

| | | | |
|---|---|---|----------------------|
|  | PROGETTISTA  | COMMESSA NQ/R20133 | UNITA' 000 |
| | LOCALITA' REGIONE SICILIA | REL-SIS-E-03024 ALLEGATO 4 | |
| | PROGETTO RIFACIMENTO DERIVAZIONE PER PORTO EMPEDOCLE DN 300 (12"), DP 24 bar ed opere connesse | | Rev. - |

Rif. SAIPEM: 023113-105-SPC-LA-E-83024_r2

Rifacimento derivazione per Porto Empedocle
DN 300 (12"), DP 24 bar
ed opere connesse

CARATTERIZZAZIONE DELLA SISMICITÀ

ALLEGATO 4

CARTA DELLE AREE POTENZIALMENTE LIQUEFACIBILI

LIQUEFACTION ANALYSIS REPORT

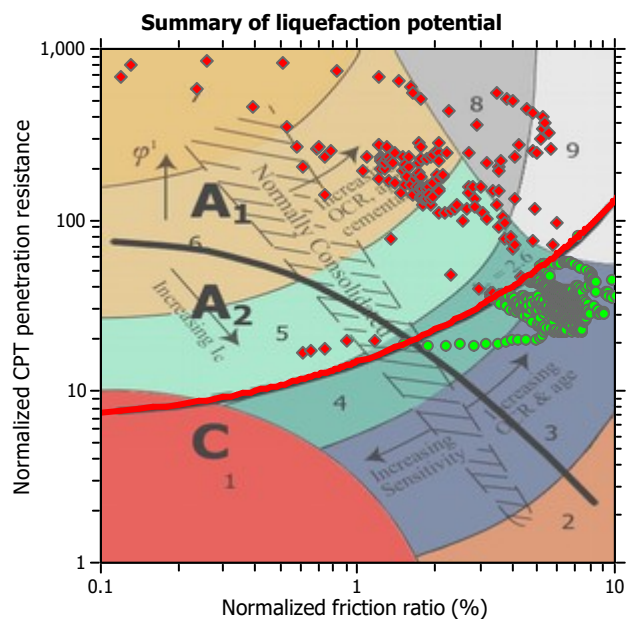
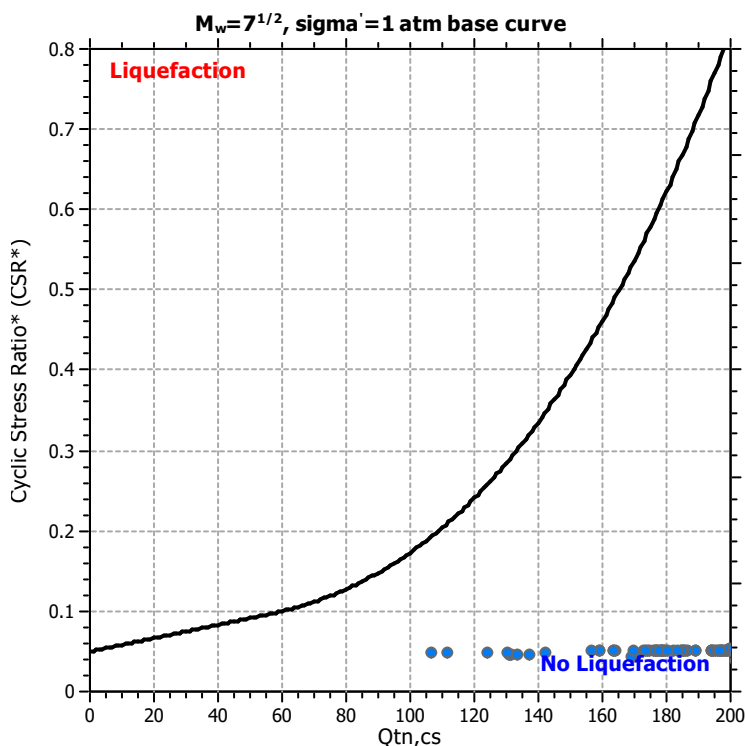
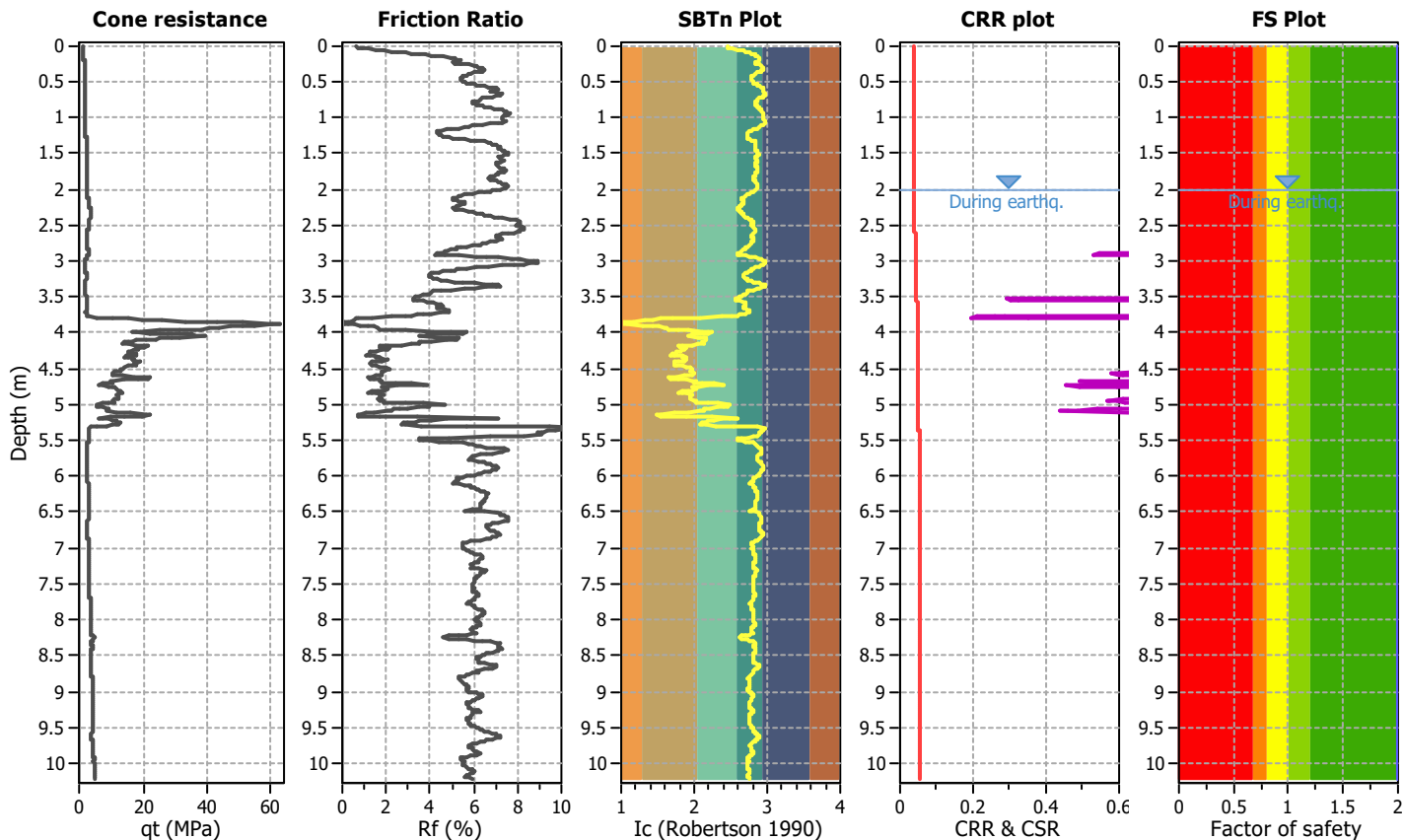
Project title : Met. Der. Porto Empedocle

Location :

CPT file : pe-b-c33

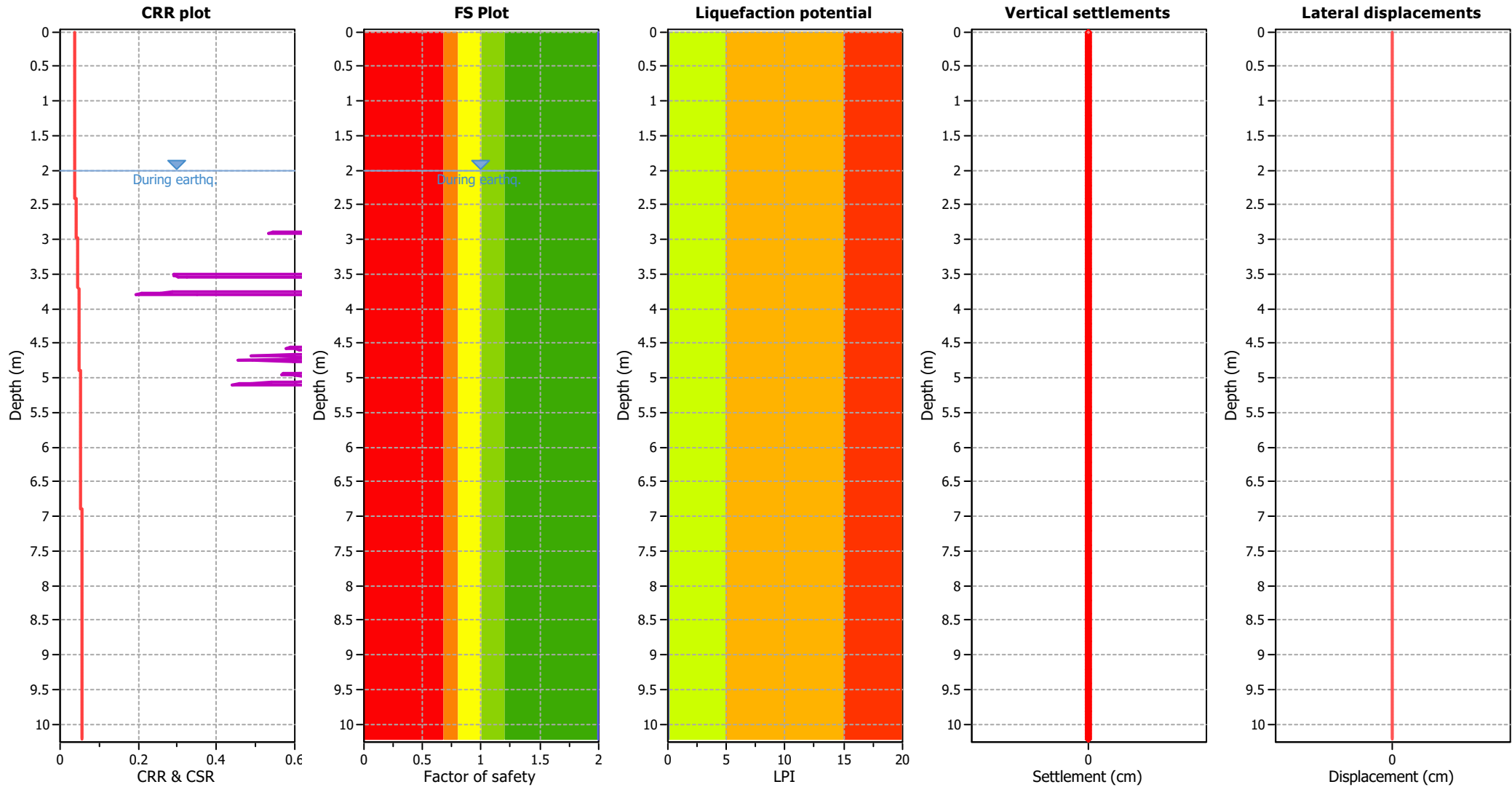
Input parameters and analysis data

| | | | | | | | |
|------------------------------|-------------------|---------------------------|--------------|-------------------------|-----|----------------------|--------------|
| Analysis method: | NCEER (1998) | G.W.T. (in-situ): | 2.00 m | Use fill: | No | Clay like behavior | |
| Fines correction method: | NCEER (1998) | G.W.T. (earthq.): | 2.00 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: | No |
| Earthquake magnitude M_w : | 5.75 | Ic cut-off value: | 2.60 | Trans. detect. applied: | No | Limit depth: | N/A |
| Peak ground acceleration: | 0.11 | Unit weight calculation: | Based on SBT | K_0 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

