EEI
Geotechnical and Environmental Solutions
Carlsbad, CA

LIQUEFACTION ANALYSIS REPORT

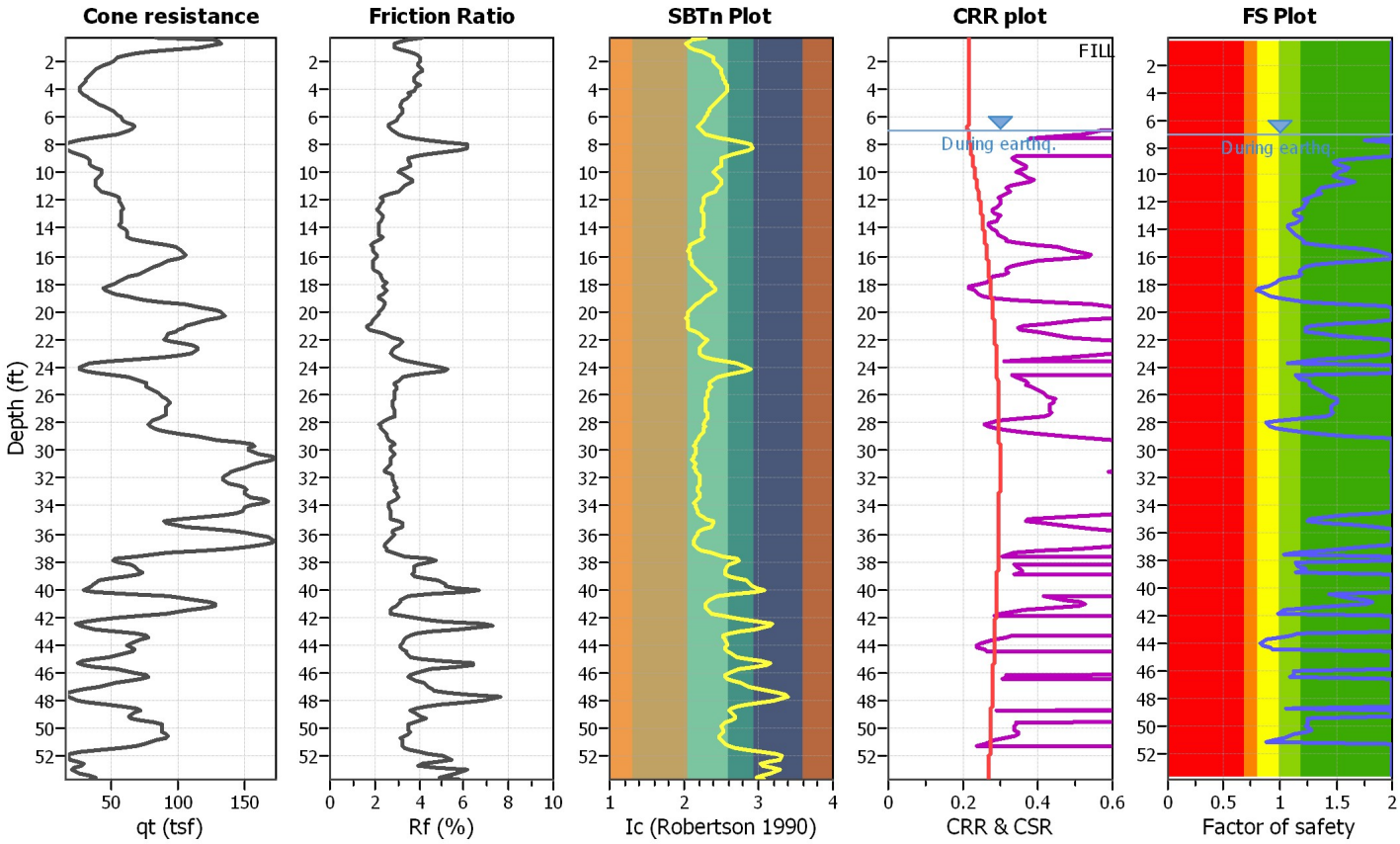
Project title : Zephyr Oceanside

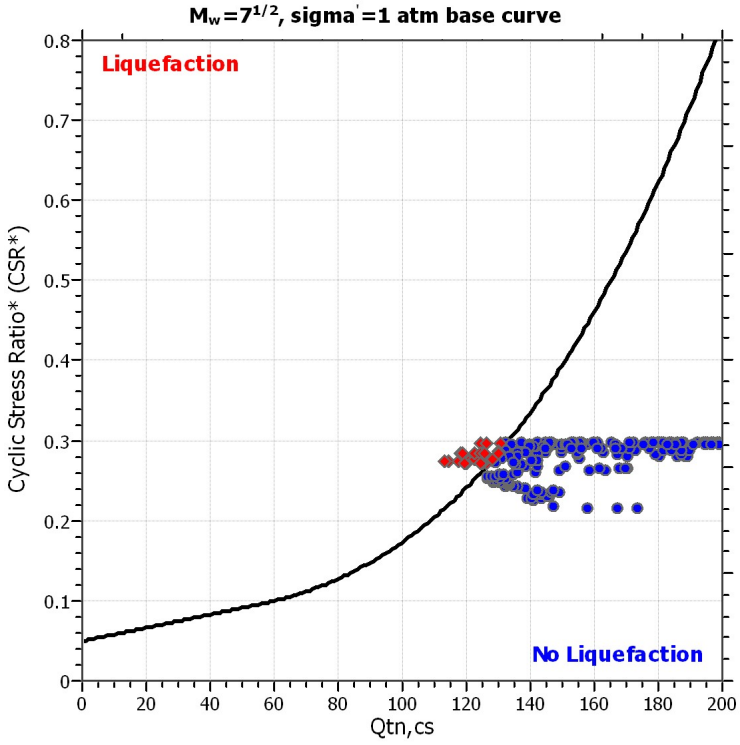
Location : Hwy 76 and Foussat Rd.,Oceanside, Ca.

