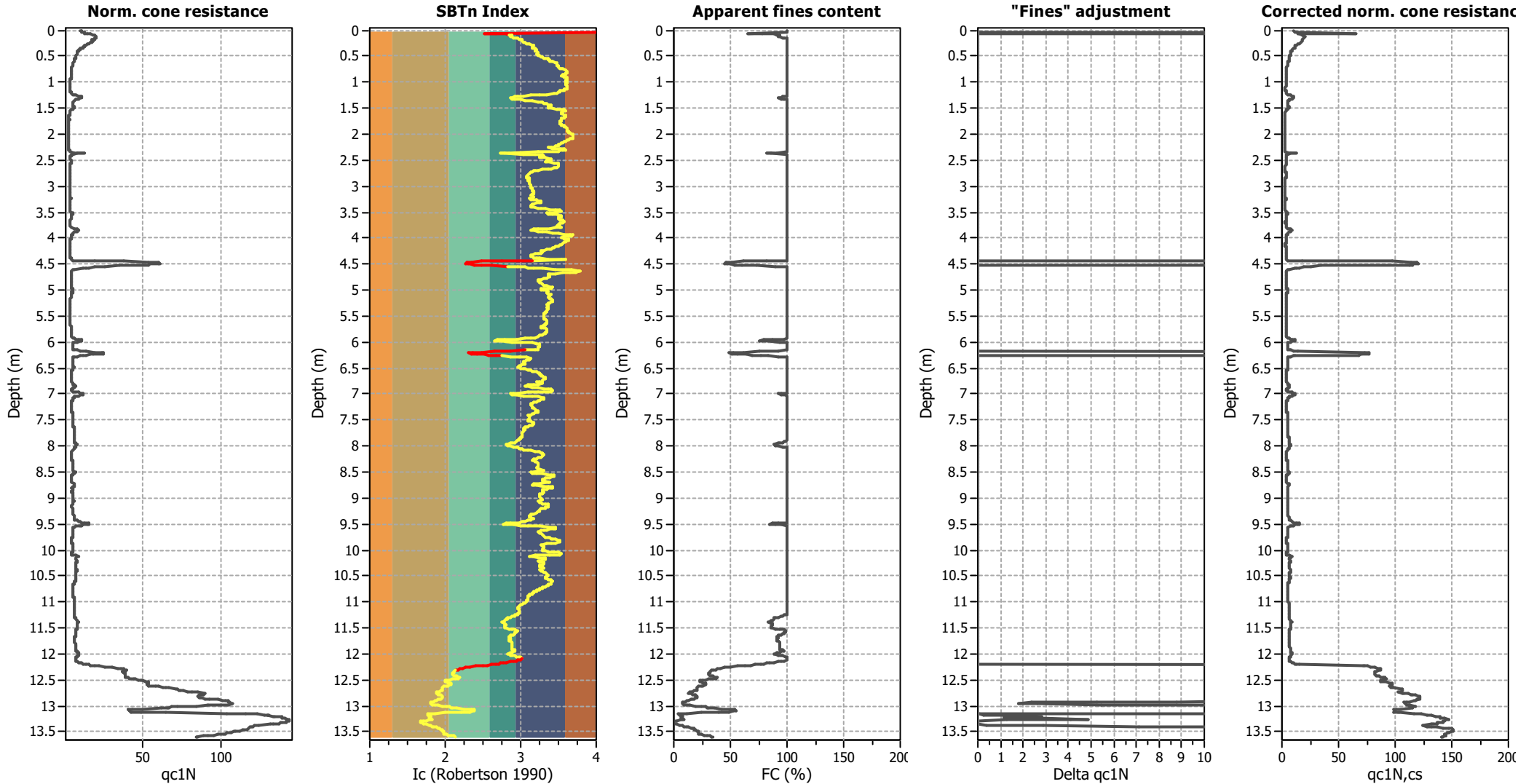
Input parameters and analysis data

|                                       |                   |                           |              |                             |             |
|---------------------------------------|-------------------|---------------------------|--------------|-----------------------------|-------------|
| 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: | Yes         |
| Points to test:                       | Based on Ic value | Ic cut-off value:         | 2.60         | K <sub>o</sub> applied:     | Yes         |
| Earthquake magnitude M <sub>w</sub> : | 6.50              | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sand & Clay |
| Peak ground acceleration:             | 0.05              | Use fill:                 | No           | Limit depth applied:        | Yes         |
| Depth to water table (insitu):        | 1.00 m            | Fill height:              | N/A          | Limit depth:                | 10.00 m     |

SBTn 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 |

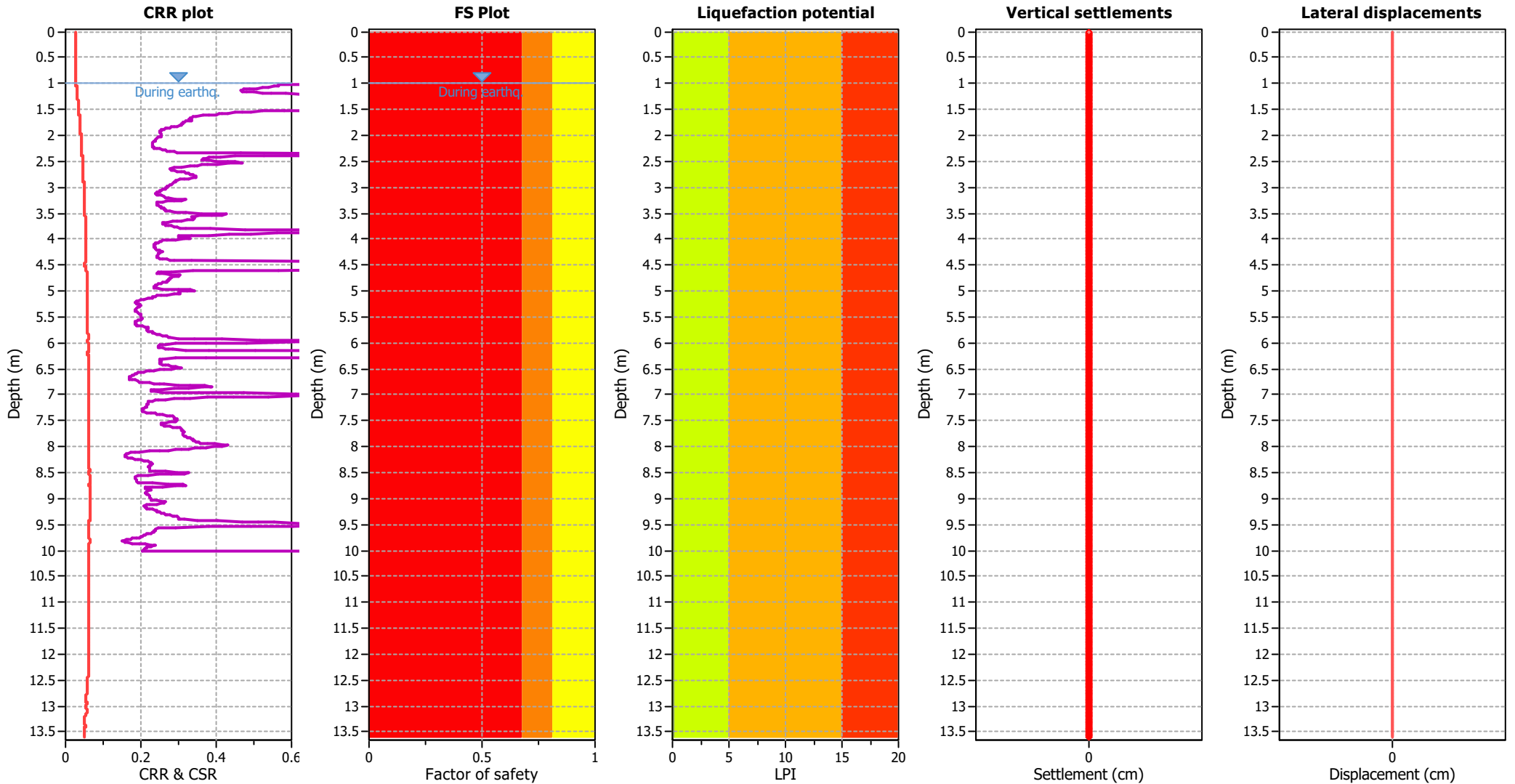
Liquefaction analysis overall plots (intermediate results)



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: | Yes         |
| Points to test:                       | Based on Ic value | Ic cut-off value:         | 2.60         | K <sub>o</sub> applied:     | Yes         |
| Earthquake magnitude M <sub>w</sub> : | 6.50              | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sand & Clay |
| Peak ground acceleration:             | 0.05              | Use fill:                 | No           | Limit depth applied:        | Yes         |
| Depth to water table (insitu):        | 1.00 m            | Fill height:              | N/A          | Limit depth:                | 10.00 m     |

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: | Yes         |
| Points to test:                       | Based on Ic value | Ic cut-off value:         | 2.60         | K <sub>o</sub> applied:     | Yes         |
| Earthquake magnitude M <sub>w</sub> : | 6.50              | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sand & Clay |
| Peak ground acceleration:             | 0.05              | Use fill:                 | No           | Limit depth applied:        | Yes         |
| Depth to water table (insitu):        | 1.00 m            | Fill height:              | N/A          | Limit depth:                | 10.00 m     |