Liquefaction analysis overall plots



Input parameters and analysis data

| | | | | | |
|---------------------------------------|-------------------|---------------------------------|--------------|-----------------------------|------------|
| Analysis method: | NCEER (1998) | Depth to water table (earthq.): | 2.00 m | Fill weight: | N/A |
| Fines correction method: | NCEER (1998) | Average results interval: | 3 | Transition detect. applied: | No |
| Points to test: | Based on Ic value | Ic cut-off value: | 2.60 | K ₀ applied: | Yes |
| Earthquake magnitude M _w : | 5.75 | Unit weight calculation: | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration: | 0.11 | Use fill: | No | Limit depth applied: | No |
| Depth to water table (insitu): | 2.00 m | Fill height: | N/A | Limit depth: | N/A |

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 REPORT

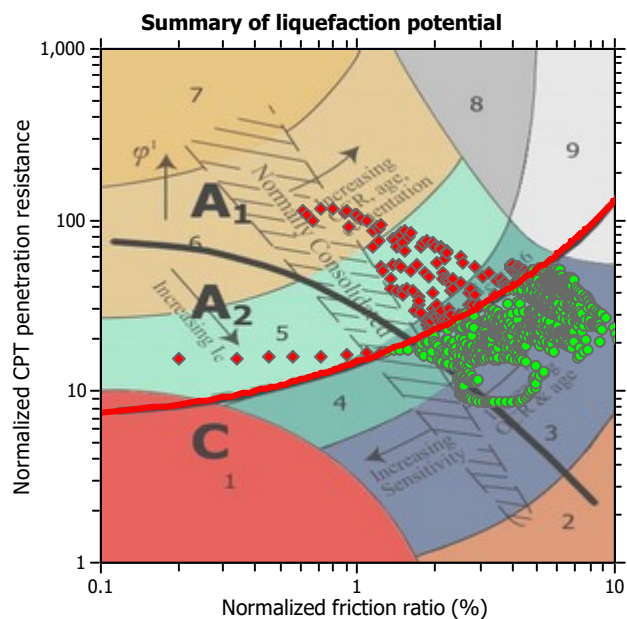
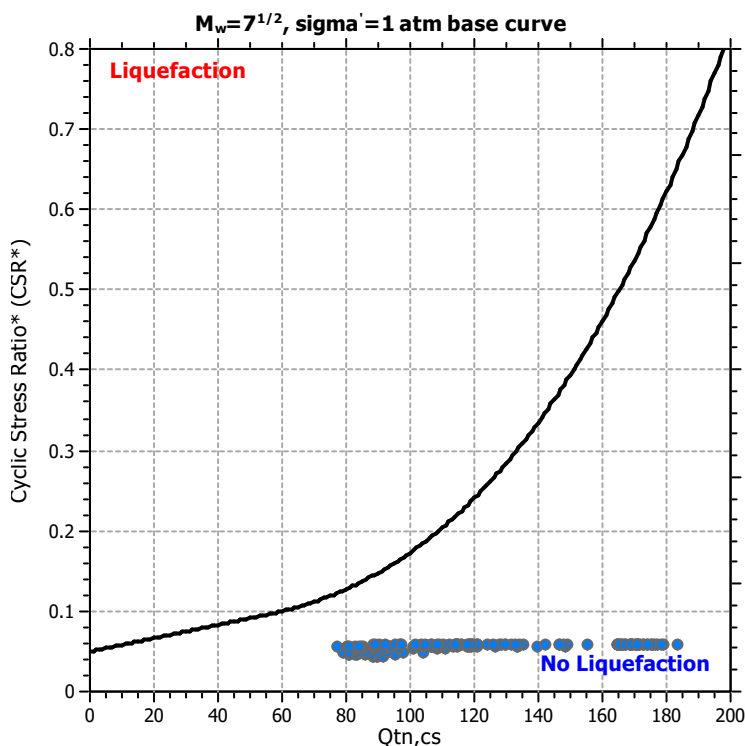
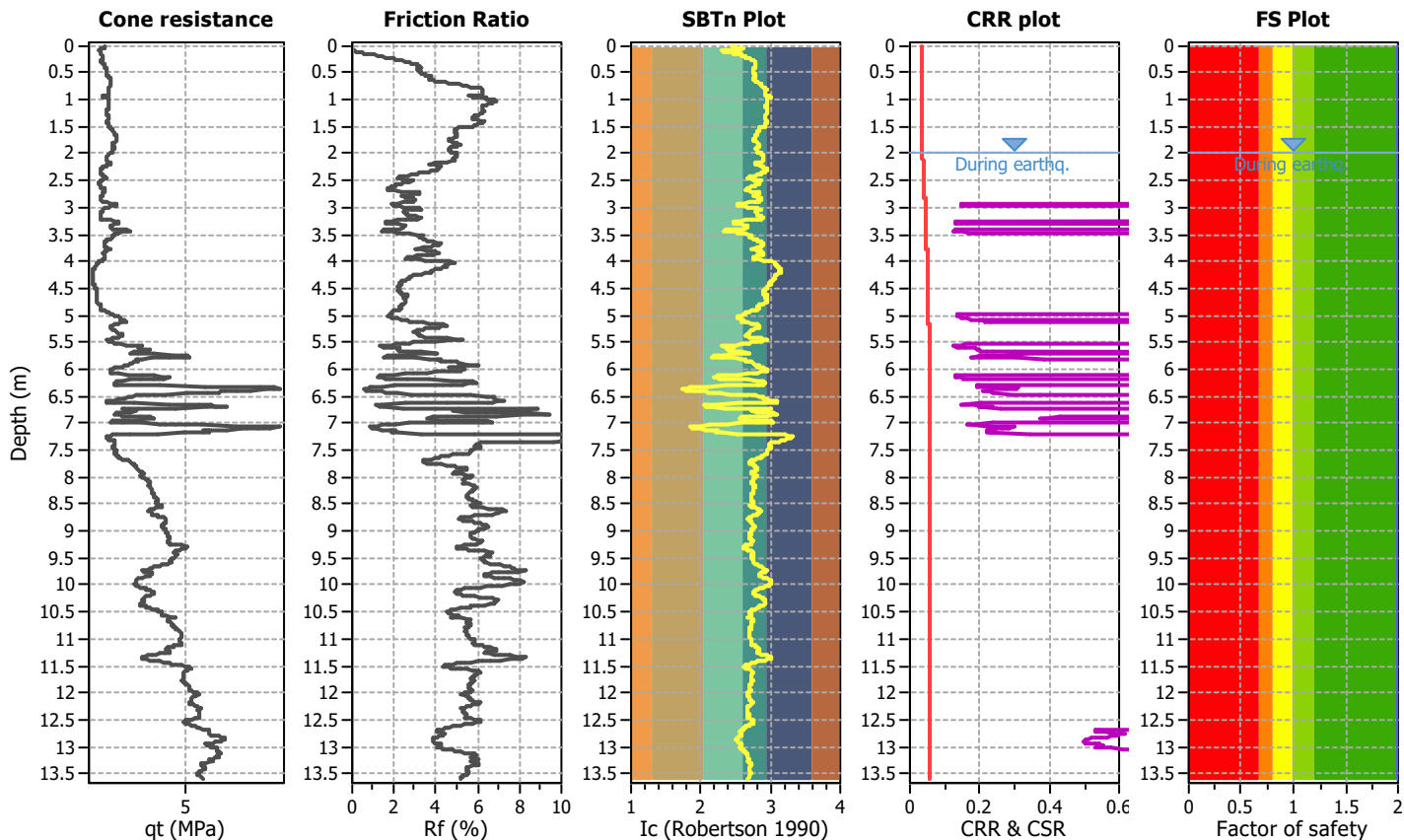
Project title : Met. Der. Porto Empedocle

Location :