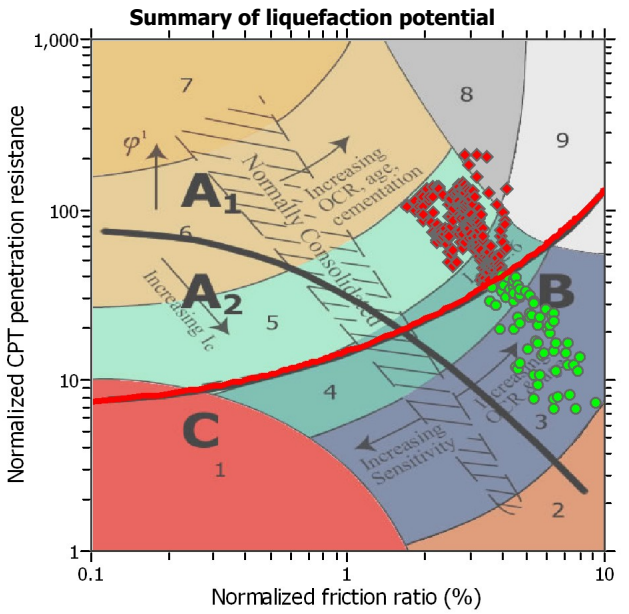
CPT file : CPT-07

Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	10.00 ft	Use fill:	Yes	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	17.00 ft	Fill height:	10.00 ft	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	120.00 lb/ft^3	Limit depth:	N/A
Earthquake magnitude M_w:	6.72	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.45	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

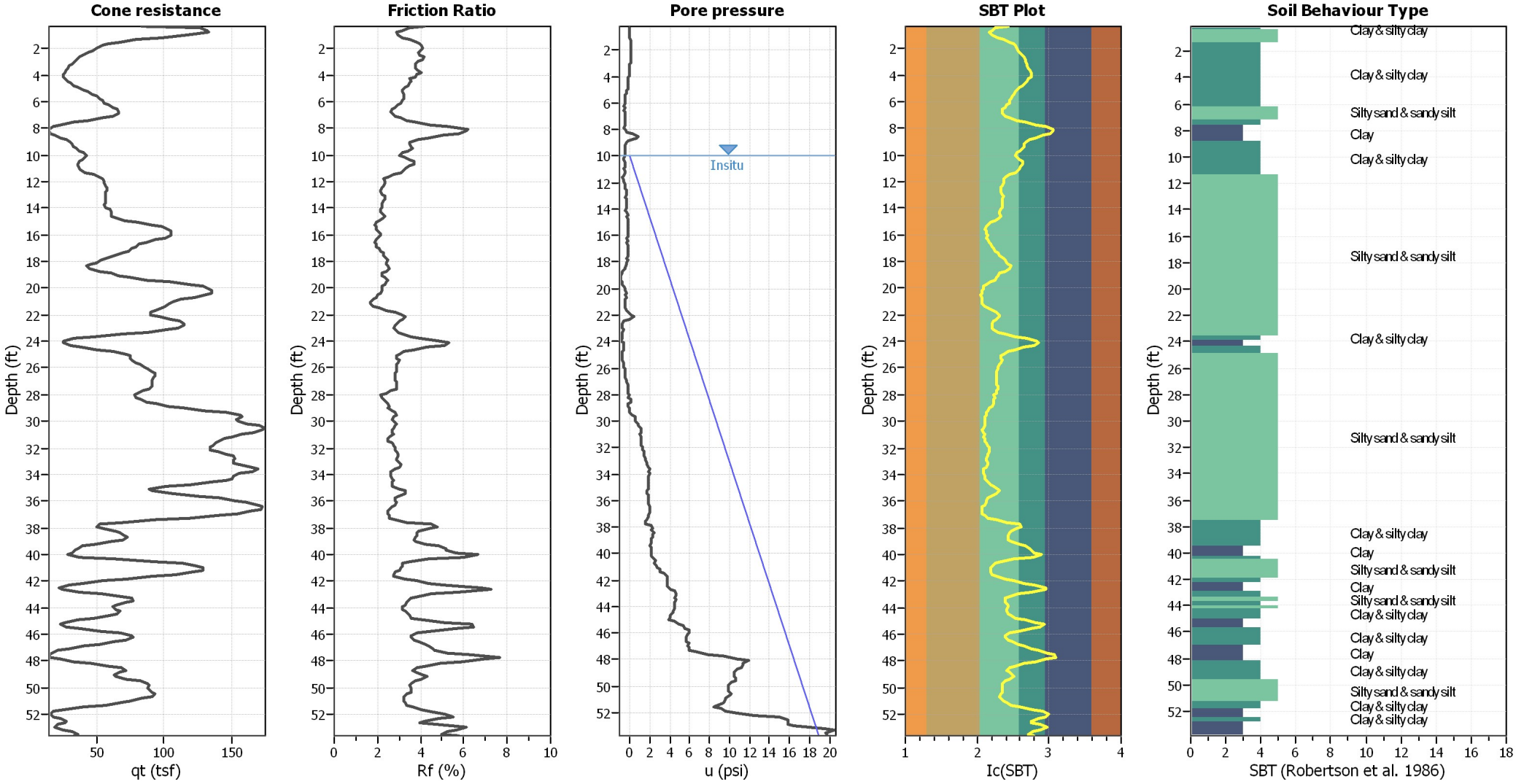






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and 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

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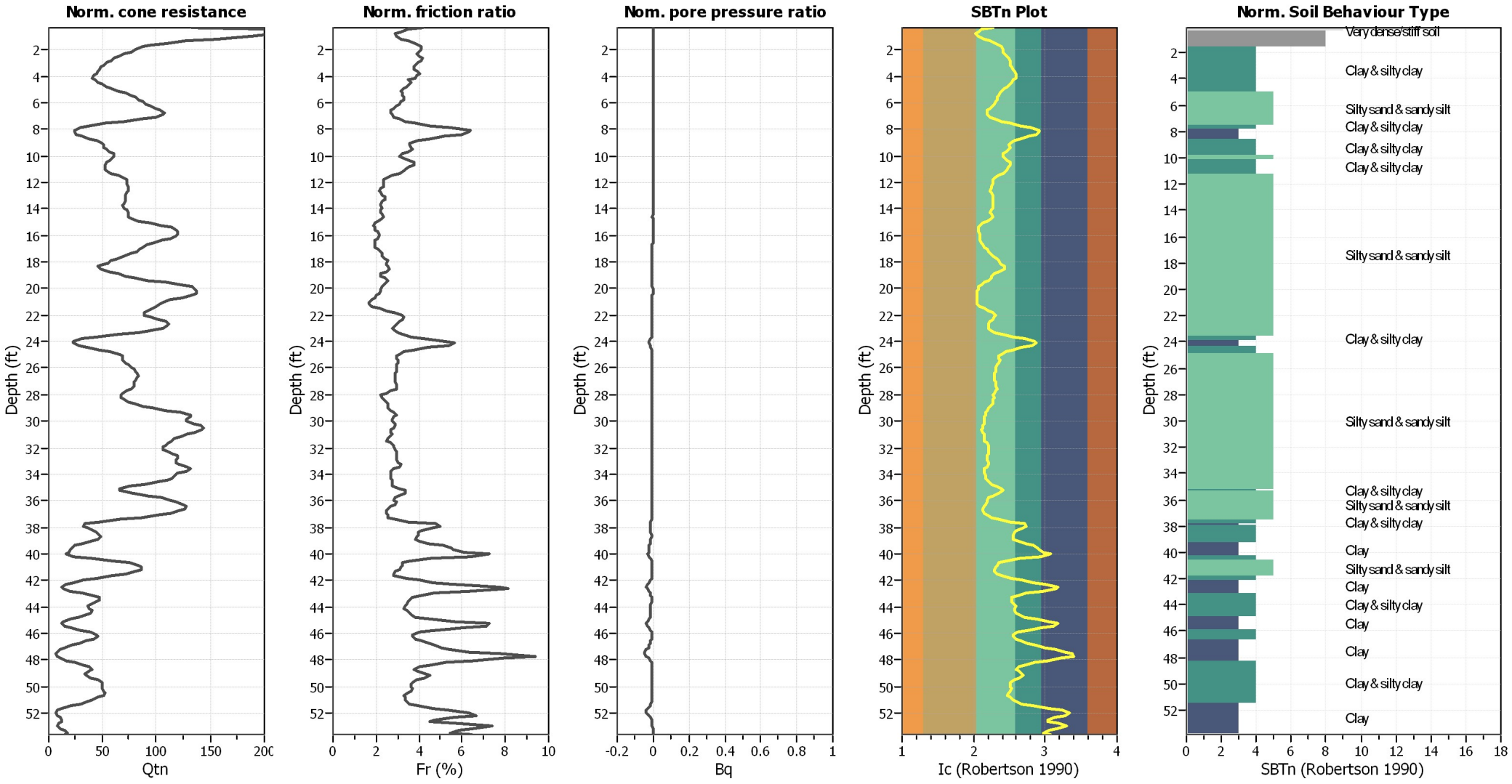
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.72	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.45	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	10.00 ft	Fill height:	10.00 ft	Limit depth:	N/A