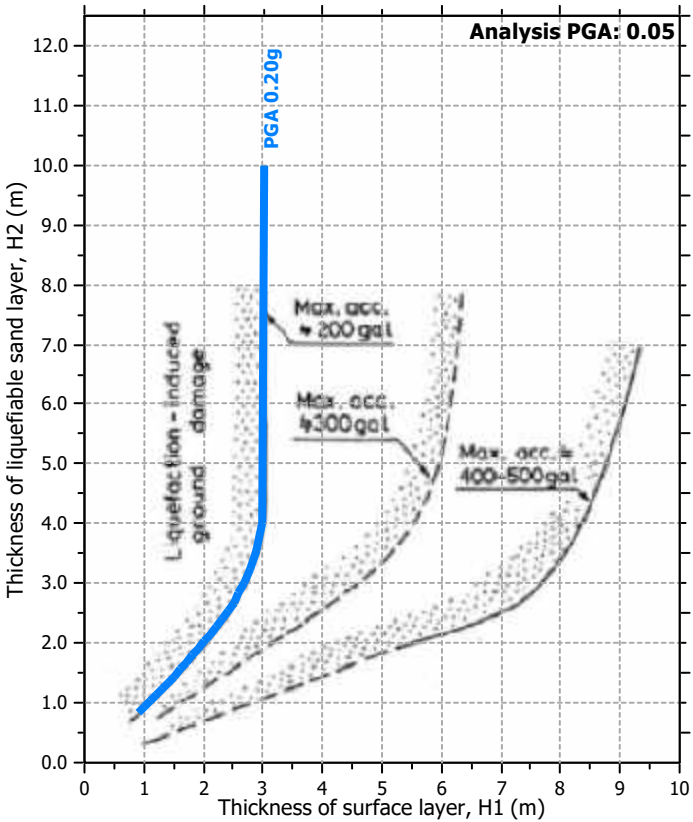
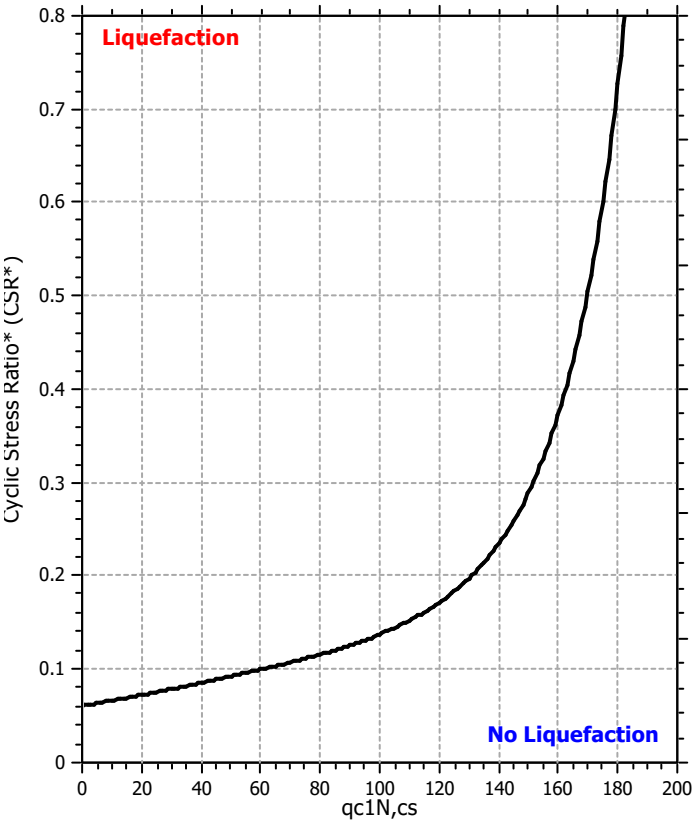
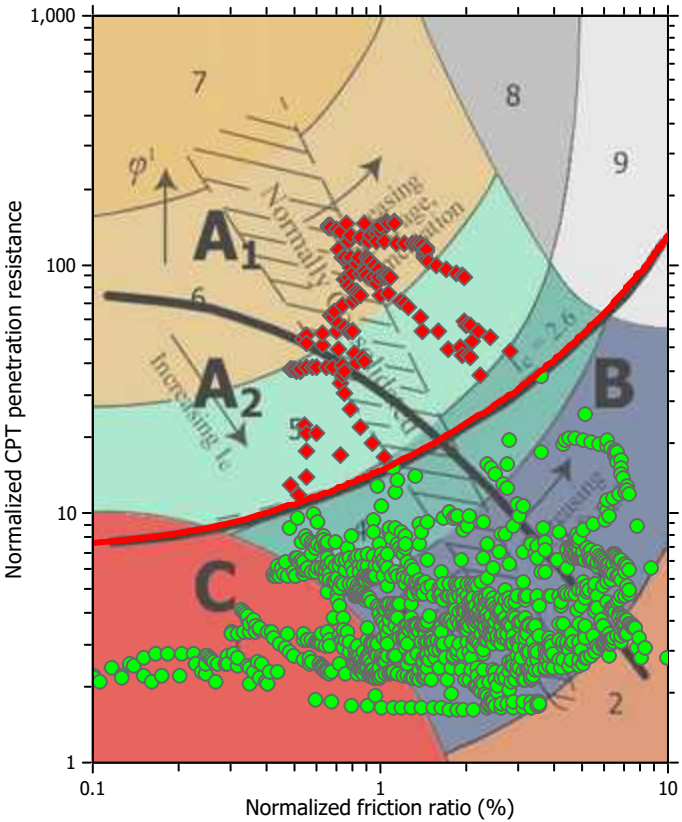
F.S. color scheme

- 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

LPI color scheme

- Very high risk
- High risk
- Low risk

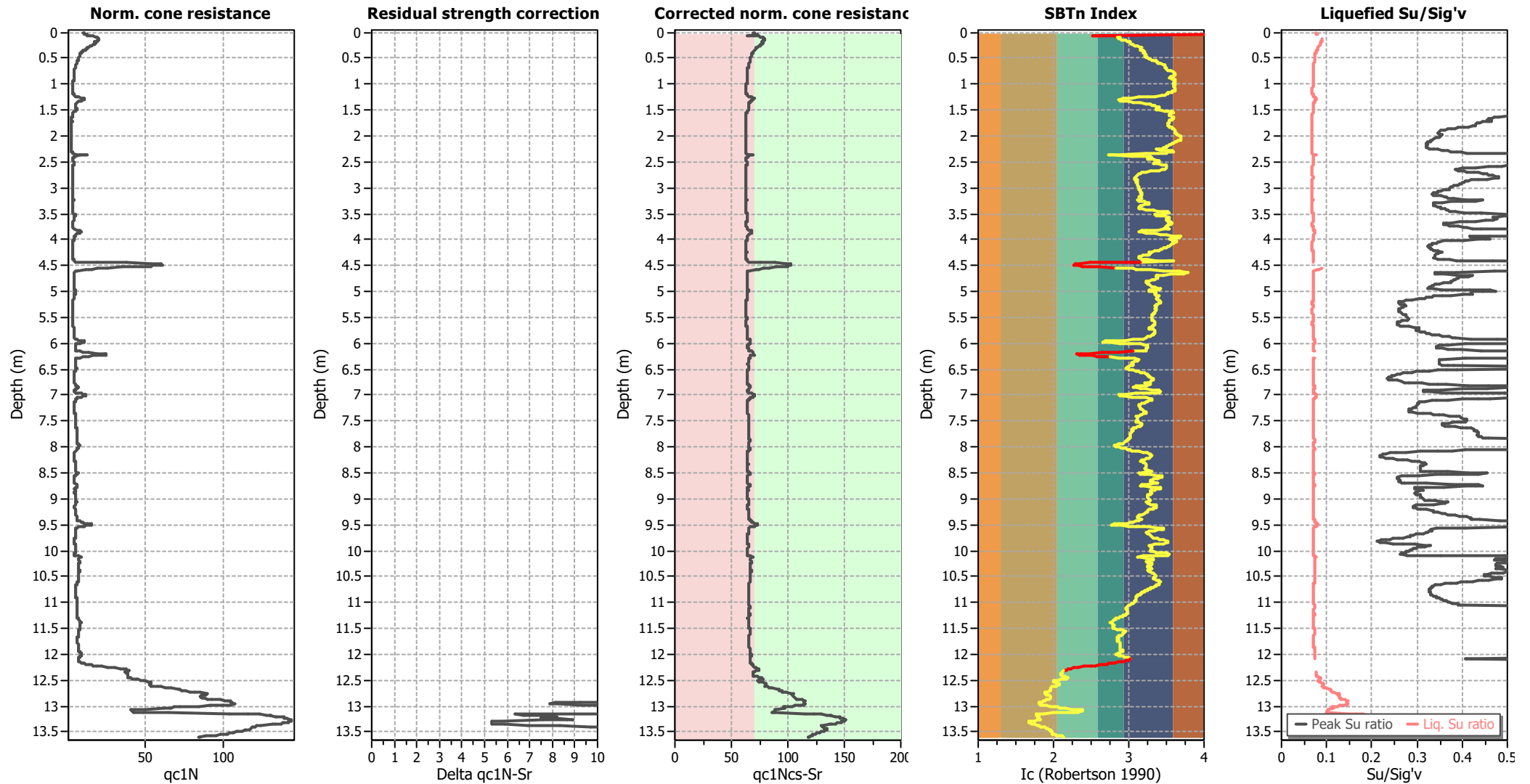
Liquefaction analysis summary plots



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: | Yes         |
| Points to test:                | Based on $I_c$ value | $I_c$ cut-off value:      | 2.60         | $K_o$ applied:              | Yes         |
| Earthquake magnitude $M_w$ :   | 6.50                 | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sand & Clay |
| Peak ground acceleration:      | 0.05                 | Use fill:                 | No           | Limit depth applied:        | Yes         |
| Depth to water table (insitu): | 1.00 m               | Fill height:              | N/A          | Limit depth:                | 10.00 m     |