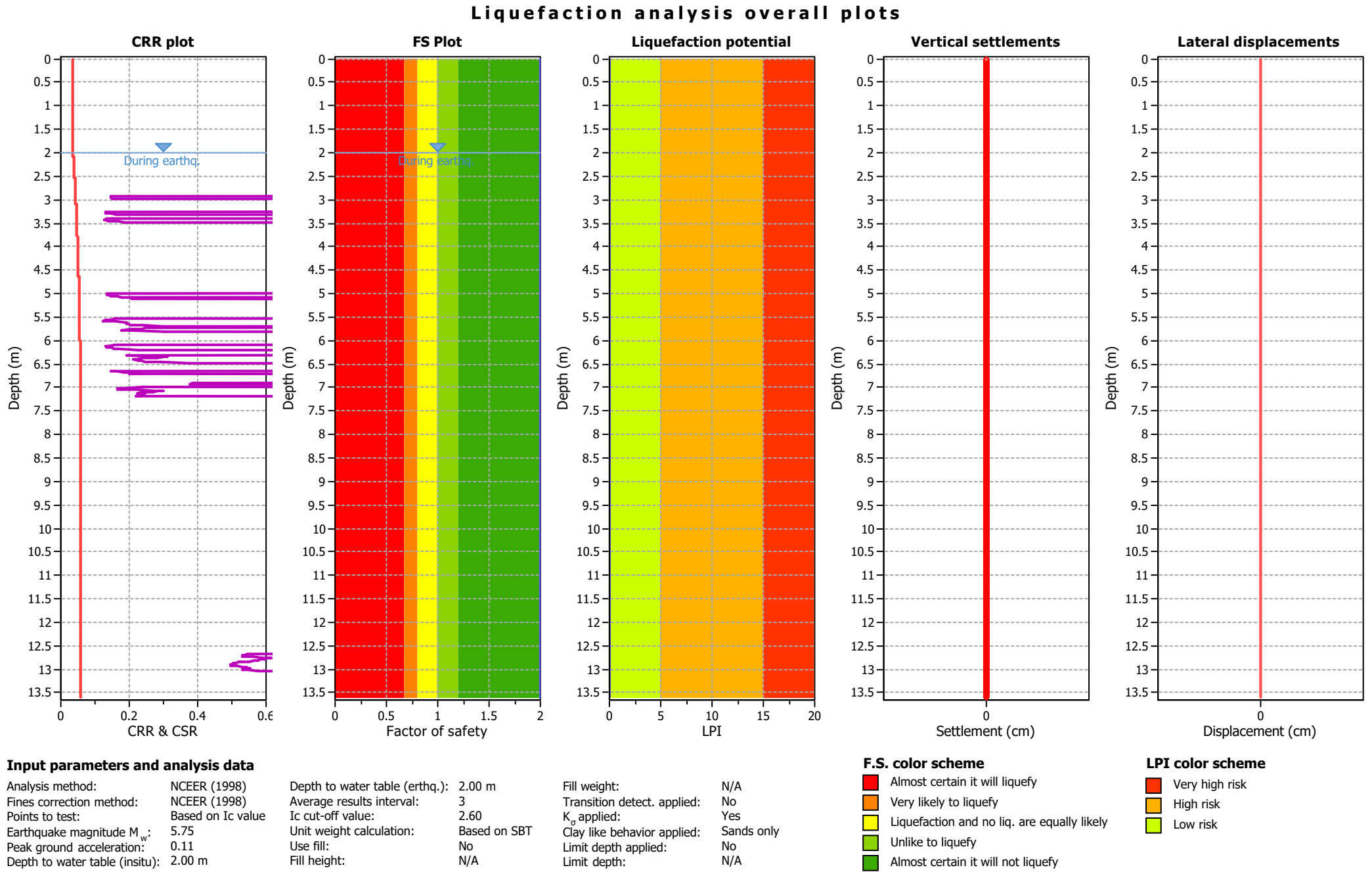
CPT file : pe-b-c39

Input parameters and analysis data

| | | | | | | | |
|------------------------------|-------------------|---------------------------|--------------|-------------------------|-----|----------------------|--------------|
| Analysis method: | NCEER (1998) | G.W.T. (in-situ): | 2.00 m | Use fill: | No | Clay like behavior | |
| Fines correction method: | NCEER (1998) | G.W.T. (earthq.): | 2.00 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: | No |
| Earthquake magnitude M_w : | 5.75 | Ic cut-off value: | 2.60 | Trans. detect. applied: | No | Limit depth: | N/A |
| Peak ground acceleration: | 0.11 | Unit weight calculation: | Based on SBT | K_0 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



LIQUEFACTION ANALYSIS REPORT

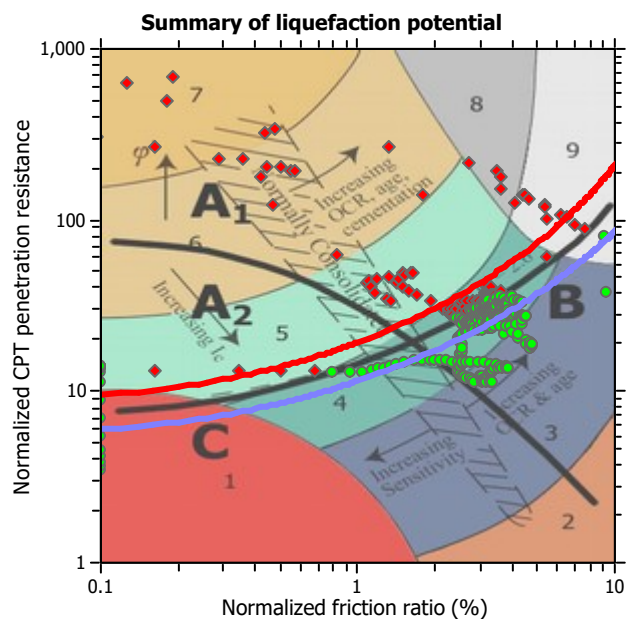
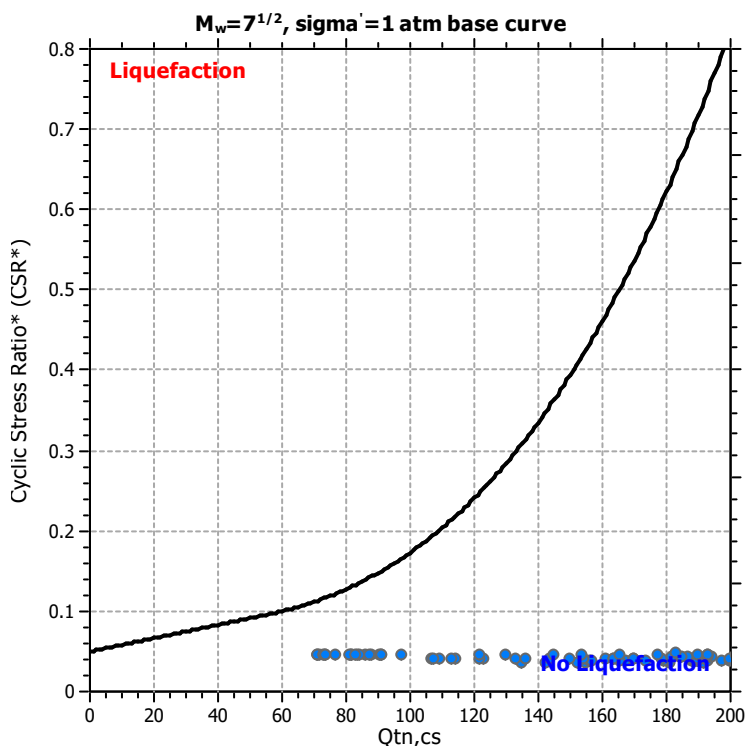
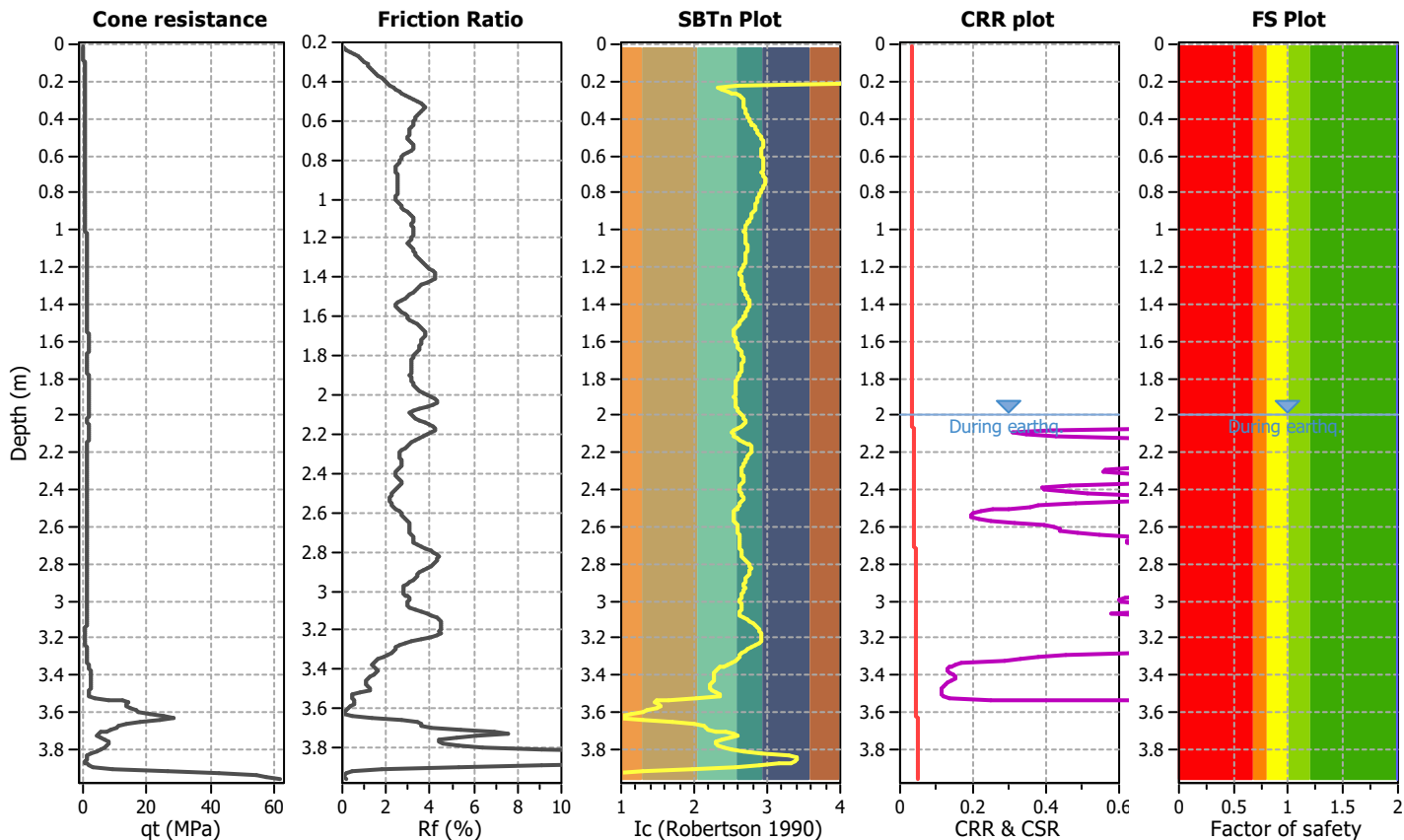
Project title : Met. Der. Porto Empedocle

Location :