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

CPT basic interpretation plots (normalized)



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SBTn legend

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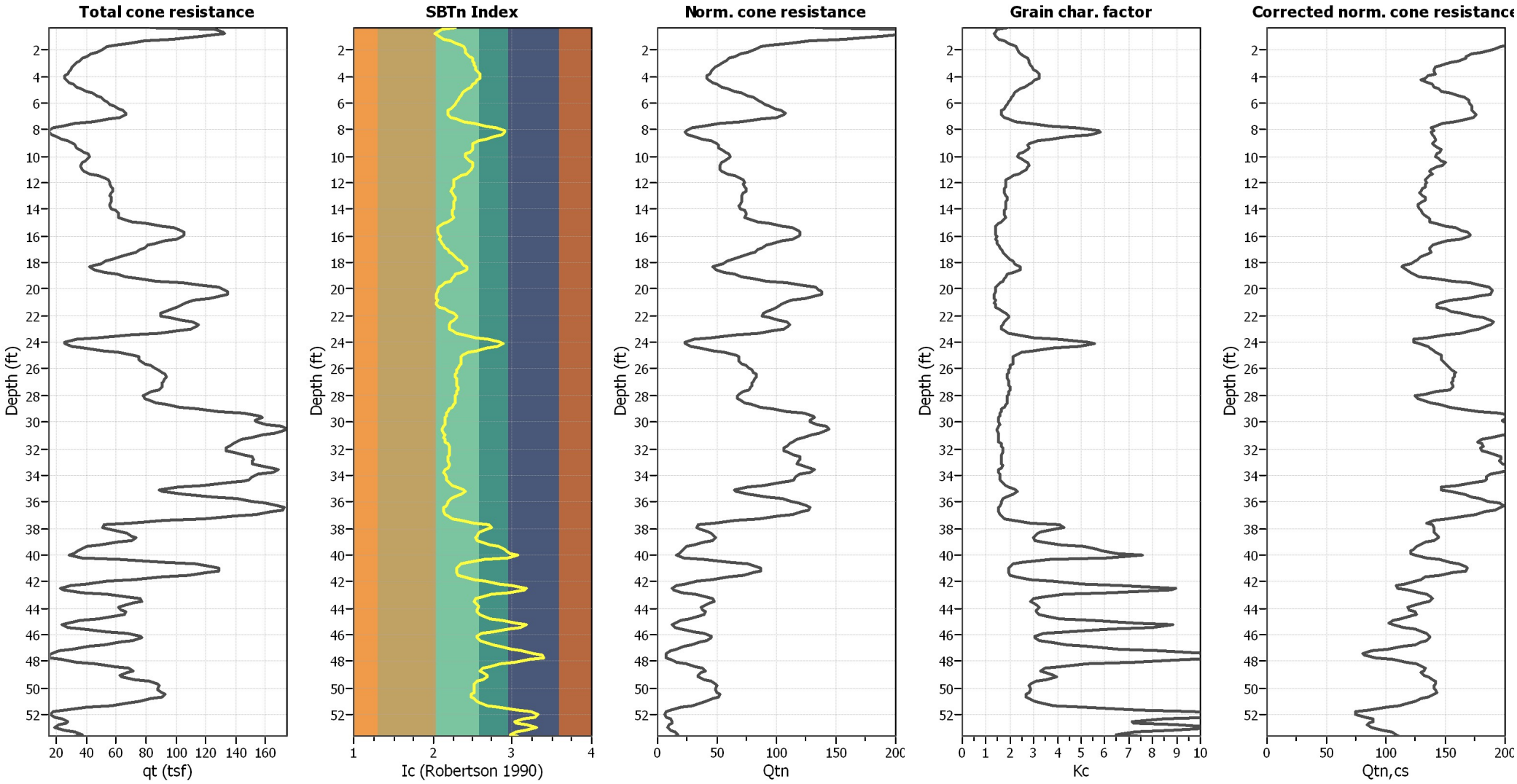
3. Clay to silty clay
4. Clayey silt to silty
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to
9. Very stiff fine grained

Liquefaction analysis overall plots (intermediate results)