## Check for strength loss plots (Idriss & Boulanger (2008))



### 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: | Yes         |
| Points to test:                | Based on Ic value | Ic cut-off value:         | 2.60         | $K_\sigma$ applied:         | Yes         |
| Earthquake magnitude $M_w$ :   | 6.50              | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sand & Clay |
| Peak ground acceleration:      | 0.05              | Use fill:                 | No           | Limit depth applied:        | Yes         |
| Depth to water table (insitu): | 1.00 m            | Fill height:              | N/A          | Limit depth:                | 10.00 m     |

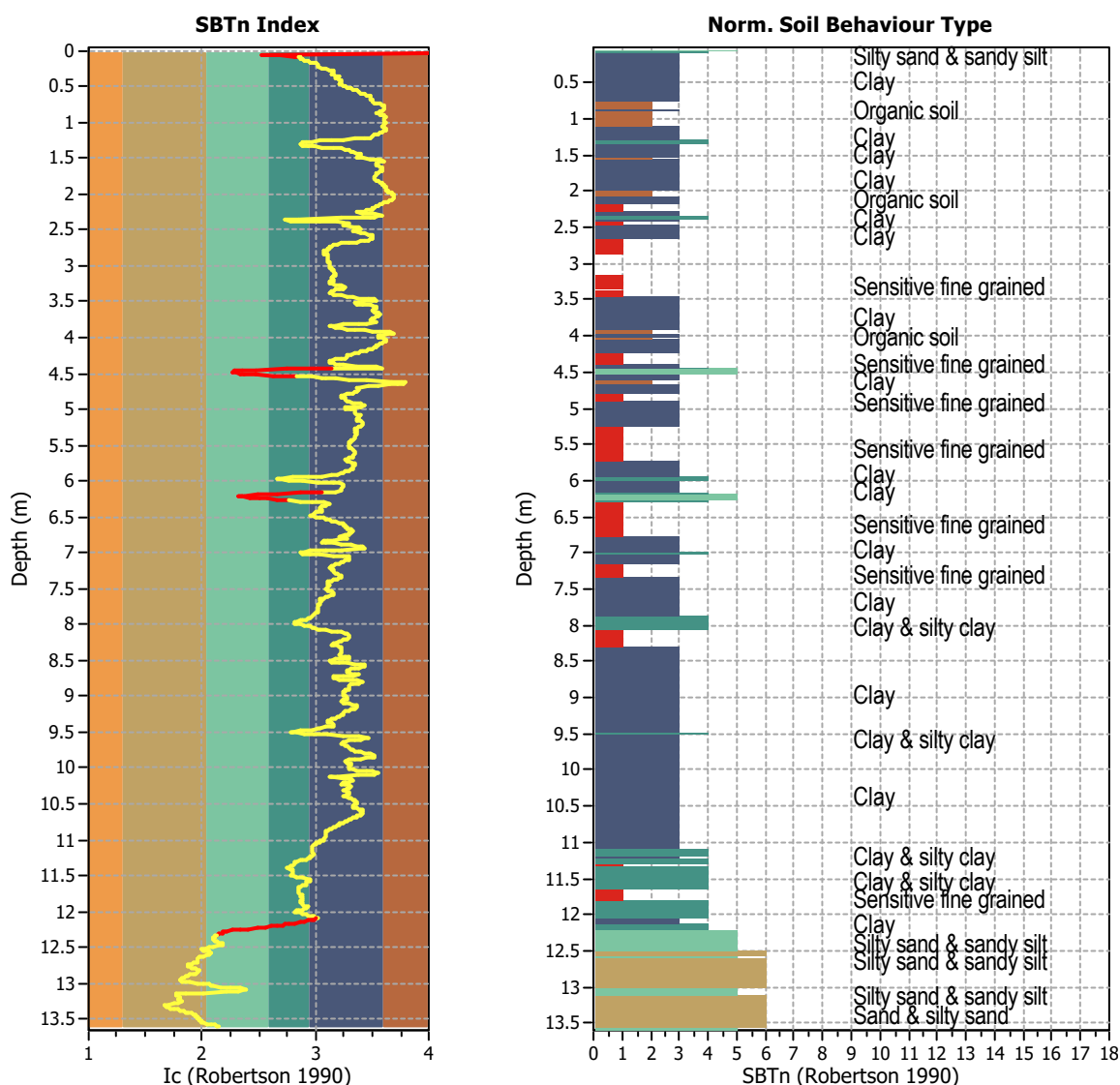
## TRANSITION LAYER DETECTION ALGORITHM REPORT

### Summary Details & Plots

#### Short description

The software will delete data when the cone is in transition from either clay to sand or vice-versa. To do this the software requires a range of  $I_c$  values over which the transition will be defined (typically somewhere between  $1.80 < I_c < 3.0$ ) and a rate of change of  $I_c$ . Transitions typically occur when the rate of change of  $I_c$  is fast (i.e.  $\Delta I_c$  is small).

The  $SBT_n$  plot below, displays in red the detected transition layers based on the parameters listed below the graphs.

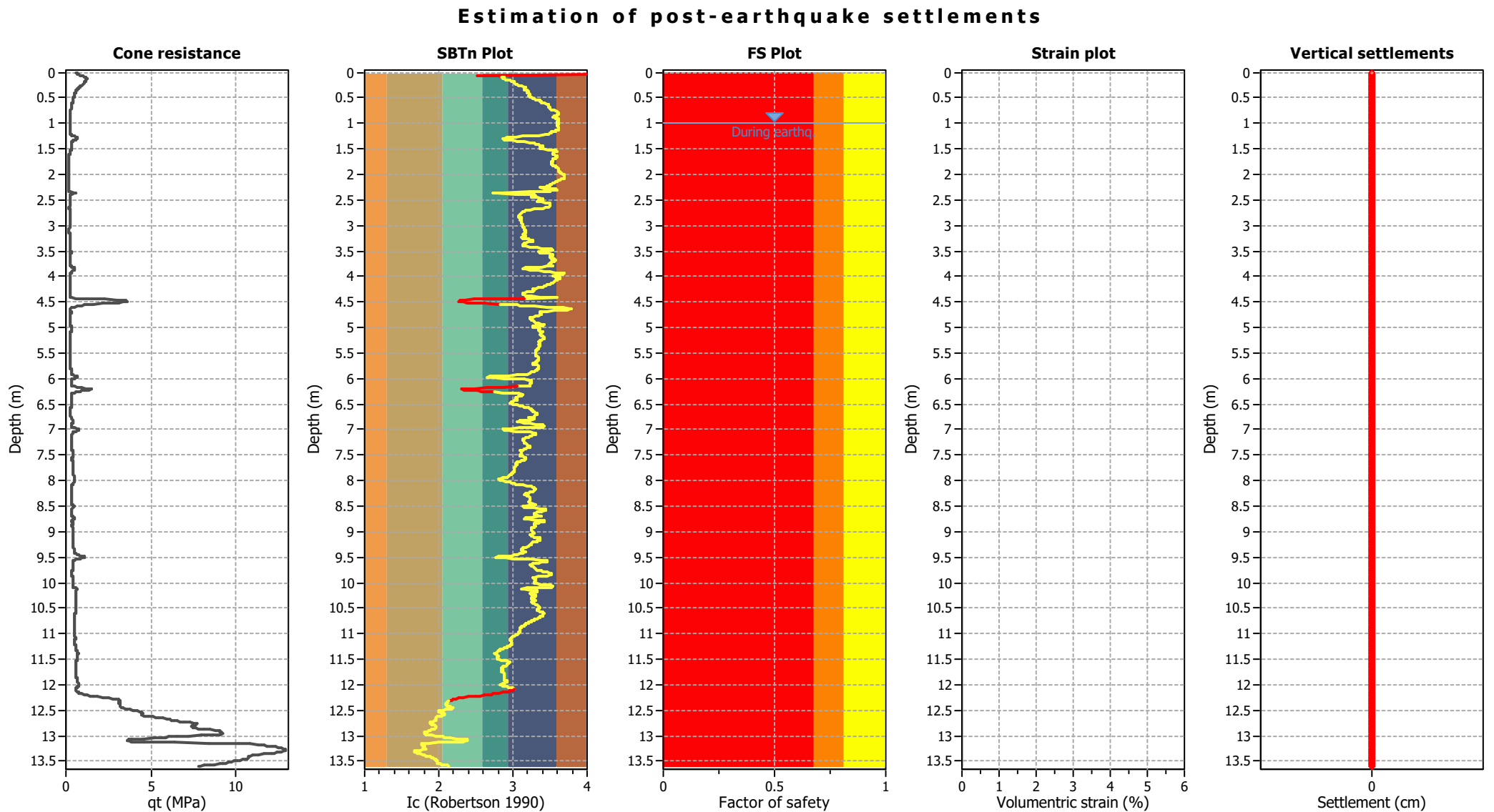


#### Transition layer algorithm properties

$I_c$  minimum check value: 1.70  
 $I_c$  maximum check value: 3.00  
 $I_c$  change ratio value: 0.0100  
 Minimum number of points in layer: 4