CPT file : pe-b-c47

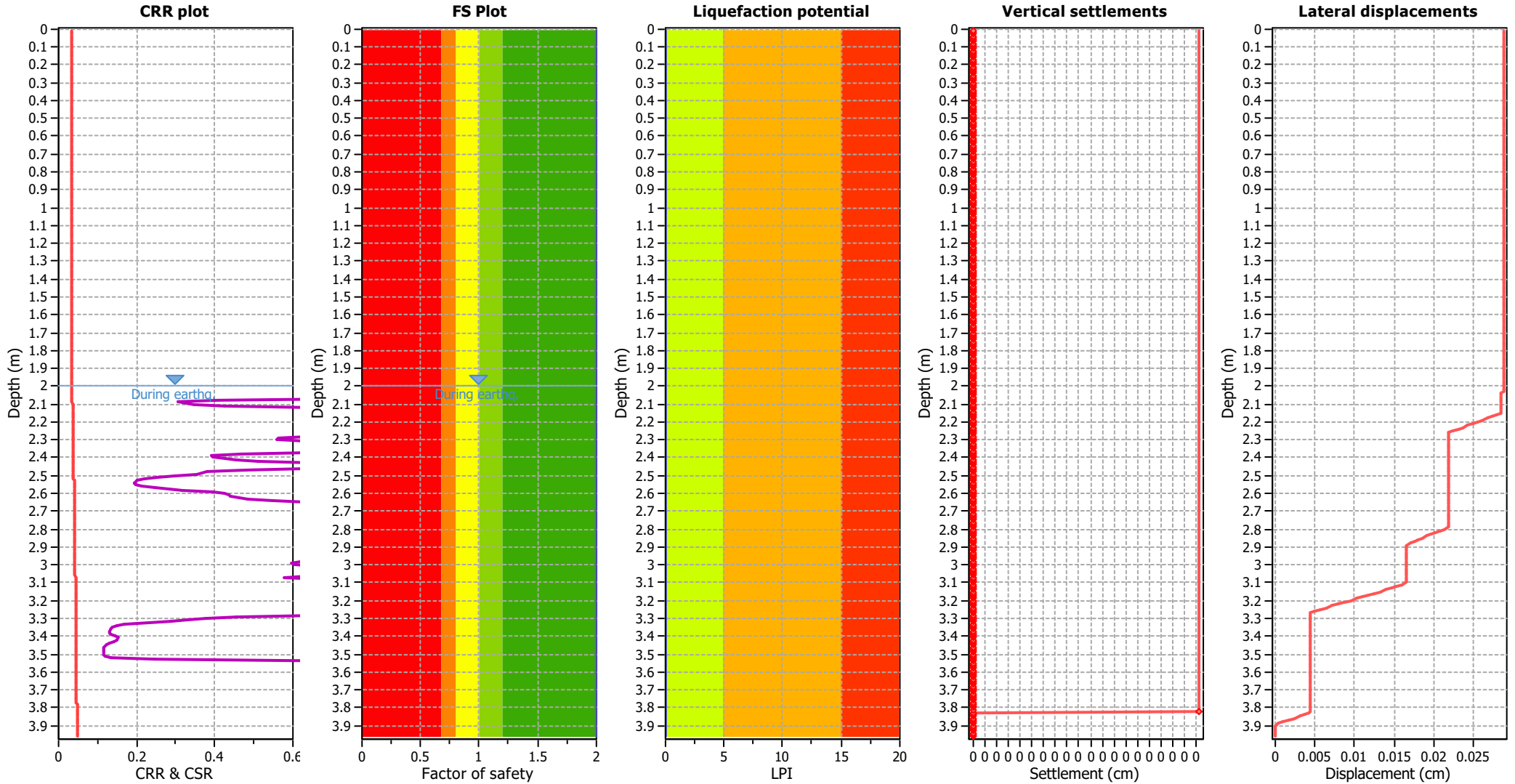
Input parameters and analysis data

| | | | | | | | |
|------------------------------|-------------------|---------------------------|--------------|-------------------------|-----|----------------------|--------------|
| Analysis method: | Robertson (2009) | G.W.T. (in-situ): | 2.00 m | Use fill: | No | Clay like behavior | |
| Fines correction method: | Robertson (2009) | G.W.T. (earthq.): | 2.00 m | Fill height: | N/A | applied: | All soils |
| Points to test: | Based on Ic value | Average results interval: | 3 | Fill weight: | N/A | Limit depth applied: | No |
| Earthquake magnitude M_w : | 5.67 | Ic cut-off value: | 2.60 | Trans. detect. applied: | No | Limit depth: | N/A |
| Peak ground acceleration: | 0.11 | Unit weight calculation: | Based on SBT | K_0 applied: | No | 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

Liquefaction analysis overall plots



Input parameters and analysis data

| | | | | | |
|---------------------------------------|-------------------|---------------------------------|--------------|-----------------------------|-----------|
| Analysis method: | Robertson (2009) | Depth to water table (earthq.): | 2.00 m | Fill weight: | N/A |
| Fines correction method: | Robertson (2009) | Average results interval: | 3 | Transition detect. applied: | No |
| Points to test: | Based on Ic value | Ic cut-off value: | 2.60 | K ₀ applied: | No |
| Earthquake magnitude M _w : | 5.67 | Unit weight calculation: | Based on SBT | Clay like behavior applied: | All soils |
| Peak ground acceleration: | 0.11 | Use fill: | No | Limit depth applied: | No |
| Depth to water table (insitu): | 2.00 m | Fill height: | N/A | Limit depth: | N/A |

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 REPORT

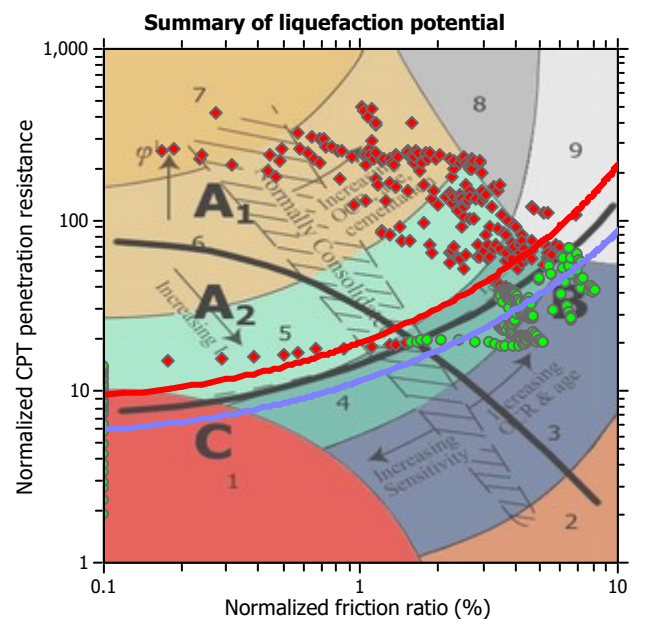
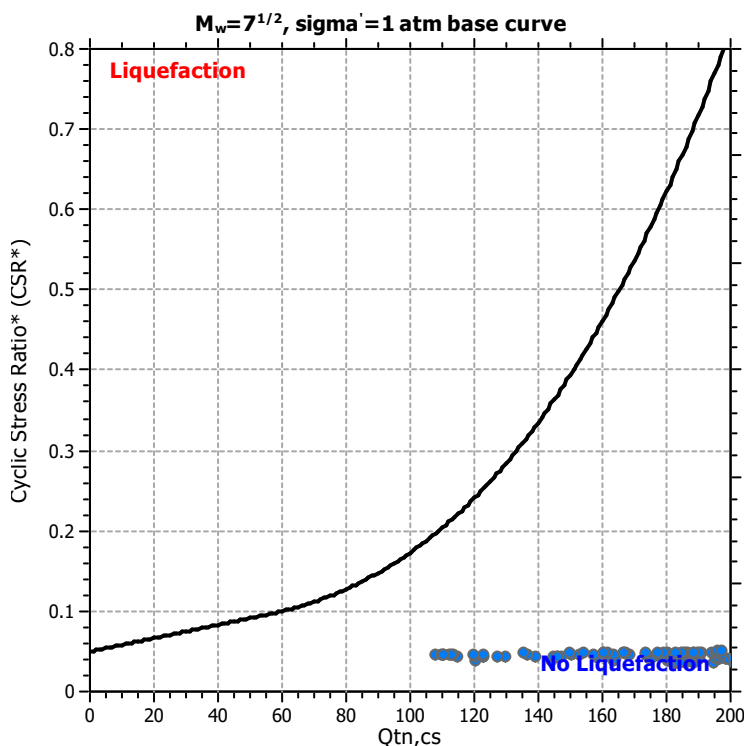
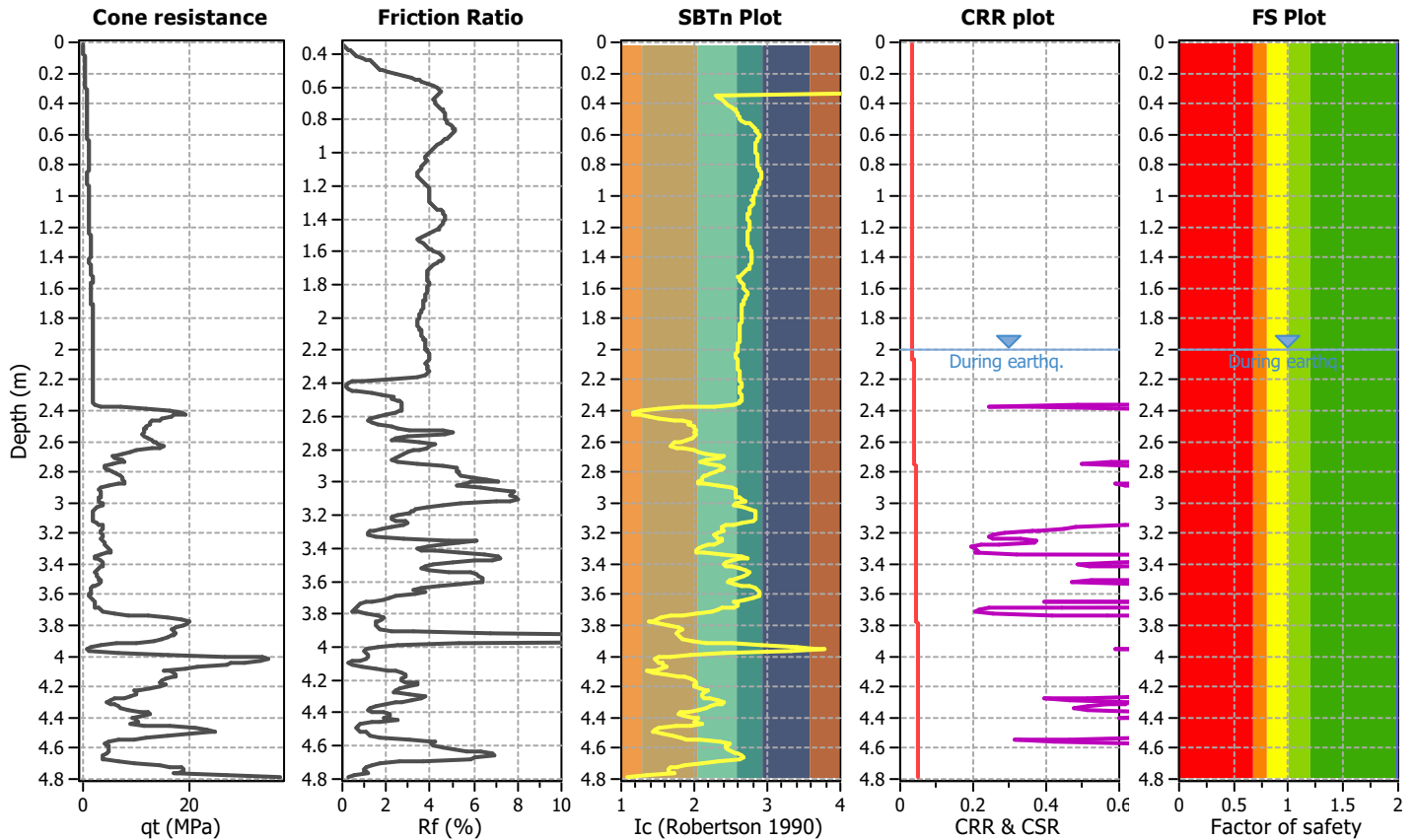
Project title : Met. Der. Porto Empedocle

Location :