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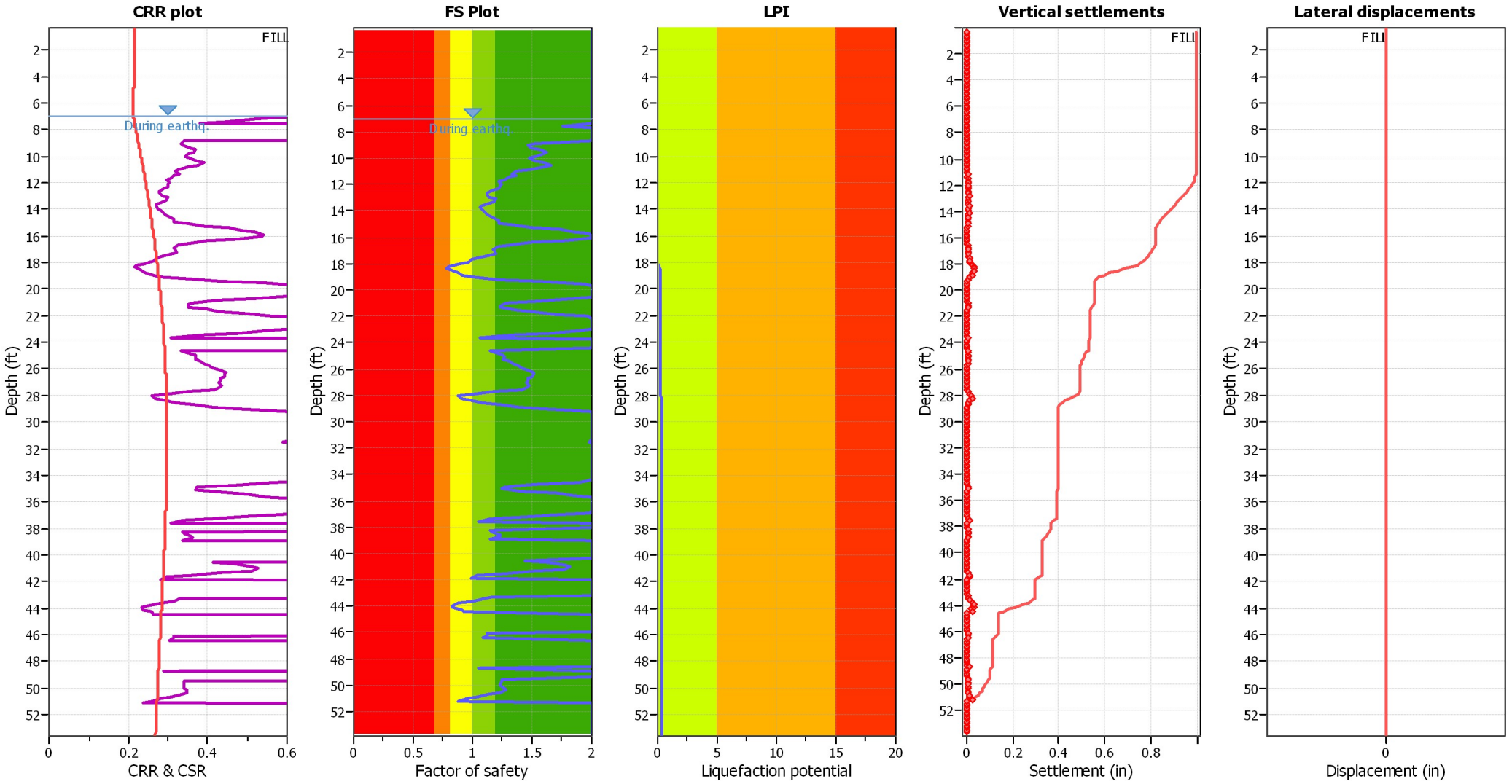
Liquefaction analysis overall plots



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Earthquake magnitude M_w:	6.72	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.45	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	10.00 ft	Fill height:	10.00 ft	Limit depth:	N/A

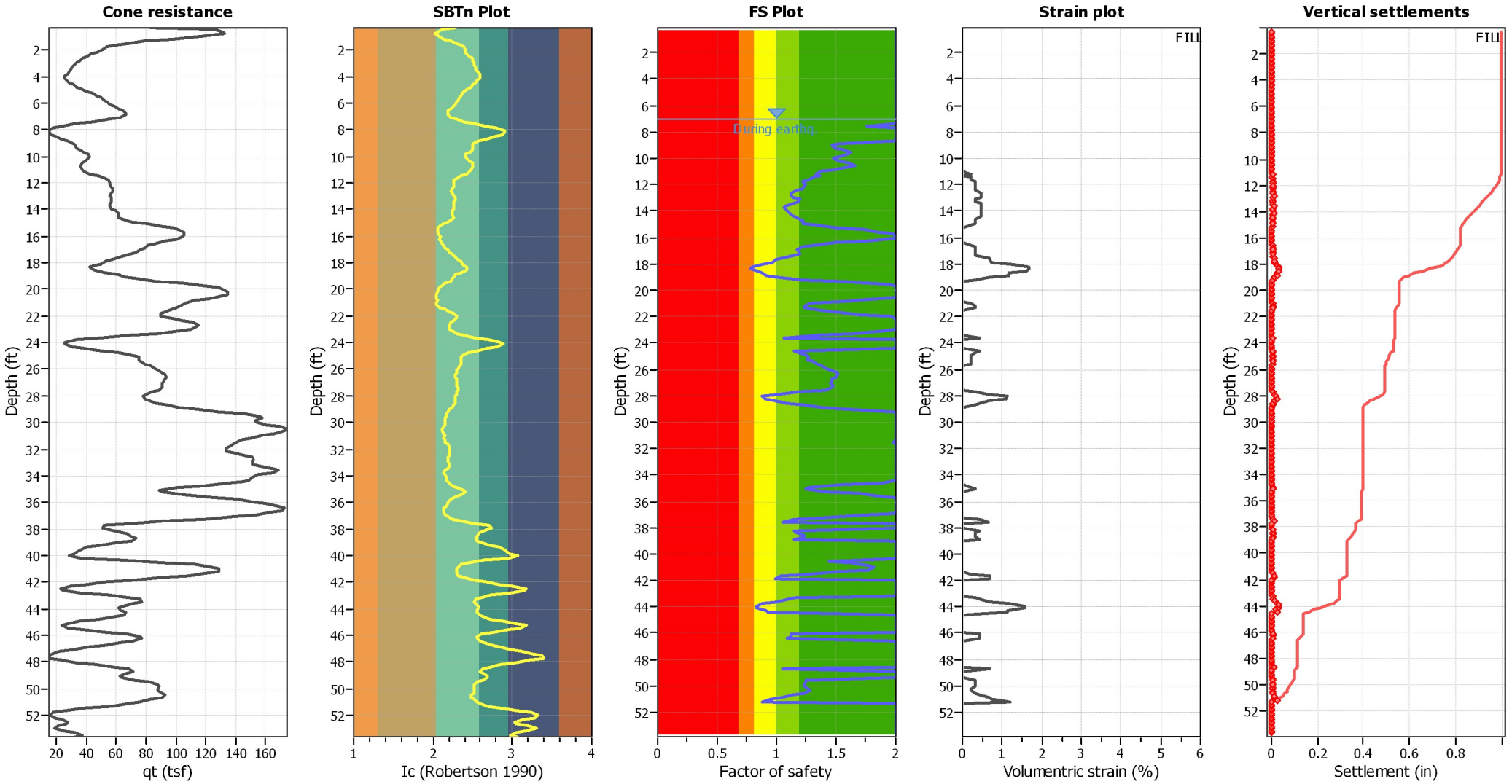
F.S. color scheme

- 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

Estimation of post-earthquake settlements



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
Volumentric strain:	Post-liquefaction volumentric strain