#### General statistics

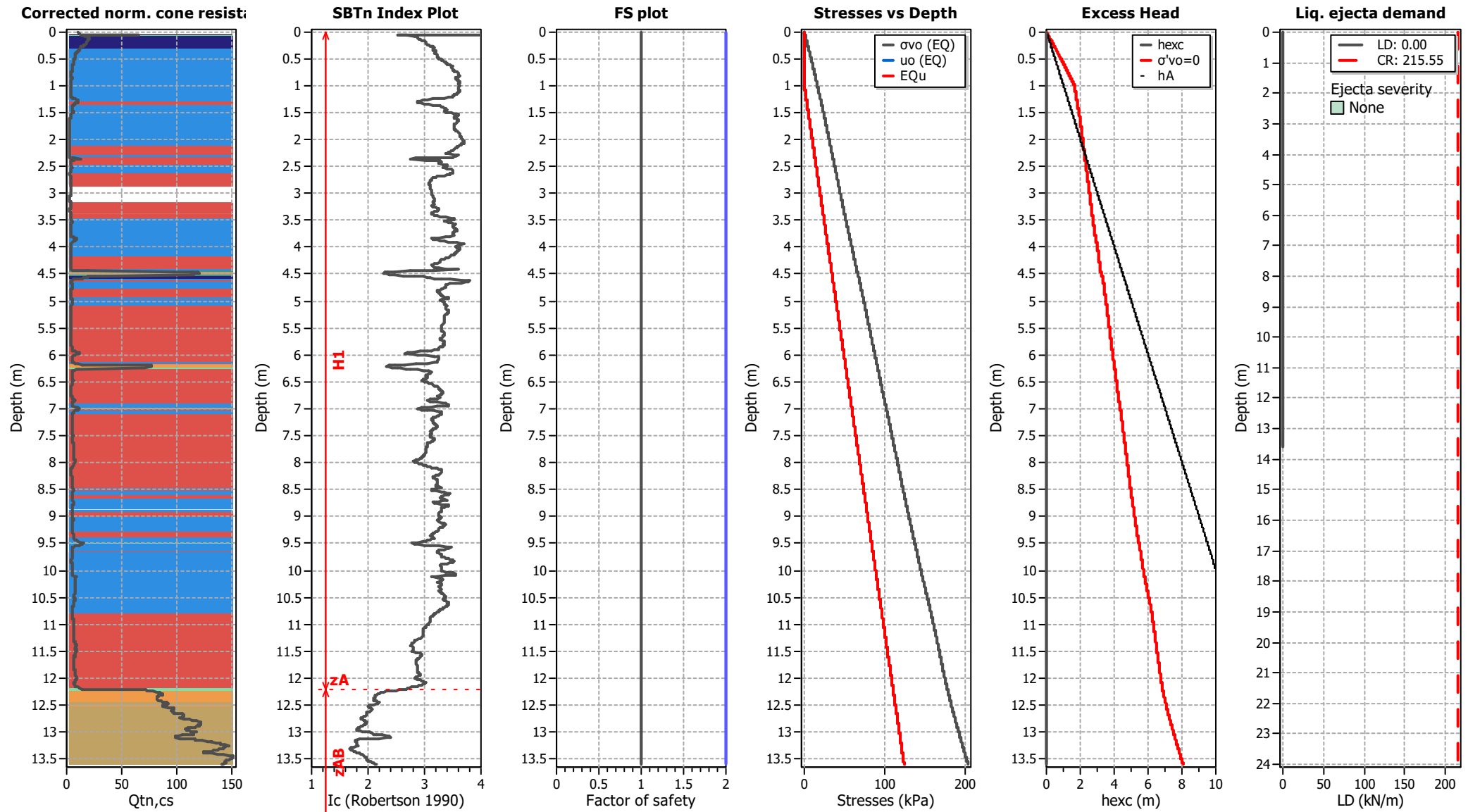
Total points in CPT file: 1360  
 Total points excluded: 54  
 Exclusion percentage: 3.97%  
 Number of layers detected: 6



Abbreviations

- q<sub>c</sub>: Total cone resistance (cone resistance q<sub>c</sub> corrected for pore water effects)
- I<sub>c</sub>: Soil Behaviour Type Index
- FS: Calculated Factor of Safety against liquefaction
- Volumetric strain: Post-liquefaction volumetric strain

## Ejecta Severity Estimation



## LIQUEFACTION ANALYSIS REPORT

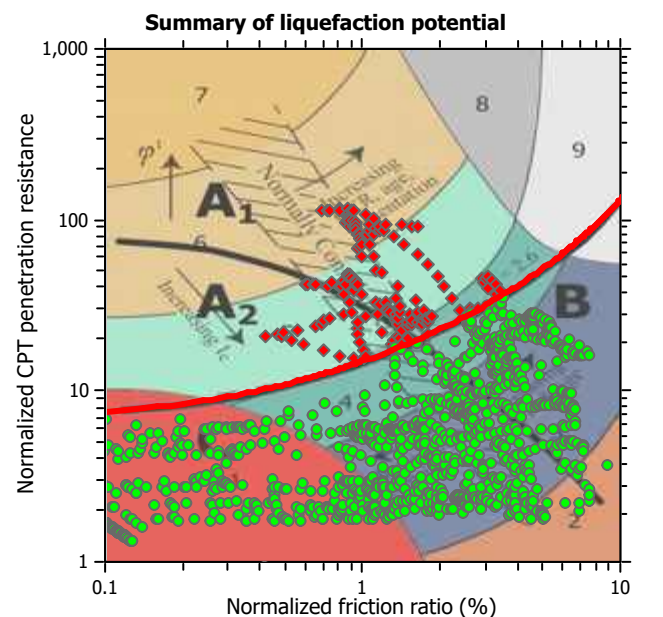
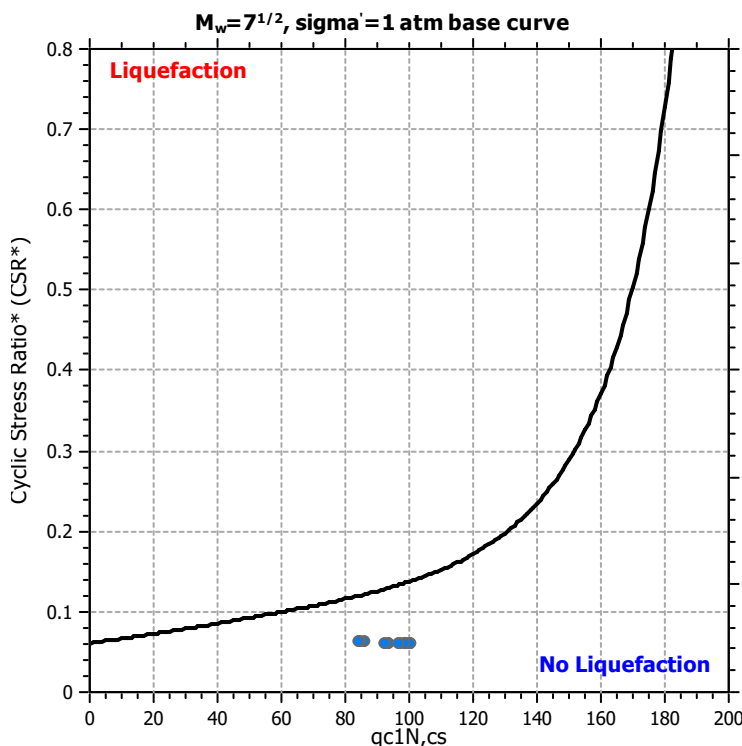
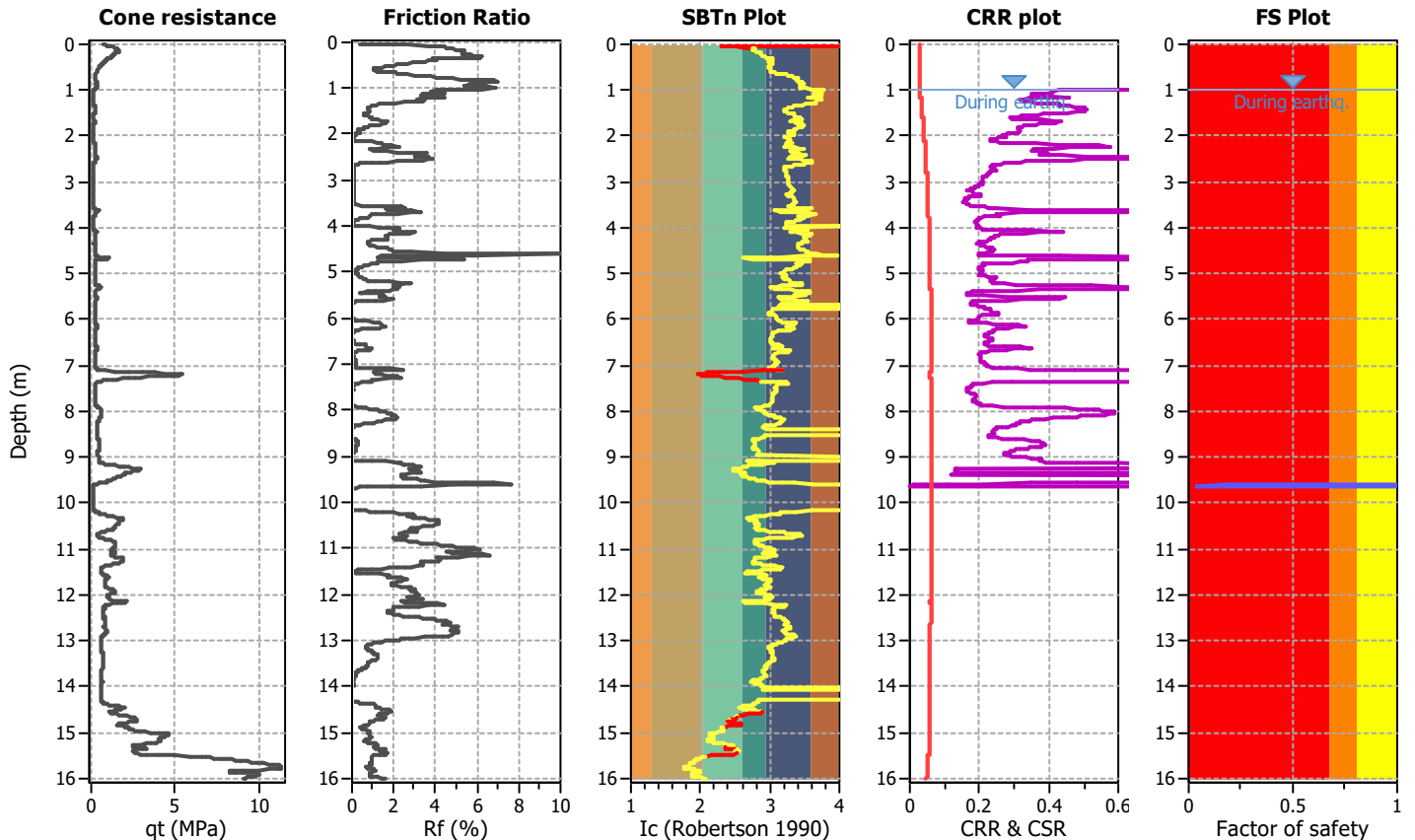
**Project title :**