CPT file : pe-b-c48

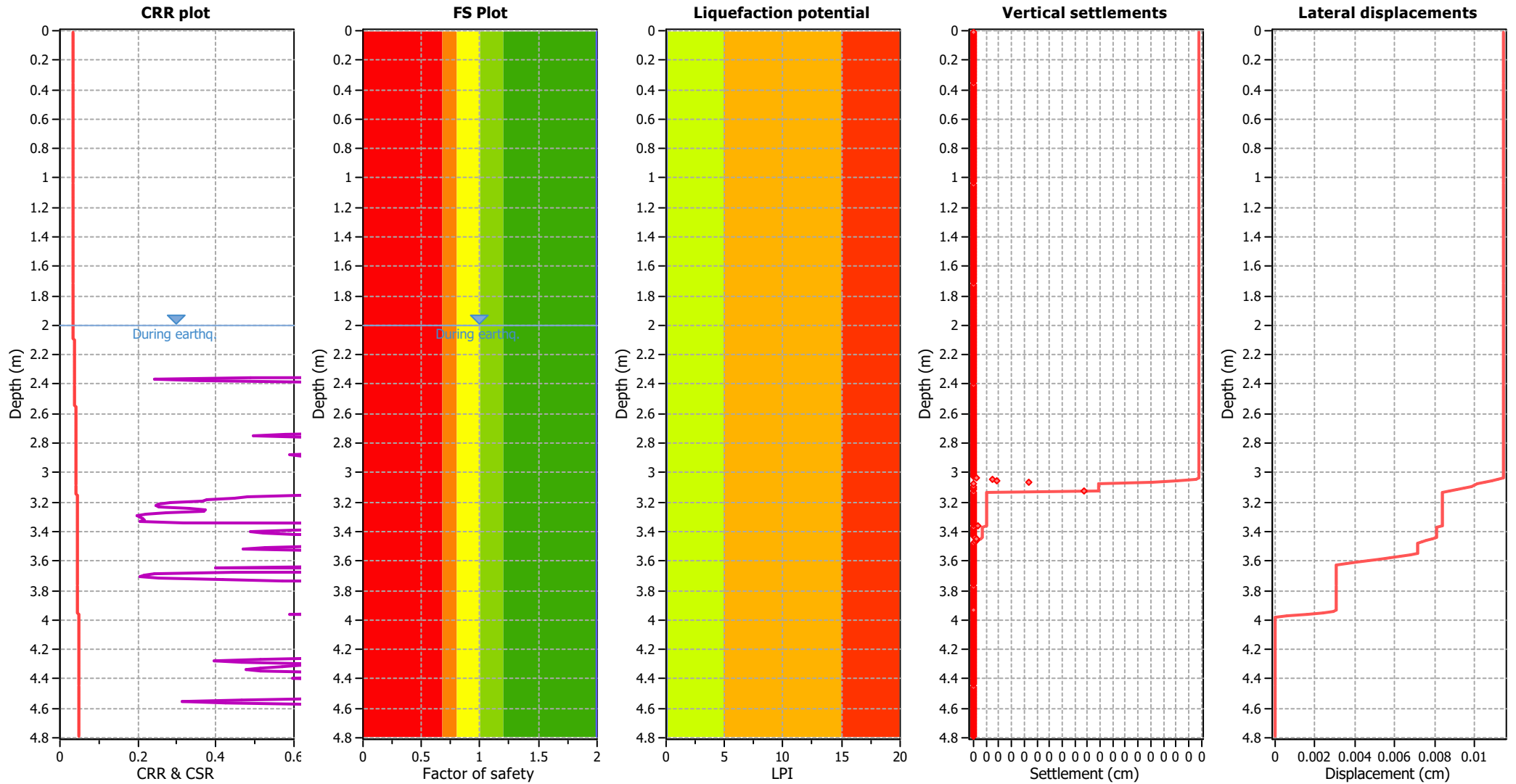
Input parameters and analysis data

| | | | | | | | |
|------------------------------|-------------------|---------------------------|--------------|-------------------------|-----|----------------------|--------------|
| Analysis method: | Robertson (2009) | G.W.T. (in-situ): | 2.00 m | Use fill: | No | Clay like behavior | |
| Fines correction method: | Robertson (2009) | G.W.T. (earthq.): | 2.00 m | Fill height: | N/A | applied: | All soils |
| Points to test: | Based on Ic value | Average results interval: | 3 | Fill weight: | N/A | Limit depth applied: | No |
| Earthquake magnitude M_w : | 5.67 | Ic cut-off value: | 2.60 | Trans. detect. applied: | No | Limit depth: | N/A |
| Peak ground acceleration: | 0.11 | Unit weight calculation: | Based on SBT | K_o applied: | No | 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

Liquefaction analysis overall plots



Input parameters and analysis data

| | | | | | |
|---------------------------------------|-------------------|---------------------------------|--------------|-----------------------------|-----------|
| Analysis method: | Robertson (2009) | Depth to water table (earthq.): | 2.00 m | Fill weight: | N/A |
| Fines correction method: | Robertson (2009) | Average results interval: | 3 | Transition detect. applied: | No |
| Points to test: | Based on Ic value | Ic cut-off value: | 2.60 | K ₀ applied: | No |
| Earthquake magnitude M _w : | 5.67 | Unit weight calculation: | Based on SBT | Clay like behavior applied: | All soils |
| Peak ground acceleration: | 0.11 | Use fill: | No | Limit depth applied: | No |
| Depth to water table (insitu): | 2.00 m | Fill height: | N/A | Limit depth: | N/A |

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 REPORT

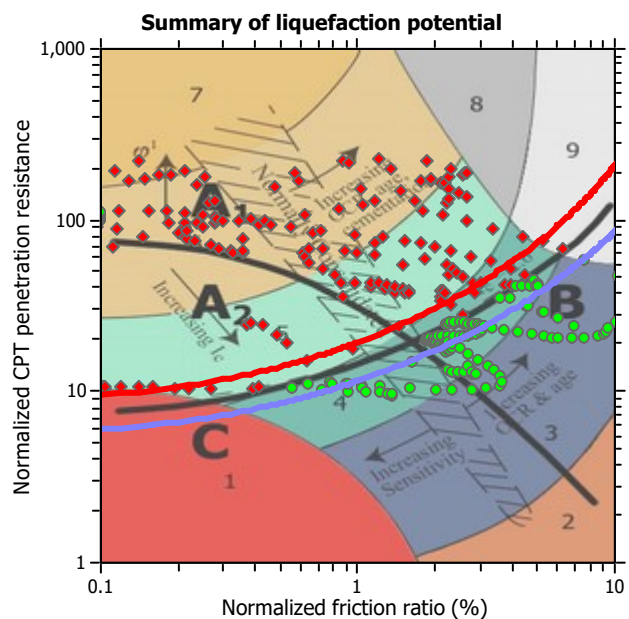
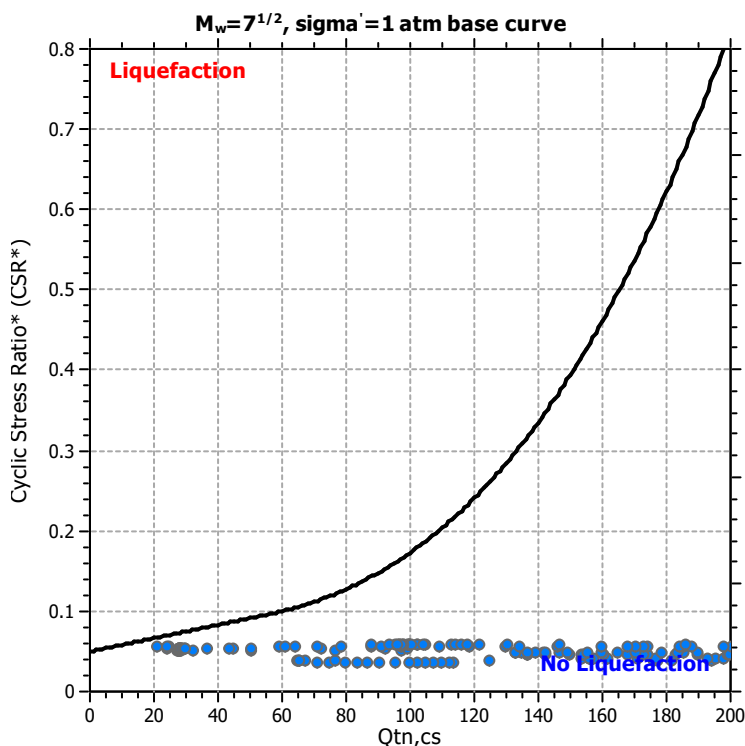
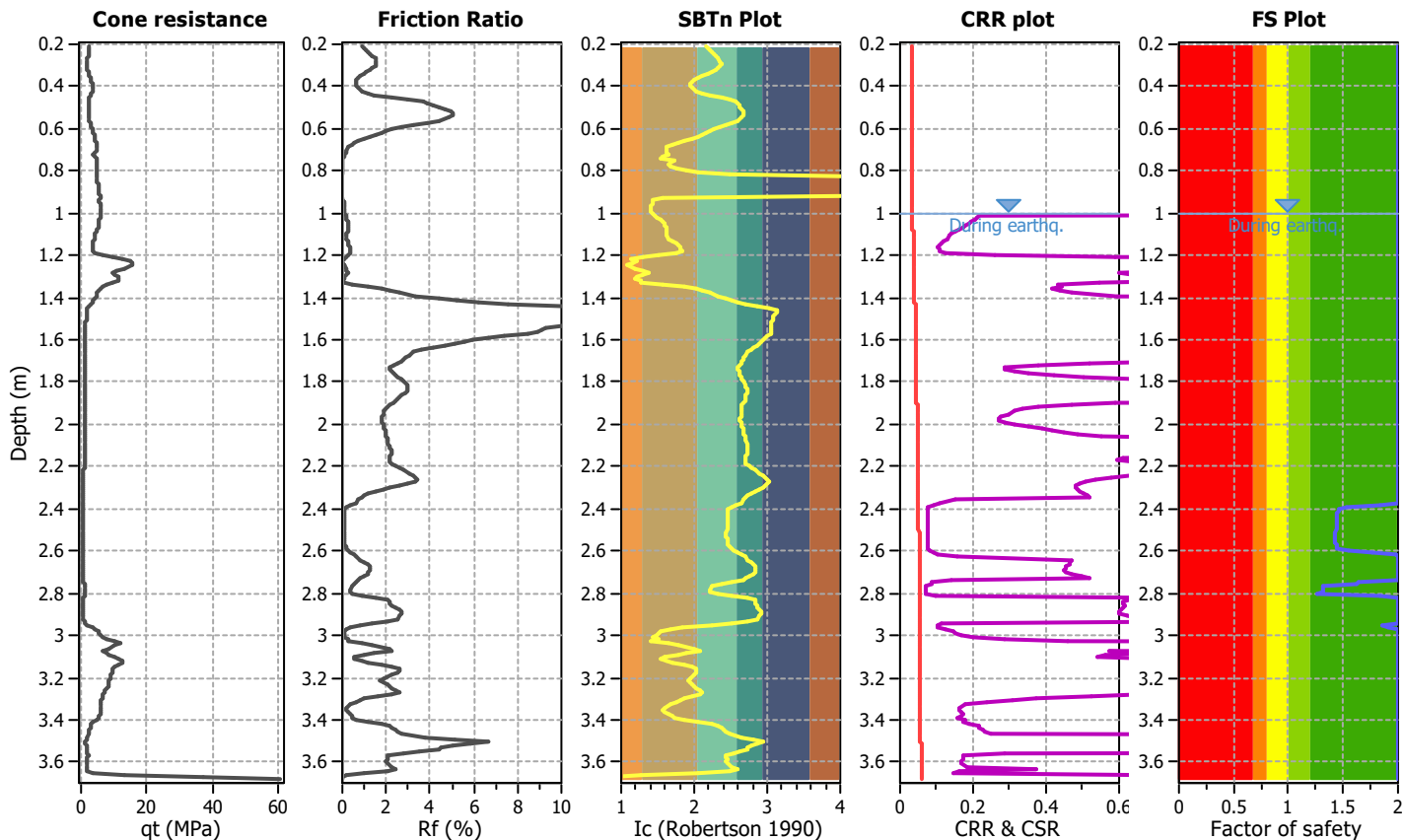
Project title : Met. Der. Porto Empedocle