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Carlsbad, CA

LIQUEFACTION ANALYSIS REPORT

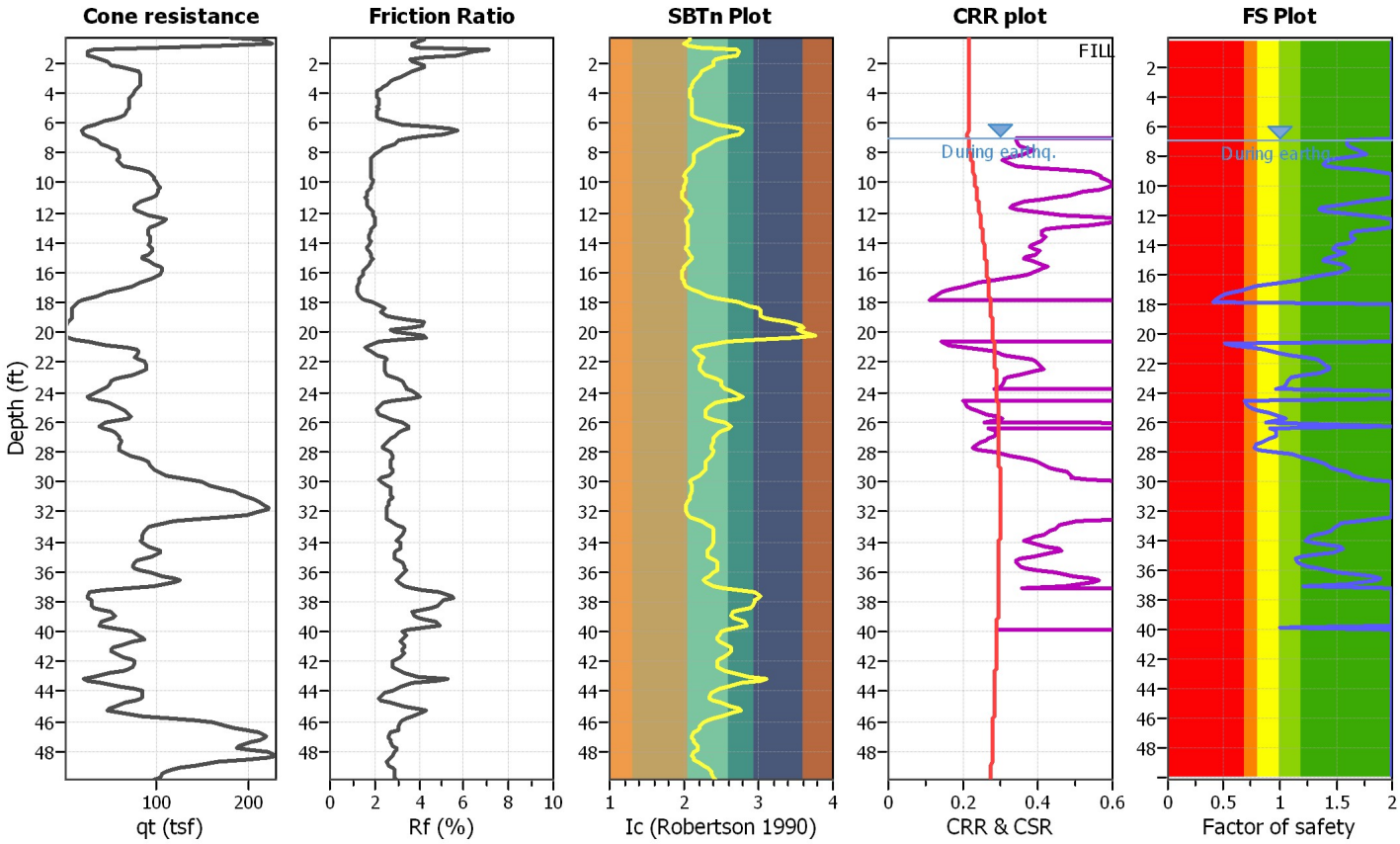
Project title : Zephyr Oceanside

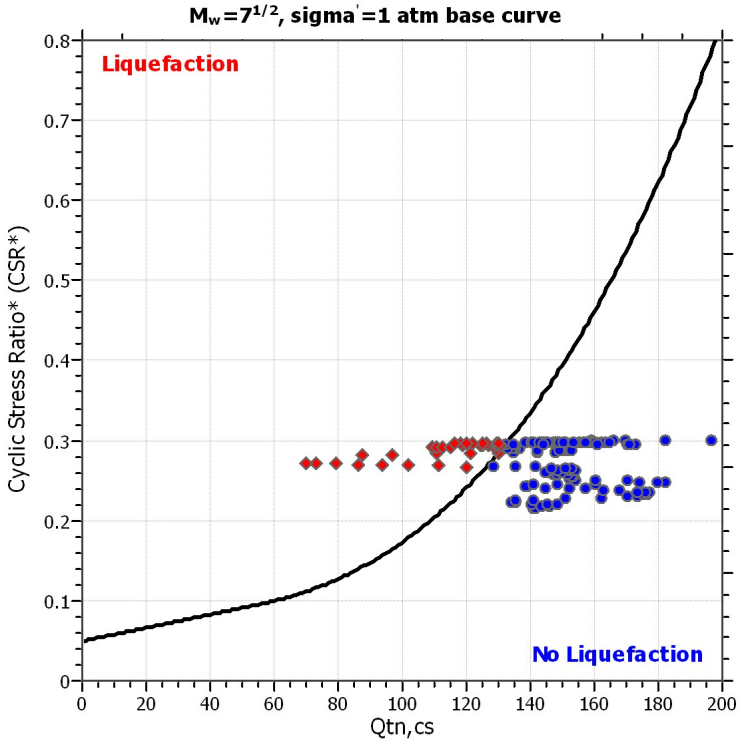
Location : Hwy 76 and Foussat Rd.,Oceanside, Ca.