**Location :**

**CPT file : CPT414**

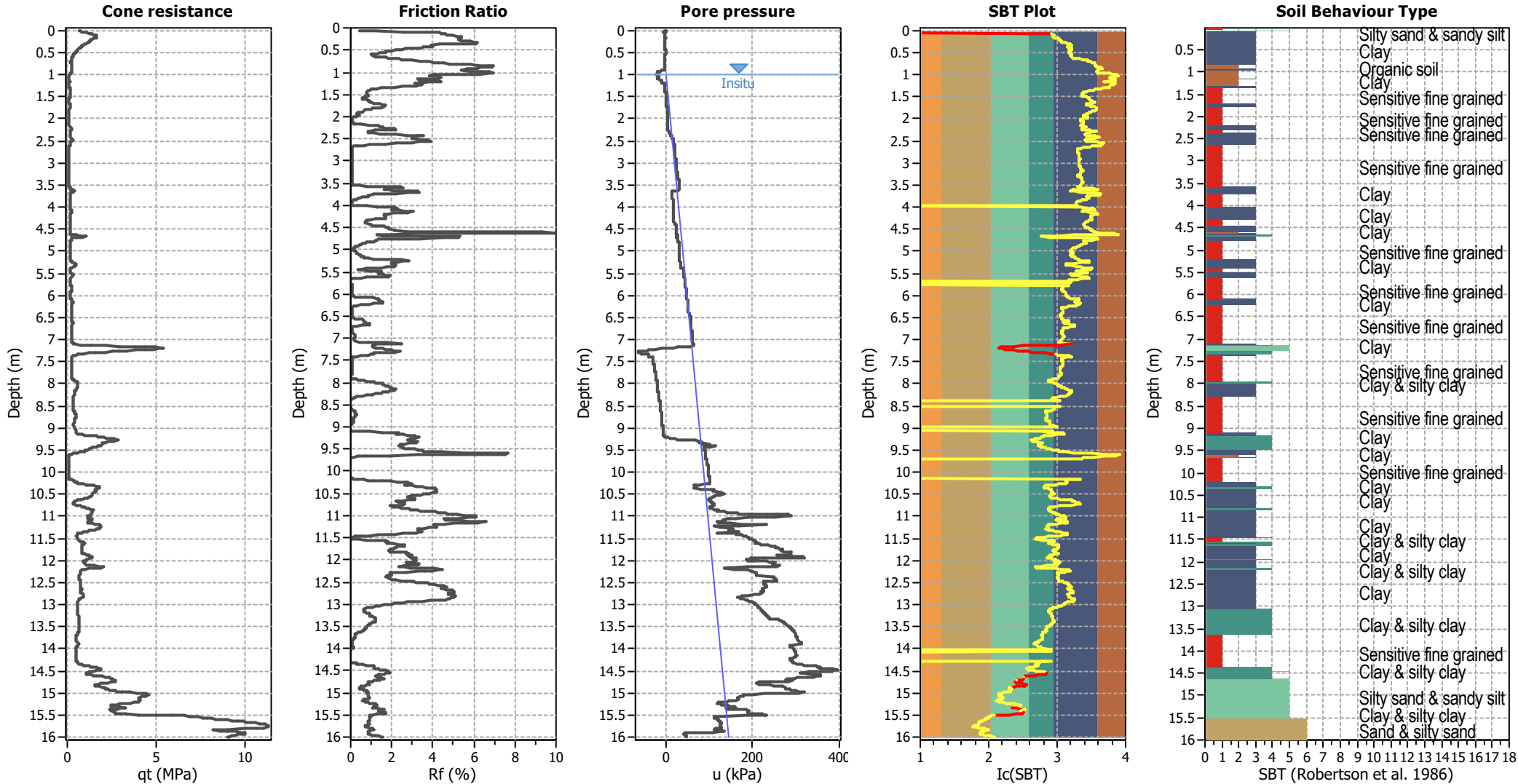
### Input parameters and analysis data

|                              |                   |                           |              |                         |     |                      |              |
|------------------------------|-------------------|---------------------------|--------------|-------------------------|-----|----------------------|--------------|
| Analysis method:             | B&I (2014)        | G.W.T. (in-situ):         | 1.00 m       | Use fill:               | No  | Clay like behavior   |              |
| Fines correction method:     | B&I (2014)        | G.W.T. (earthq.):         | 1.00 m       | Fill height:            | N/A | applied:             | Sand & Clay  |
| Points to test:              | Based on Ic value | Average results interval: | 3            | Fill weight:            | N/A | Limit depth applied: | Yes          |
| Earthquake magnitude $M_w$ : | 6.50              | Ic cut-off value:         | 2.60         | Trans. detect. applied: | Yes | Limit depth:         | 10.00 m      |
| Peak ground acceleration:    | 0.05              | Unit weight calculation:  | Based on SBT | $K_\sigma$ applied:     | Yes | MSF method:          | Method based |



Zone A<sub>1</sub>: Cyclic liquefaction likely depending on size and duration of cyclic loading  
 Zone A<sub>2</sub>: Cyclic liquefaction and strength loss likely depending on loading and ground geometry  
 Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening  
 Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots

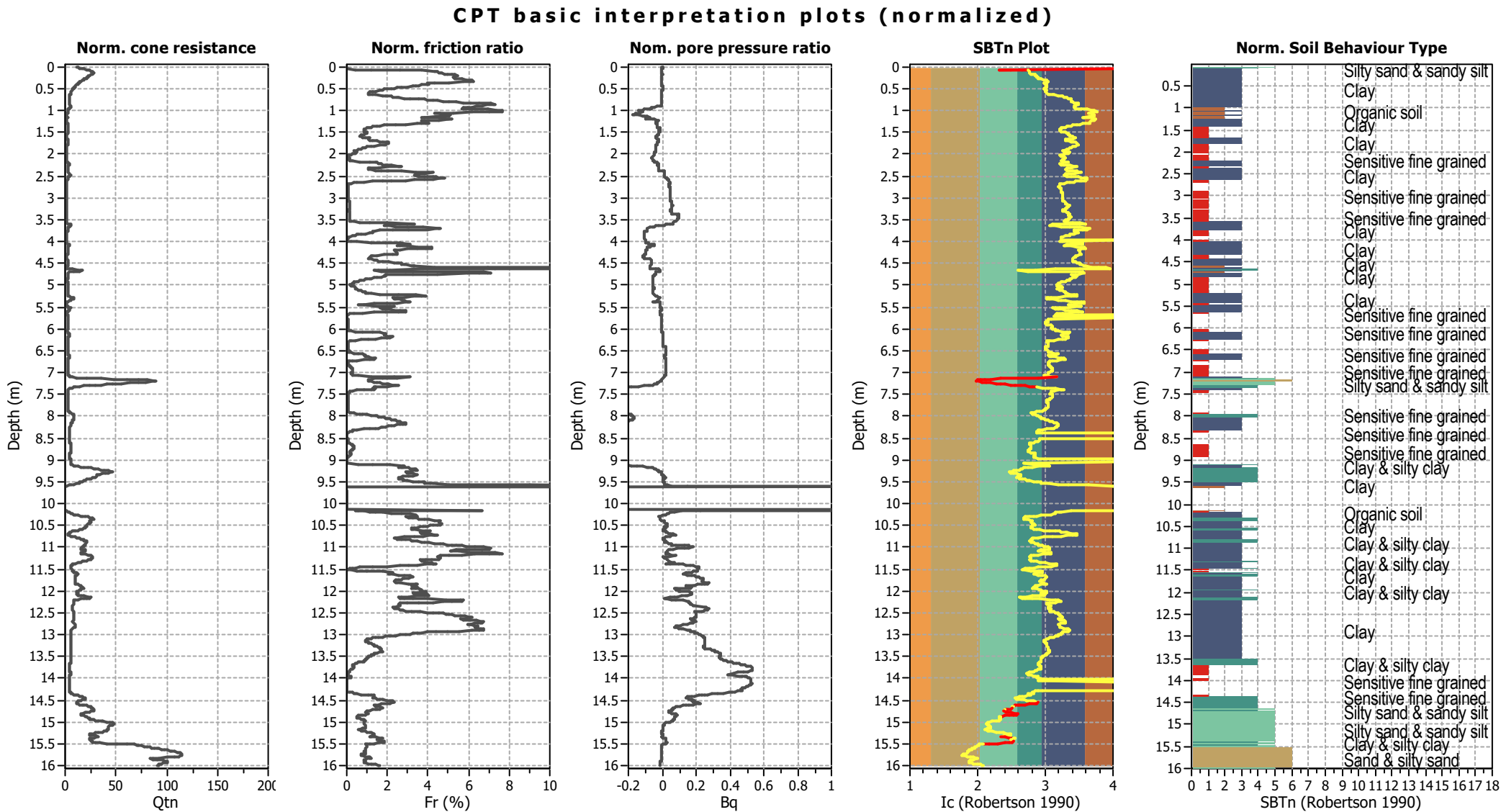


Input parameters and analysis data

|                                       |                   |                           |              |                             |             |
|---------------------------------------|-------------------|---------------------------|--------------|-----------------------------|-------------|
| 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: | Yes         |
| 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> : | 6.50              | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sand & Clay |
| Peak ground acceleration:             | 0.05              | 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 |



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: | Yes         |
| Points to test:                       | Based on Ic value | Ic cut-off value:         | 2.60         | K <sub>o</sub> applied:     | Yes         |
| Earthquake magnitude M <sub>w</sub> : | 6.50              | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sand & Clay |
| Peak ground acceleration:             | 0.05              | Use fill:                 | No           | Limit depth applied:        | Yes         |
| Depth to water table (insitu):        | 1.00 m            | Fill height:              | N/A          | Limit depth:                | 10.00 m     |

SBTn legend

1. Sensitive fine grained

2. Organic material

3. Clay to silty clay

4. Clayey silt to silty

5. Silty sand to sandy silt

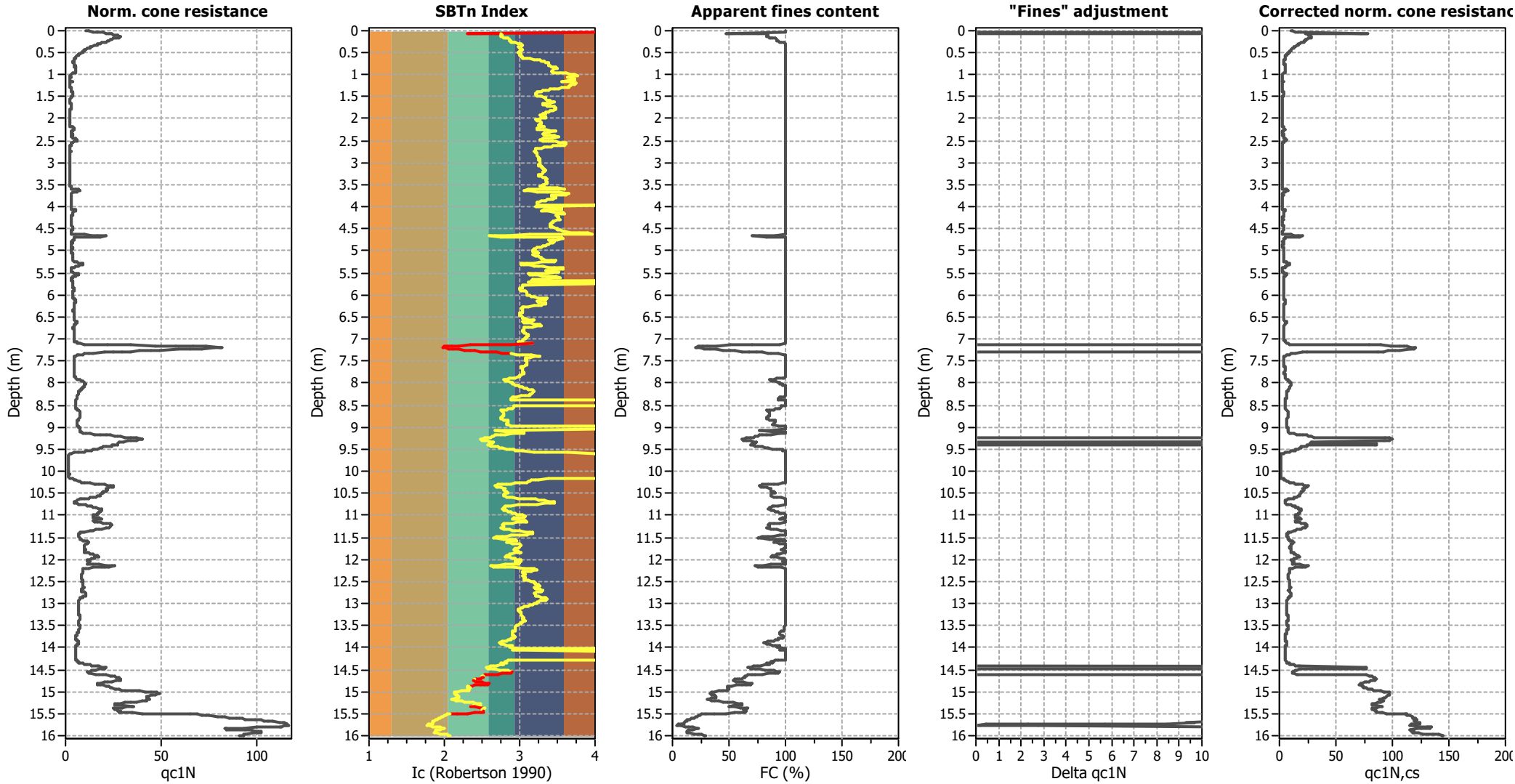
6. Clean sand to silty sand

7. Gravely sand to sand

8. Very stiff sand to

9. Very stiff fine grained

Liquefaction analysis overall plots (intermediate results)