Location :

CPT file : ag-b-c67

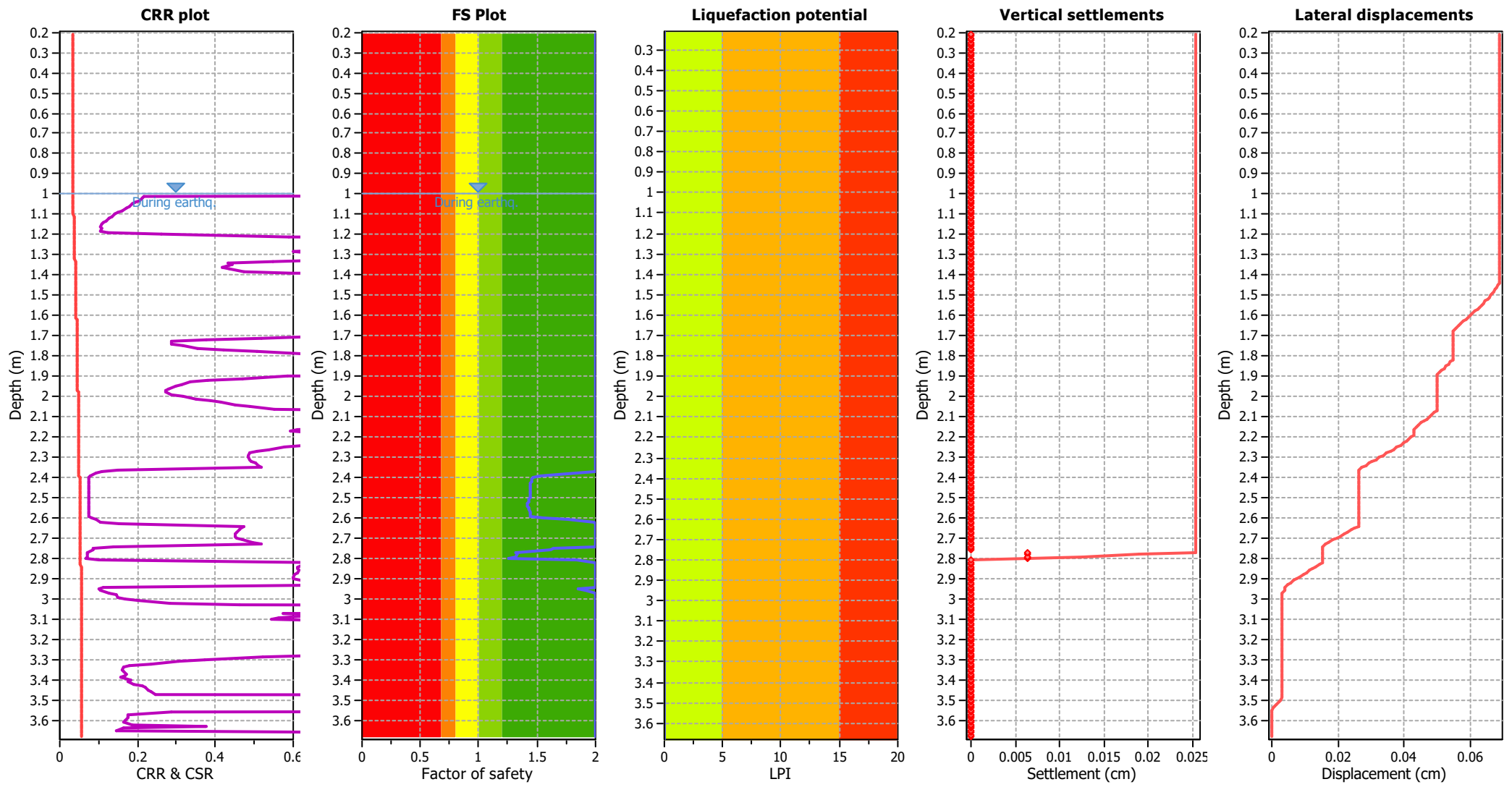
Input parameters and analysis data

| | | | | | | | |
|------------------------------|-------------------|---------------------------|--------------|-------------------------|-----|----------------------|--------------|
| Analysis method: | Robertson (2009) | G.W.T. (in-situ): | 1.00 m | Use fill: | No | Clay like behavior | |
| Fines correction method: | Robertson (2009) | G.W.T. (earthq.): | 1.00 m | Fill height: | N/A | applied: | All soils |
| Points to test: | Based on Ic value | Average results interval: | 3 | Fill weight: | N/A | Limit depth applied: | No |
| Earthquake magnitude M_w : | 5.80 | Ic cut-off value: | 2.60 | Trans. detect. applied: | No | Limit depth: | N/A |
| Peak ground acceleration: | 0.10 | Unit weight calculation: | Based on SBT | K_0 applied: | No | 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

Liquefaction analysis overall plots



Input parameters and analysis data

| | | | | | |
|---------------------------------------|-------------------|---------------------------------|--------------|-----------------------------|-----------|
| Analysis method: | Robertson (2009) | Depth to water table (earthq.): | 1.00 m | Fill weight: | N/A |
| Fines correction method: | Robertson (2009) | Average results interval: | 3 | Transition detect. applied: | No |
| Points to test: | Based on Ic value | Ic cut-off value: | 2.60 | K ₀ applied: | No |
| Earthquake magnitude M _w : | 5.80 | Unit weight calculation: | Based on SBT | Clay like behavior applied: | All soils |
| Peak ground acceleration: | 0.10 | Use fill: | No | Limit depth applied: | No |
| Depth to water table (insitu): | 1.00 m | Fill height: | N/A | Limit depth: | N/A |

F.S. color scheme

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

LPI color scheme

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

SPT BASED LIQUEFACTION ANALYSIS REPORT

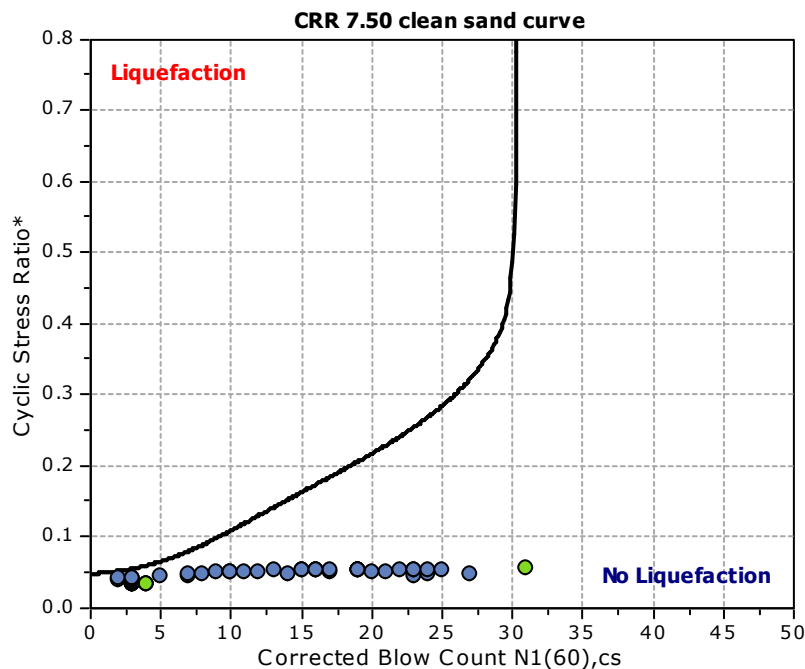
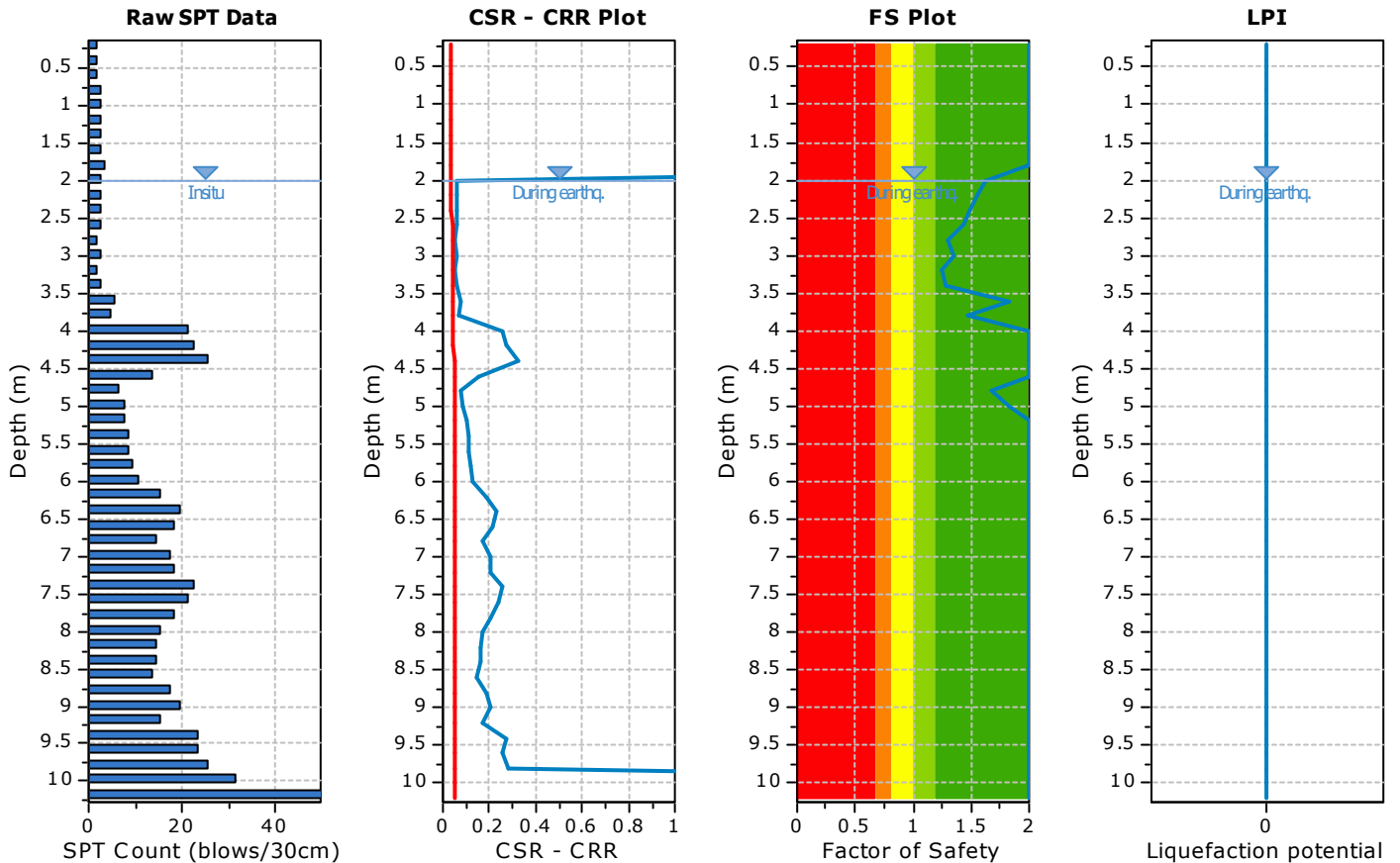
Project title :