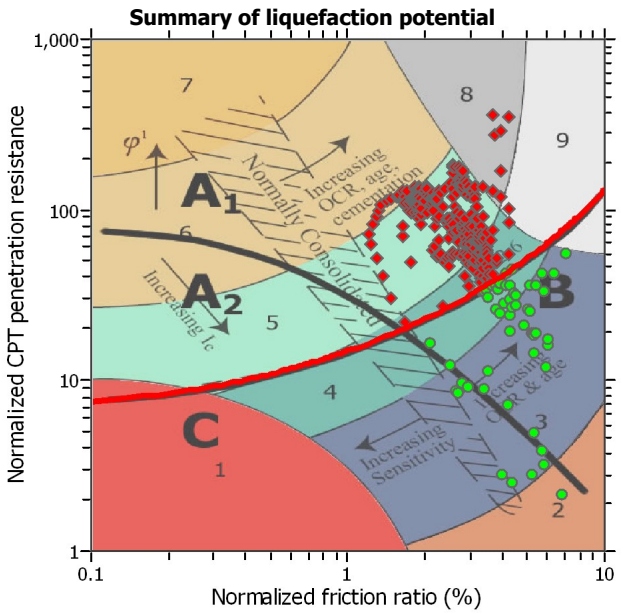
CPT file : CPT-08

Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	10.00 ft	Use fill:	Yes	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	17.00 ft	Fill height:	10.00 ft	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	120.00 lb/ft^3	Limit depth:	50.00 ft
Earthquake magnitude M_w:	6.72	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.45	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		







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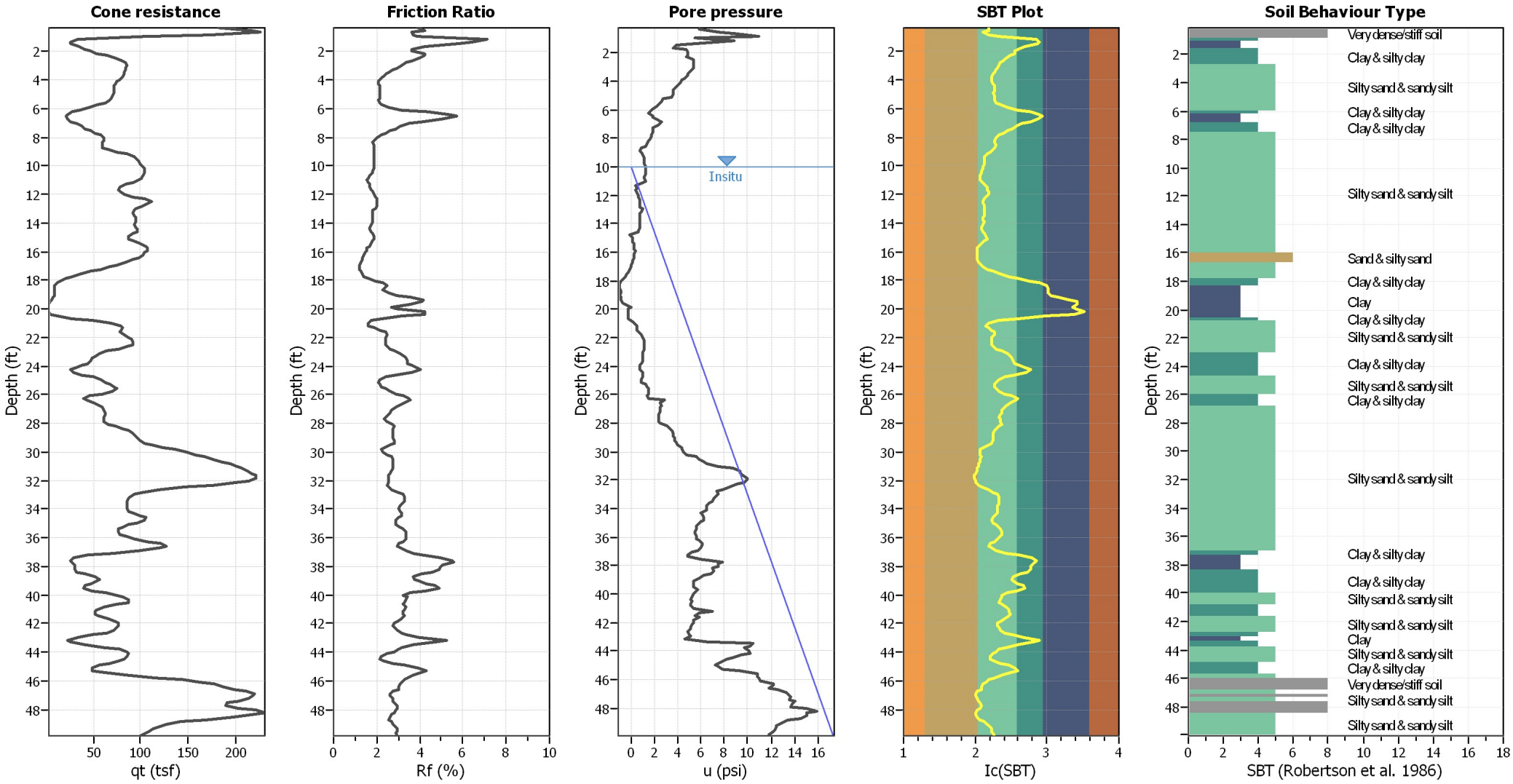
CPT basic interpretation plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	17.00 ft	Fill weight:	120.00 lb/ft^3
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_σ applied:	Yes
Earthquake magnitude M_w:	6.72	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.45	Use fill:	Yes	Limit depth applied:	Yes
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SBT legend

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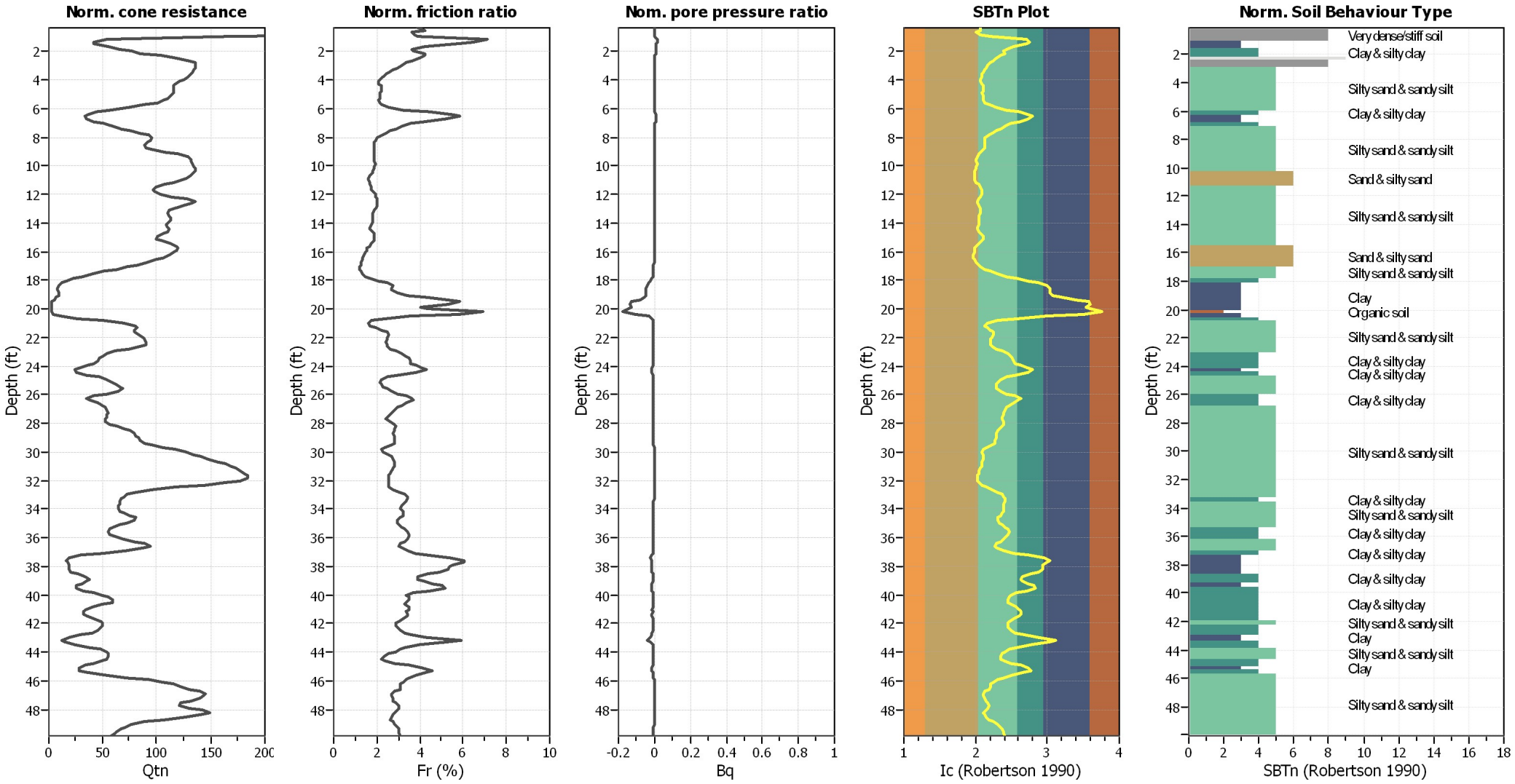
CPT basic interpretation plots (normalized)