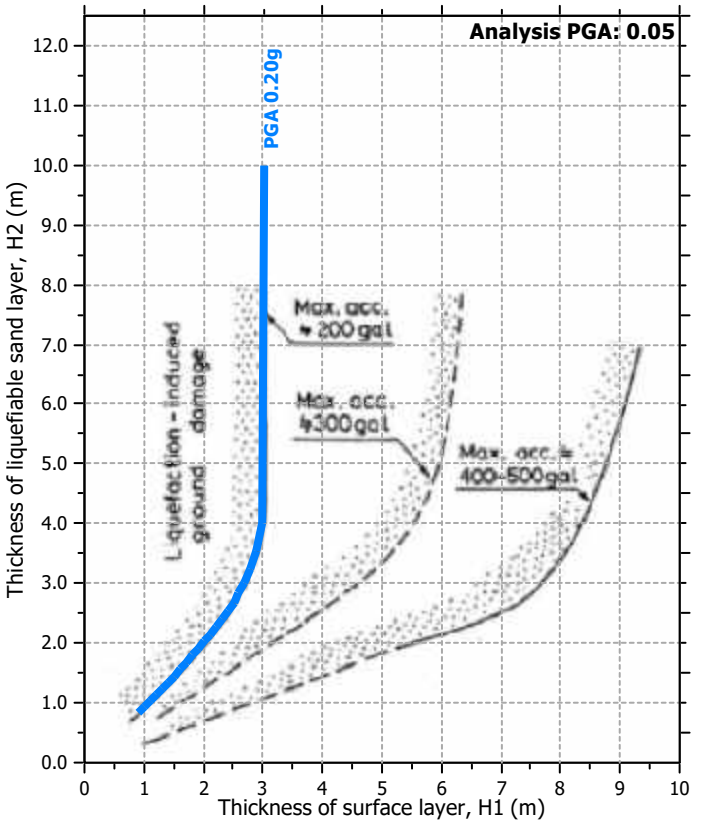
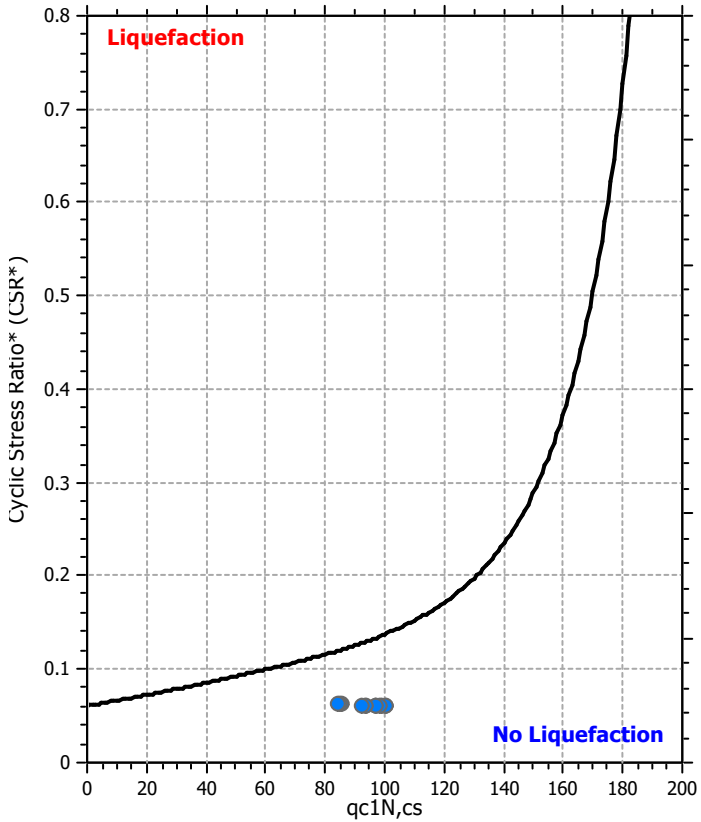
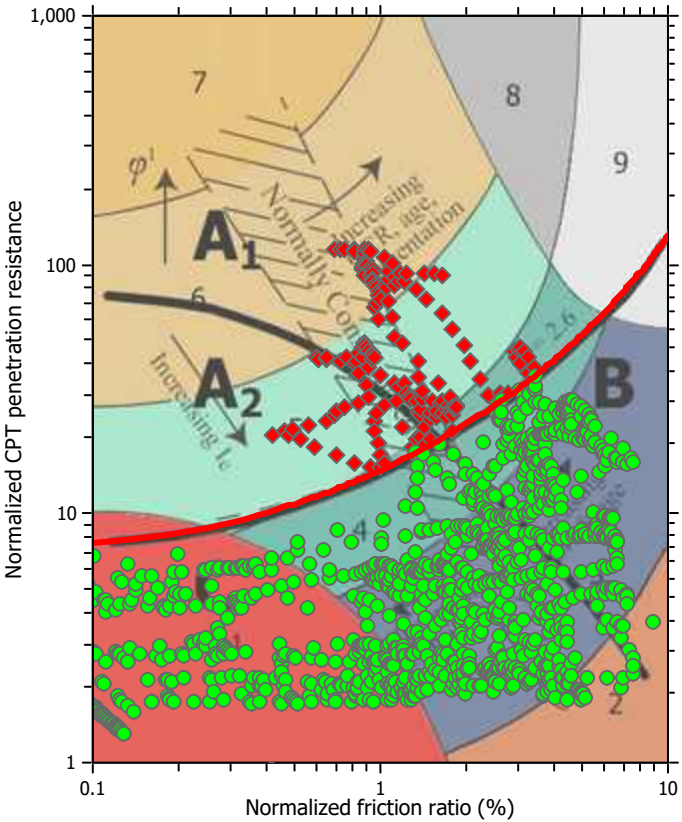


Input parameters and analysis data

|                                       |                   |                           |              |                             |             |
|---------------------------------------|-------------------|---------------------------|--------------|-----------------------------|-------------|
| 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: | Yes         |
| Points to test:                       | Based on Ic value | Ic cut-off value:         | 2.60         | K <sub>o</sub> applied:     | Yes         |
| Earthquake magnitude M <sub>w</sub> : | 6.50              | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sand & Clay |
| Peak ground acceleration:             | 0.05              | Use fill:                 | No           | Limit depth applied:        | Yes         |
| Depth to water table (insitu):        | 1.00 m            | Fill height:              | N/A          | Limit depth:                | 10.00 m     |



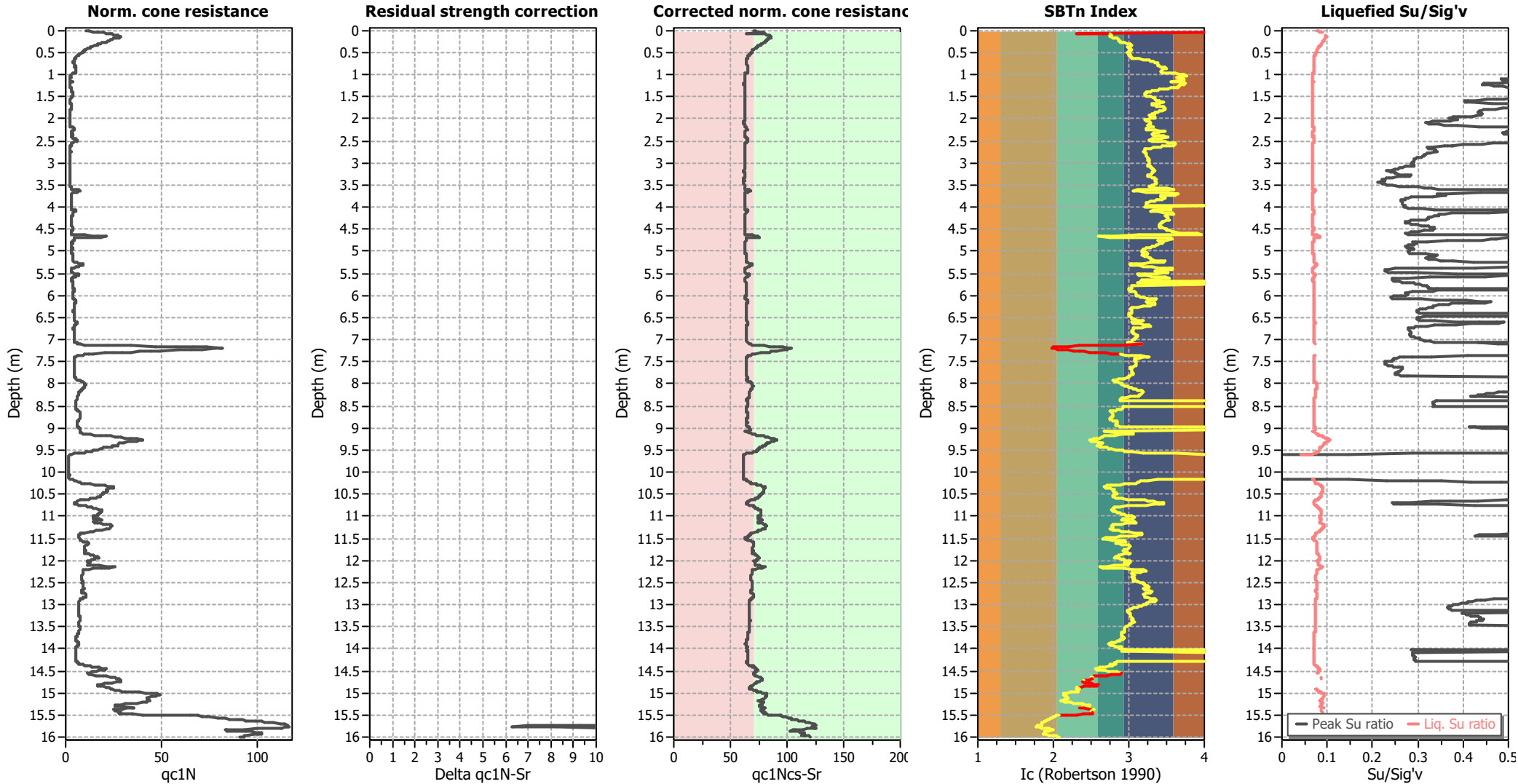
Liquefaction analysis summary plots



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: | Yes         |
| Points to test:                | Based on $I_c$ value | $I_c$ cut-off value:      | 2.60         | $K_0$ applied:              | Yes         |
| Earthquake magnitude $M_w$ :   | 6.50                 | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sand & Clay |
| Peak ground acceleration:      | 0.05                 | Use fill:                 | No           | Limit depth applied:        | Yes         |
| Depth to water table (insitu): | 1.00 m               | Fill height:              | N/A          | Limit depth:                | 10.00 m     |

Check for strength loss plots (Idriss & Boulanger (2008))