SPT Name: PE-B-D47a

Location :

:: Input parameters and analysis properties ::

| | | | |
|--------------------------|------------------|------------------------------|----------|
| Analysis method: | NCEER 1998 | G.W.T. (in-situ): | 2.00 m |
| Fines correction method: | NCEER 1998 | G.W.T. (earthq.): | 2.00 m |
| Sampling method: | Standard Sampler | Earthquake magnitude M_w : | 5.67 |
| Borehole diameter: | 65mm to 115mm | Peak ground acceleration: | 0.11 g |
| Rod length: | 1.00 m | Eq. external load: | 0.00 kPa |
| Hammer energy ratio: | 1.00 | | |



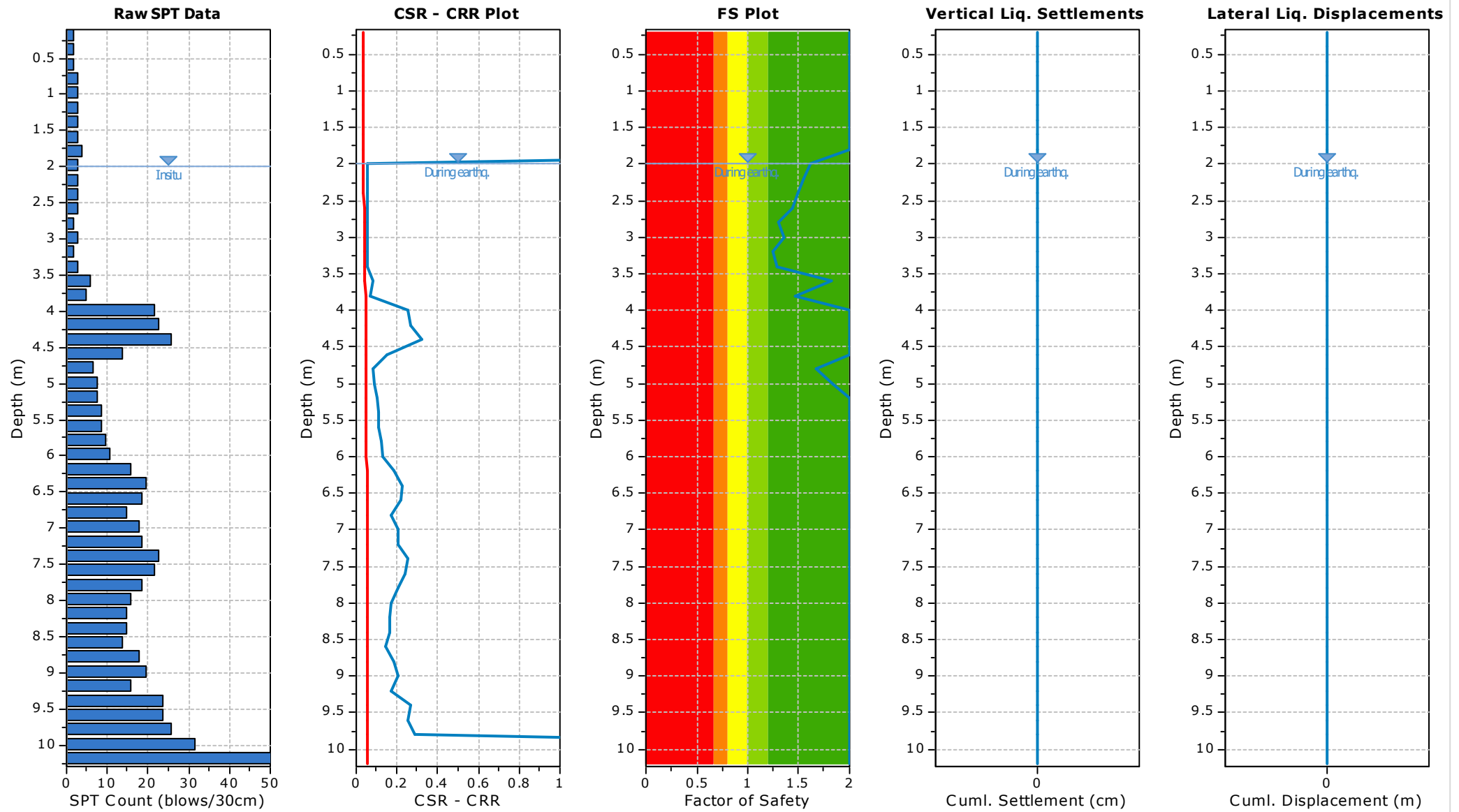
F.S. color scheme

- 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

:: Overall Liquefaction Assessment Analysis Plots ::



SPT BASED LIQUEFACTION ANALYSIS REPORT

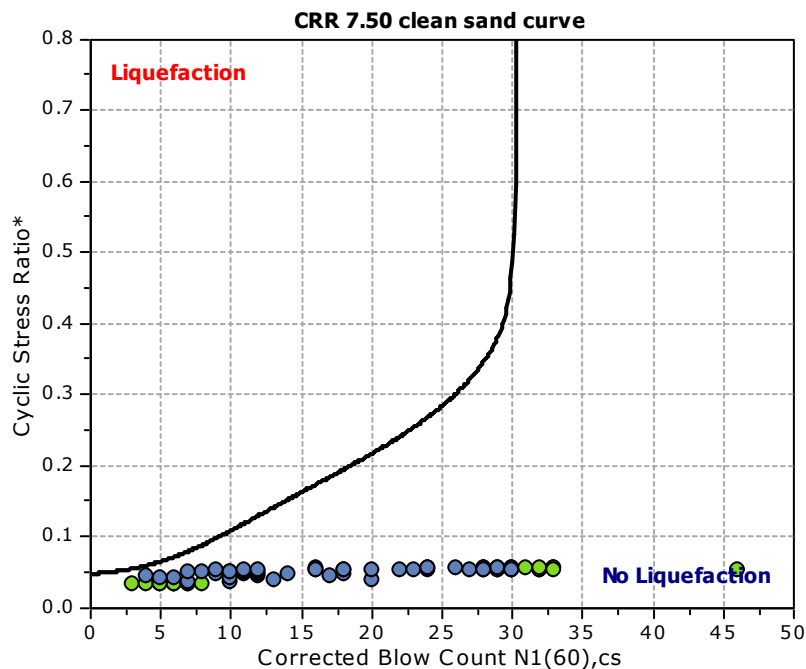
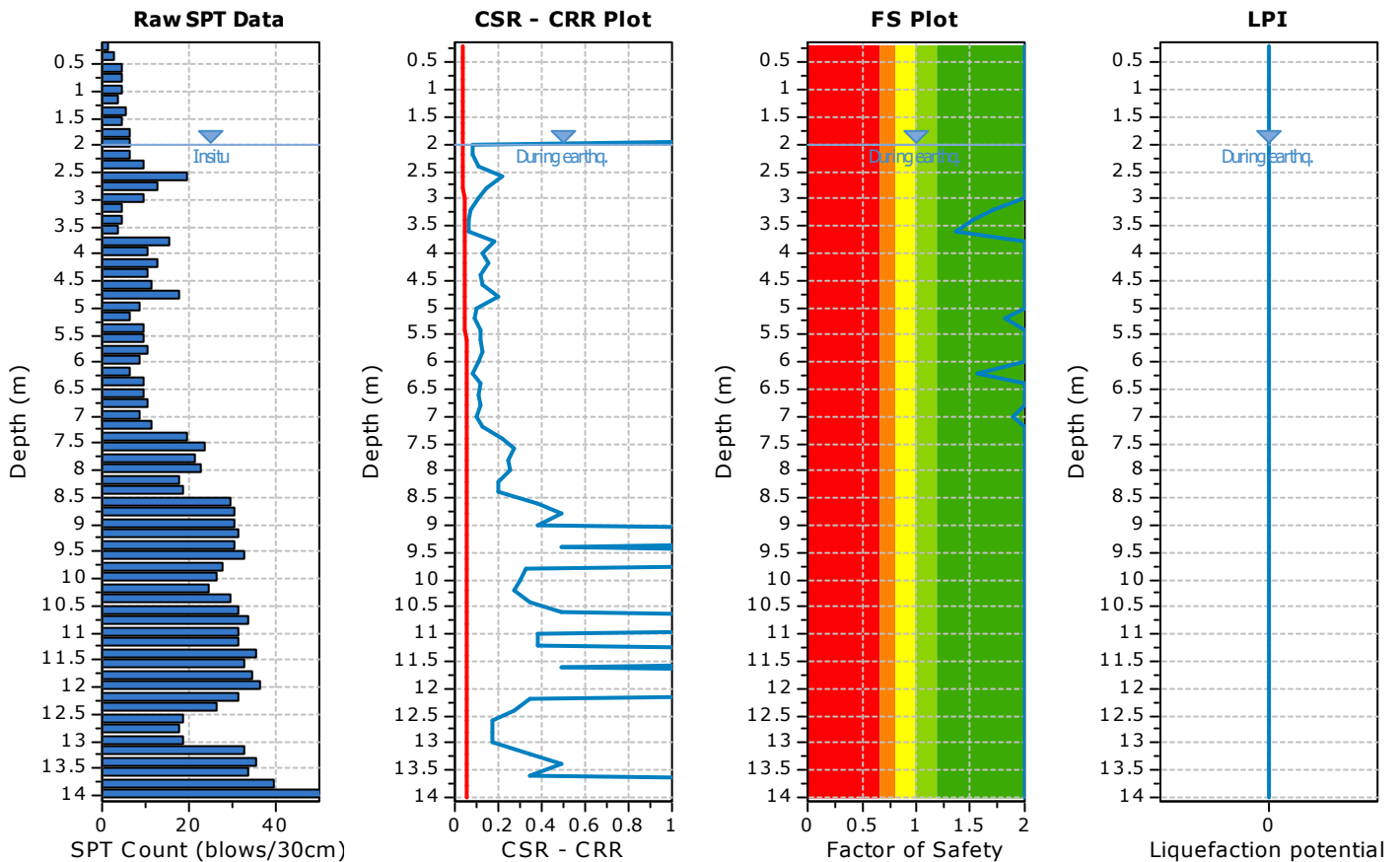
Project title :