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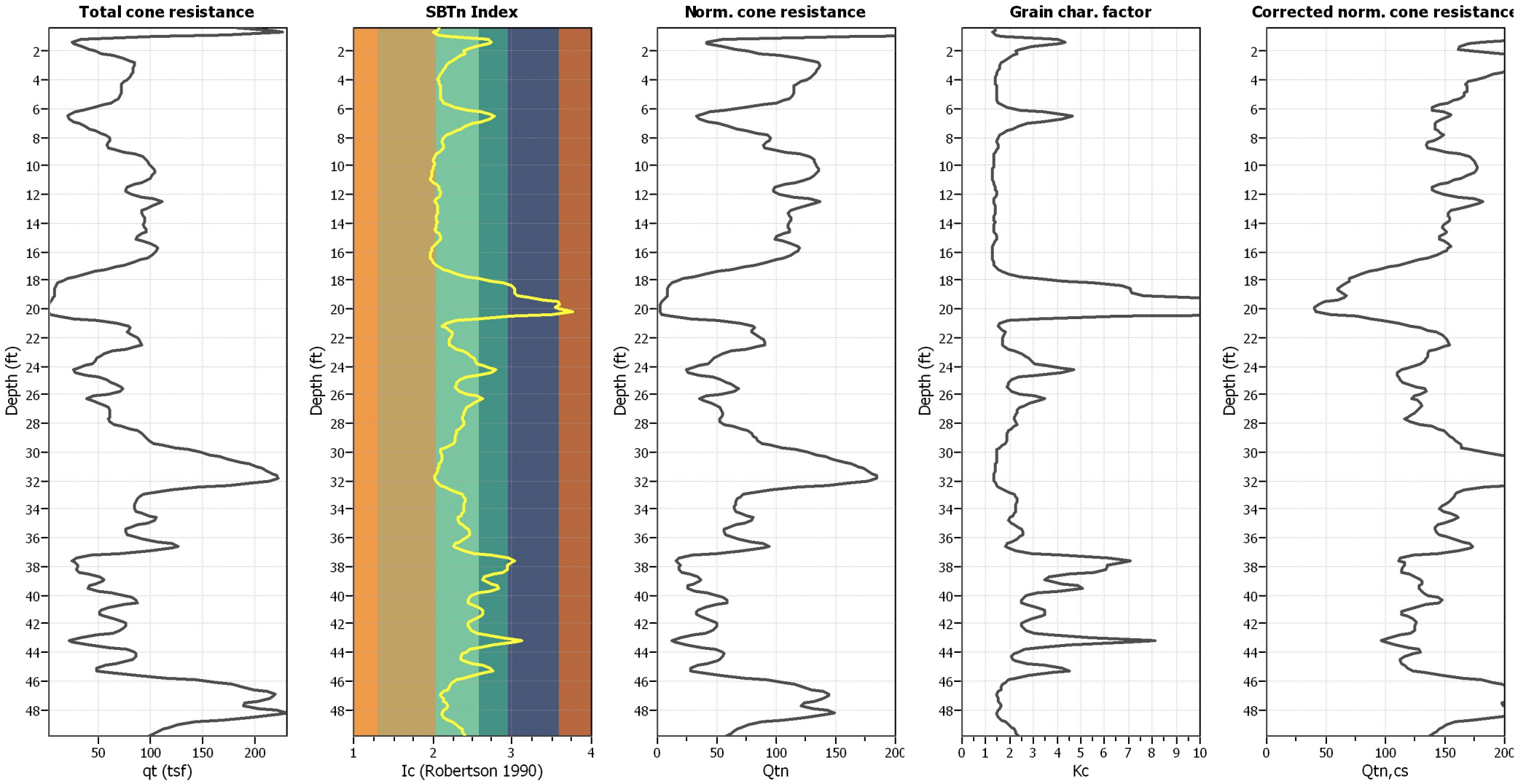
Liquefaction analysis overall plots (intermediate results)