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: | Yes         |
| Points to test:                       | Based on Ic value | Ic cut-off value:         | 2.60         | K <sub>o</sub> applied:     | Yes         |
| Earthquake magnitude M <sub>w</sub> : | 6.50              | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sand & Clay |
| Peak ground acceleration:             | 0.05              | Use fill:                 | No           | Limit depth applied:        | Yes         |
| Depth to water table (insitu):        | 1.00 m            | Fill height:              | N/A          | Limit depth:                | 10.00 m     |

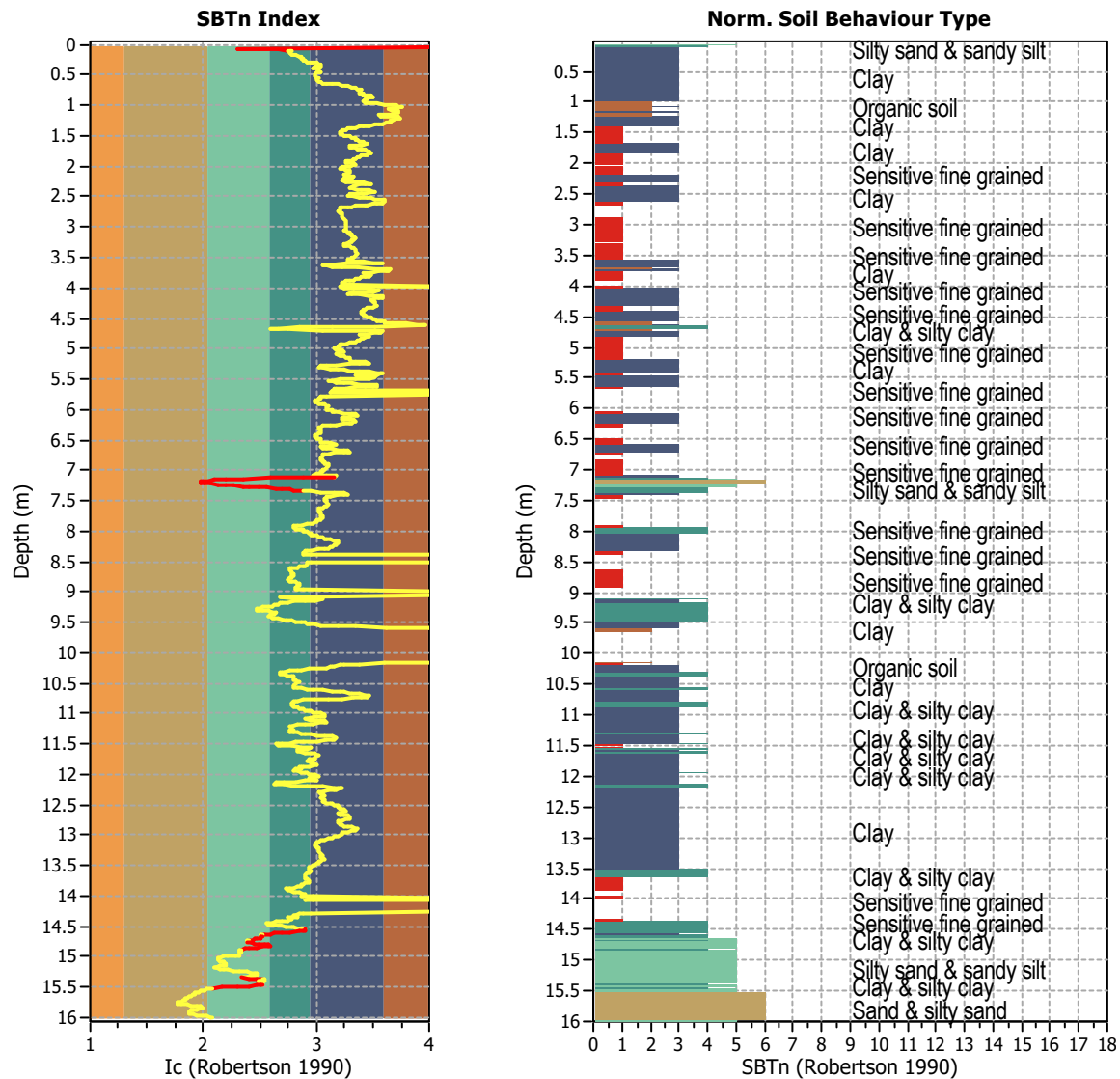
TRANSITION LAYER DETECTION ALGORITHM REPORT

Summary Details & Plots

Short description

The software will delete data when the cone is in transition from either clay to sand or vise-versa. To do this the software requires a range of  $I_c$  values over which the transition will be defined (typically somewhere between  $1.80 < I_c < 3.0$ ) and a rate of change of  $I_c$ . Transitions typically occur when the rate of change of  $I_c$  is fast (i.e.  $\Delta I_c$  is small).

The  $SBT_n$  plot below, displays in red the detected transition layers based on the parameters listed below the graphs.



Transition layer algorithm properties

$I_c$  minimum check value:1.70

$I_c$  maximum check value:3.00

$I_c$  change ratio value:0.0100

Minimum number of points in layer:4

General statistics

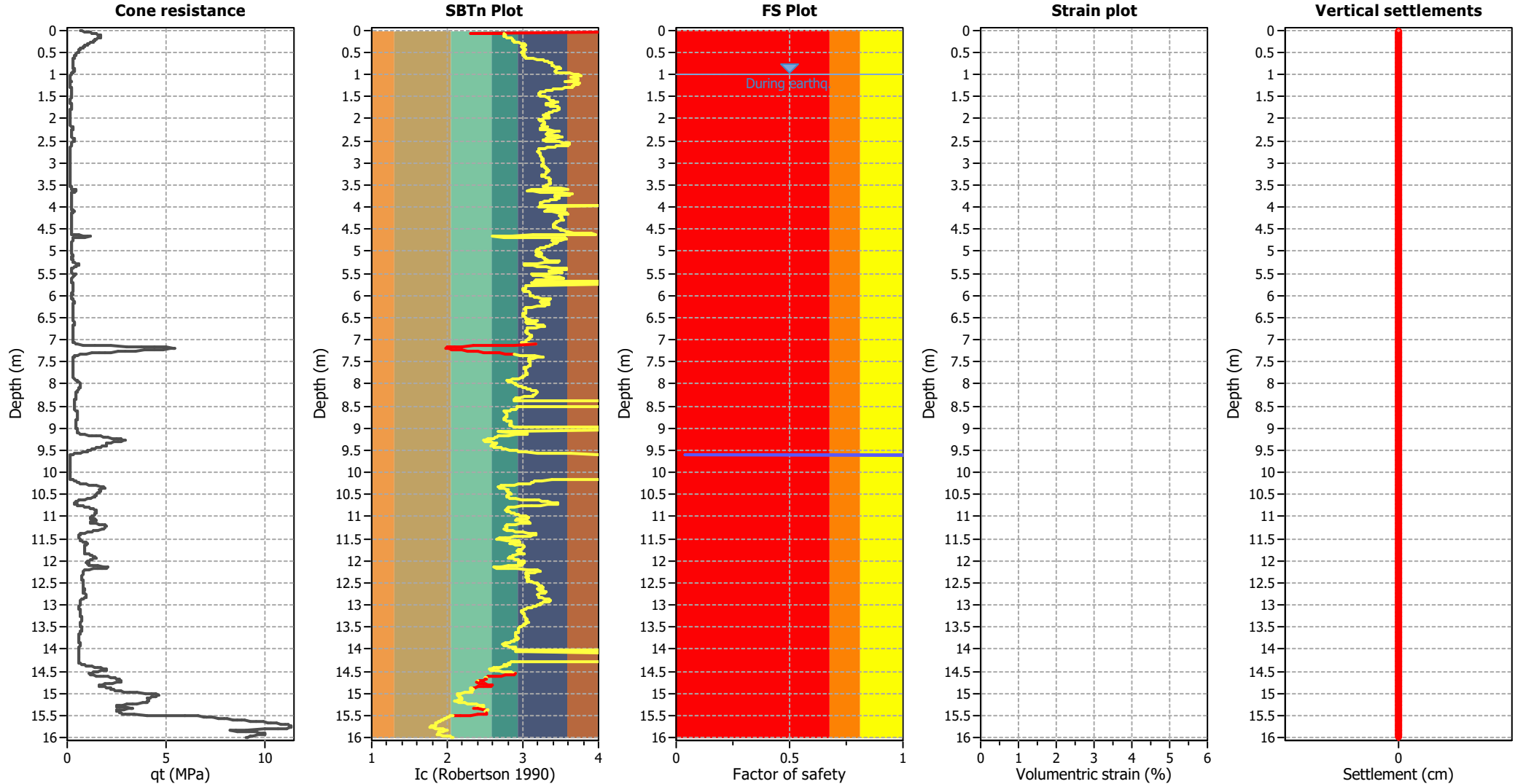
Total points in CPT file:1600

Total points excluded:72

Exclusion percentage:4.50%

Number of layers detected:9

Estimation of post-earthquake settlements



Abbreviations

- q<sub>c</sub>: Total cone resistance (cone resistance q<sub>c</sub> corrected for pore water effects)
- I<sub>c</sub>: Soil Behaviour Type Index
- FS: Calculated Factor of Safety against liquefaction
- Volumetric strain: Post-liquefaction volumetric strain

## Ejecta Severity Estimation