SPT Name: PE-B-D48a

Location :

:: Input parameters and analysis properties ::

| | | | |
|--------------------------|------------------|------------------------------|----------|
| Analysis method: | NCEER 1998 | G.W.T. (in-situ): | 2.00 m |
| Fines correction method: | NCEER 1998 | G.W.T. (earthq.): | 2.00 m |
| Sampling method: | Standard Sampler | Earthquake magnitude M_w : | 5.67 |
| Borehole diameter: | 65mm to 115mm | Peak ground acceleration: | 0.11 g |
| Rod length: | 1.00 m | Eq. external load: | 0.00 kPa |
| Hammer energy ratio: | 1.00 | | |



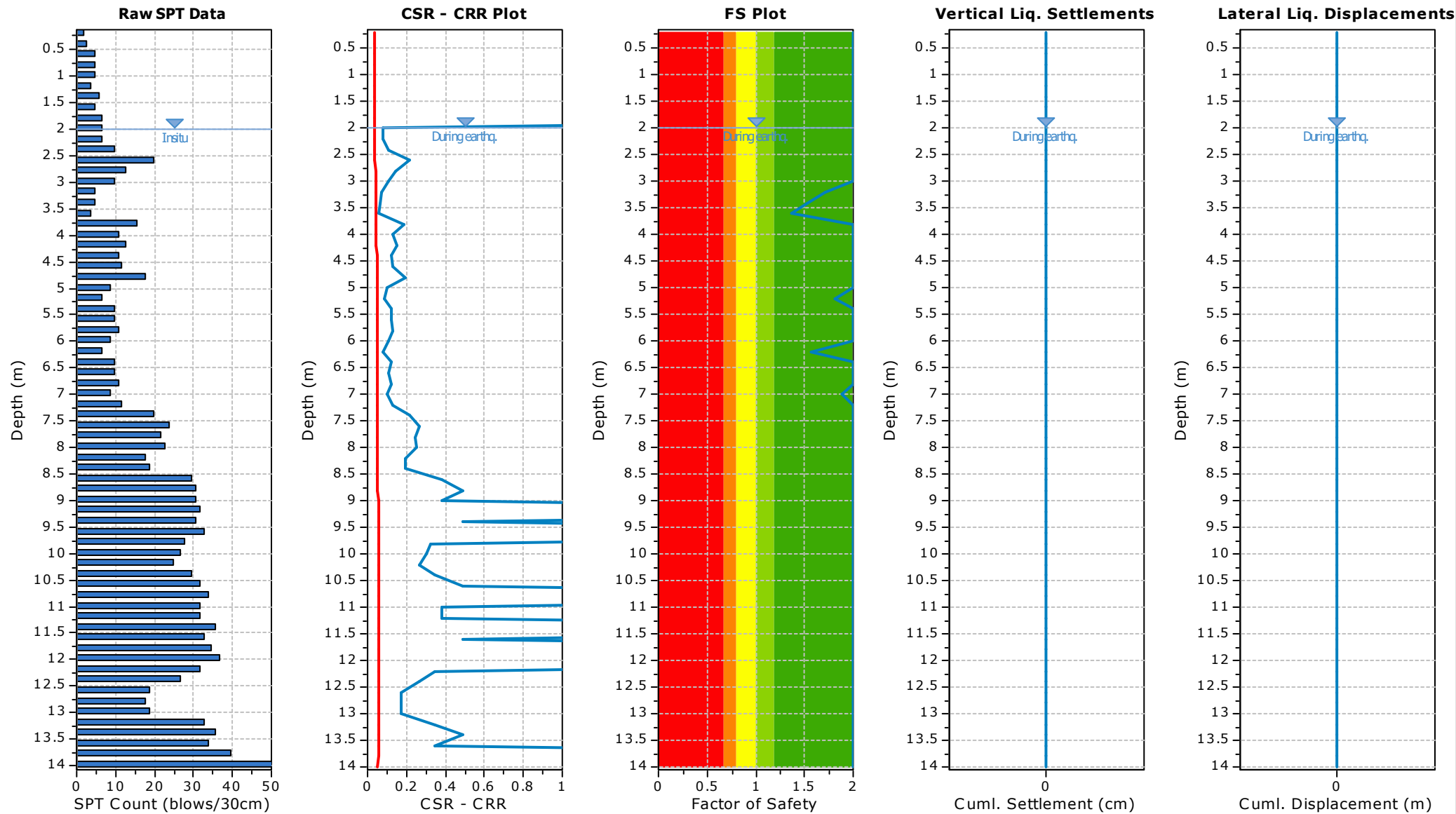
F.S. color scheme

- 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

:: Overall Liquefaction Assessment Analysis Plots ::



SPT BASED LIQUEFACTION ANALYSIS REPORT

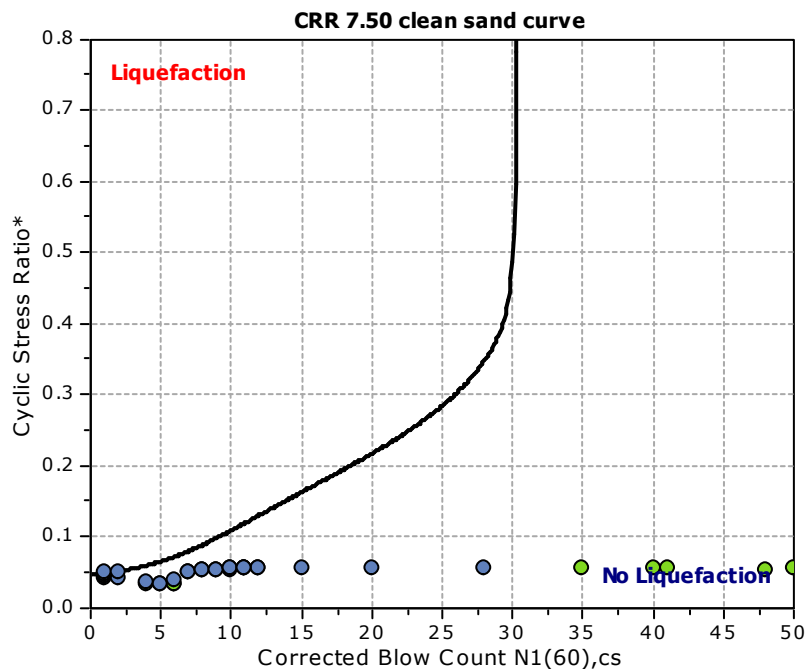
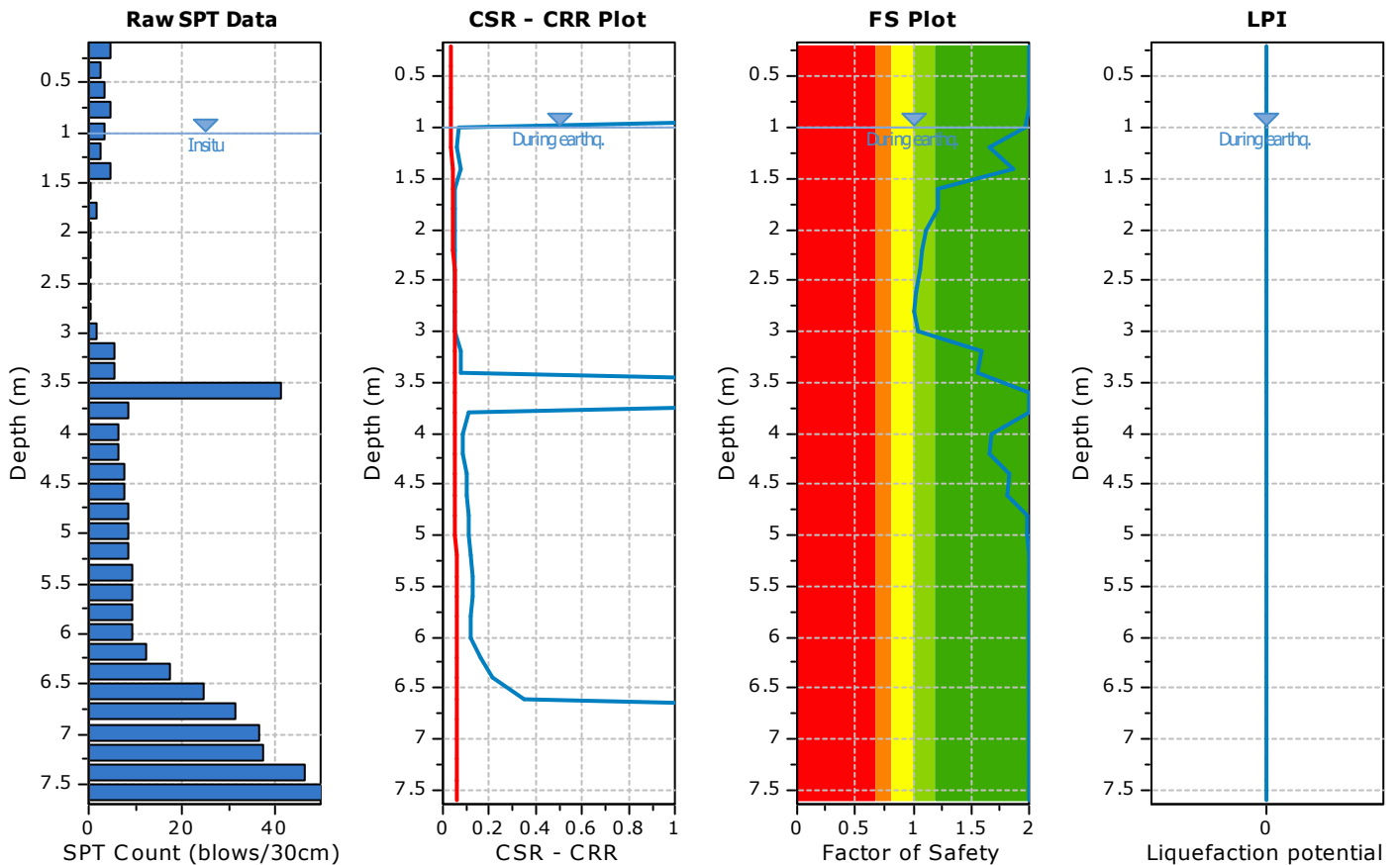
Project title :

SPT Name: AG-B-D67a

Location :

:: Input parameters and analysis properties ::

| | | | |
|--------------------------|------------------|------------------------------|----------|
| Analysis method: | NCEER 1998 | G.W.T. (in-situ): | 1.00 m |
| Fines correction method: | NCEER 1998 | G.W.T. (earthq.): | 1.00 m |
| Sampling method: | Standard Sampler | Earthquake magnitude M_w : | 5.80 |
| Borehole diameter: | 65mm to 115mm | Peak ground acceleration: | 0.10 g |
| Rod length: | 1.00 m | Eq. external load: | 0.00 kPa |
| Hammer energy ratio: | 1.00 | | |



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

:: Overall Liquefaction Assessment Analysis Plots ::