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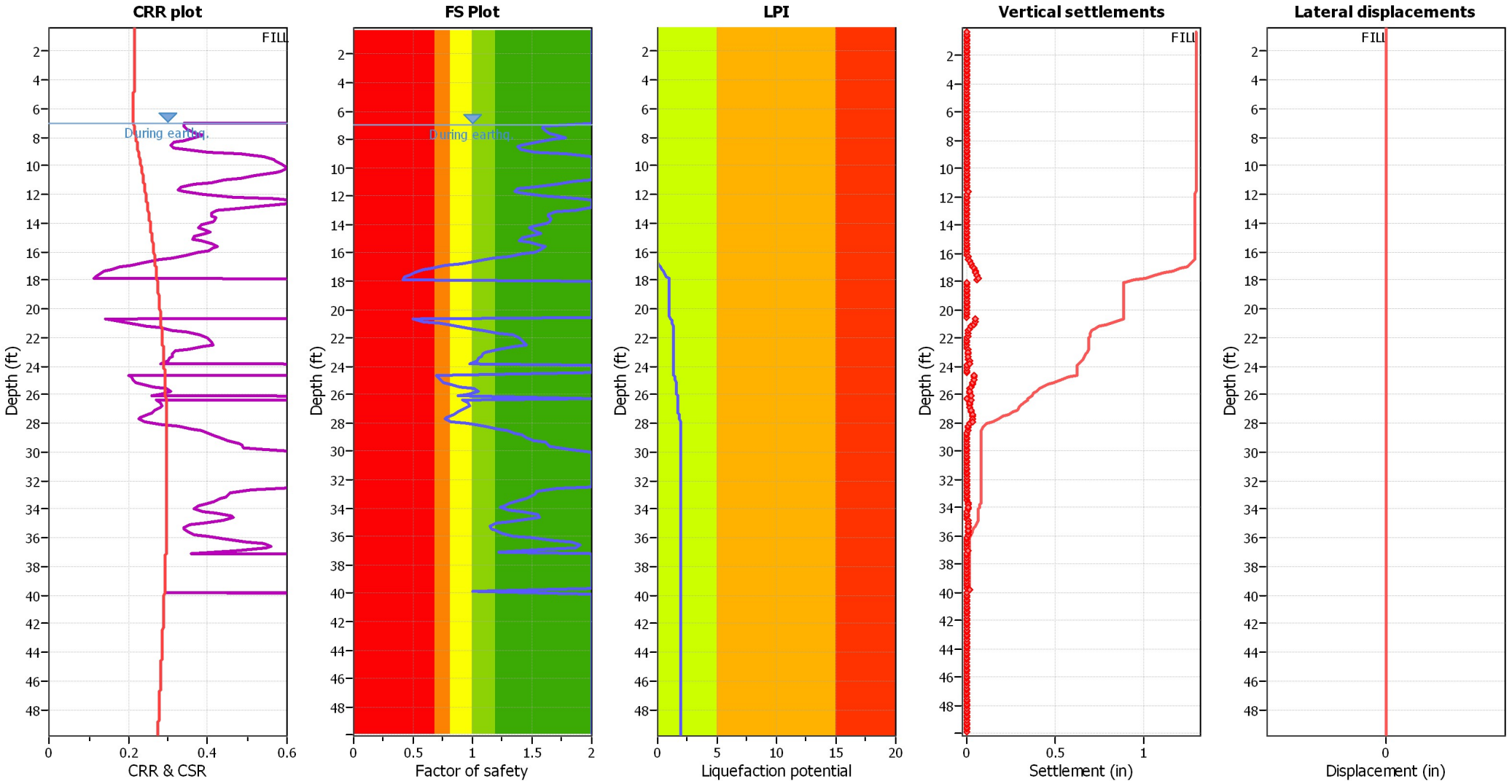
Liquefaction analysis overall plots



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Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
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- Very high risk
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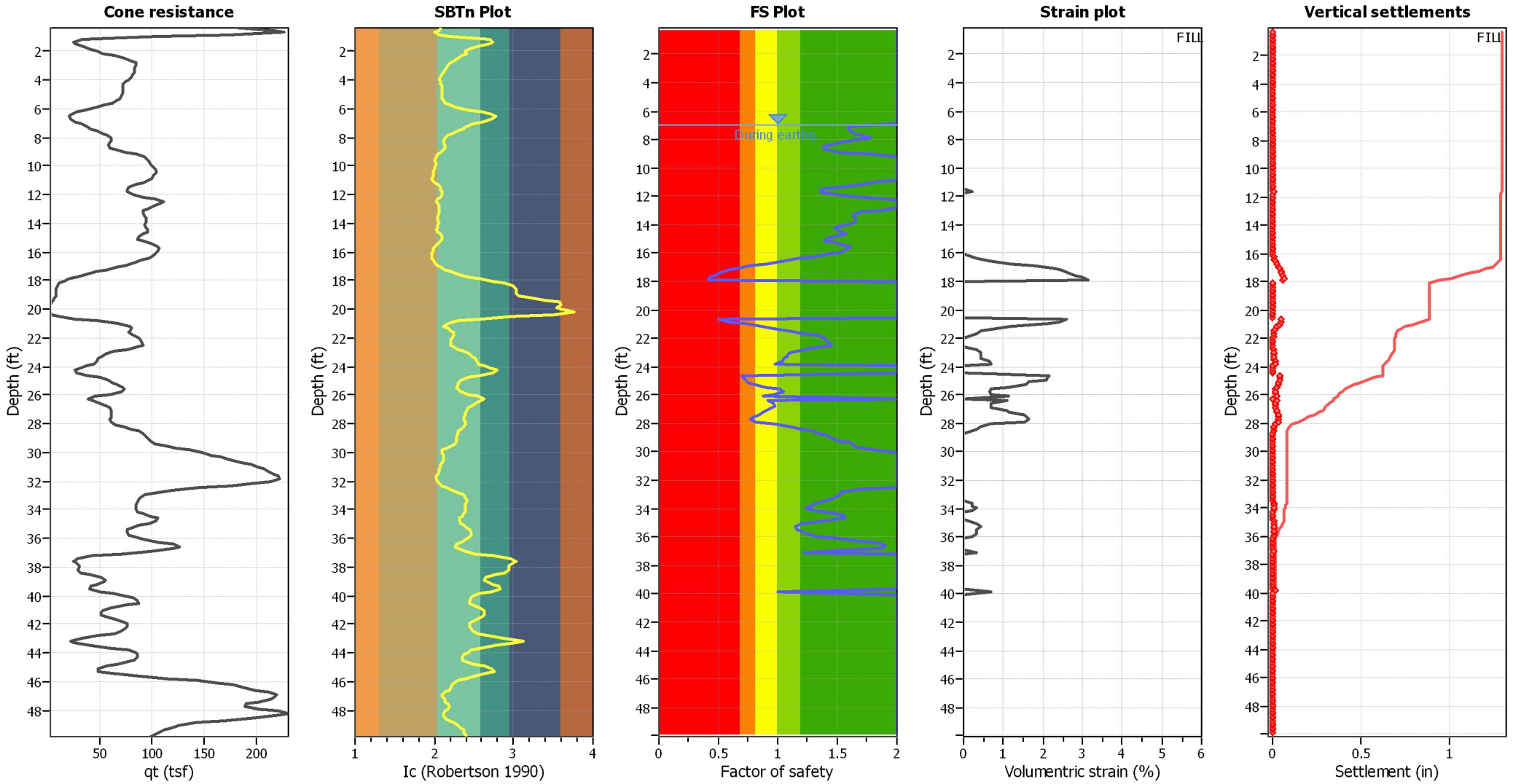
Estimation of post-earthquake settlements



Abbreviations

q_t:	Total cone resistance (cone resistance q_c corrected for pore water effects)
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Volumentric strain:	Post-liquefaction volumentric strain

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LIQUEFACTION ANALYSIS REPORT

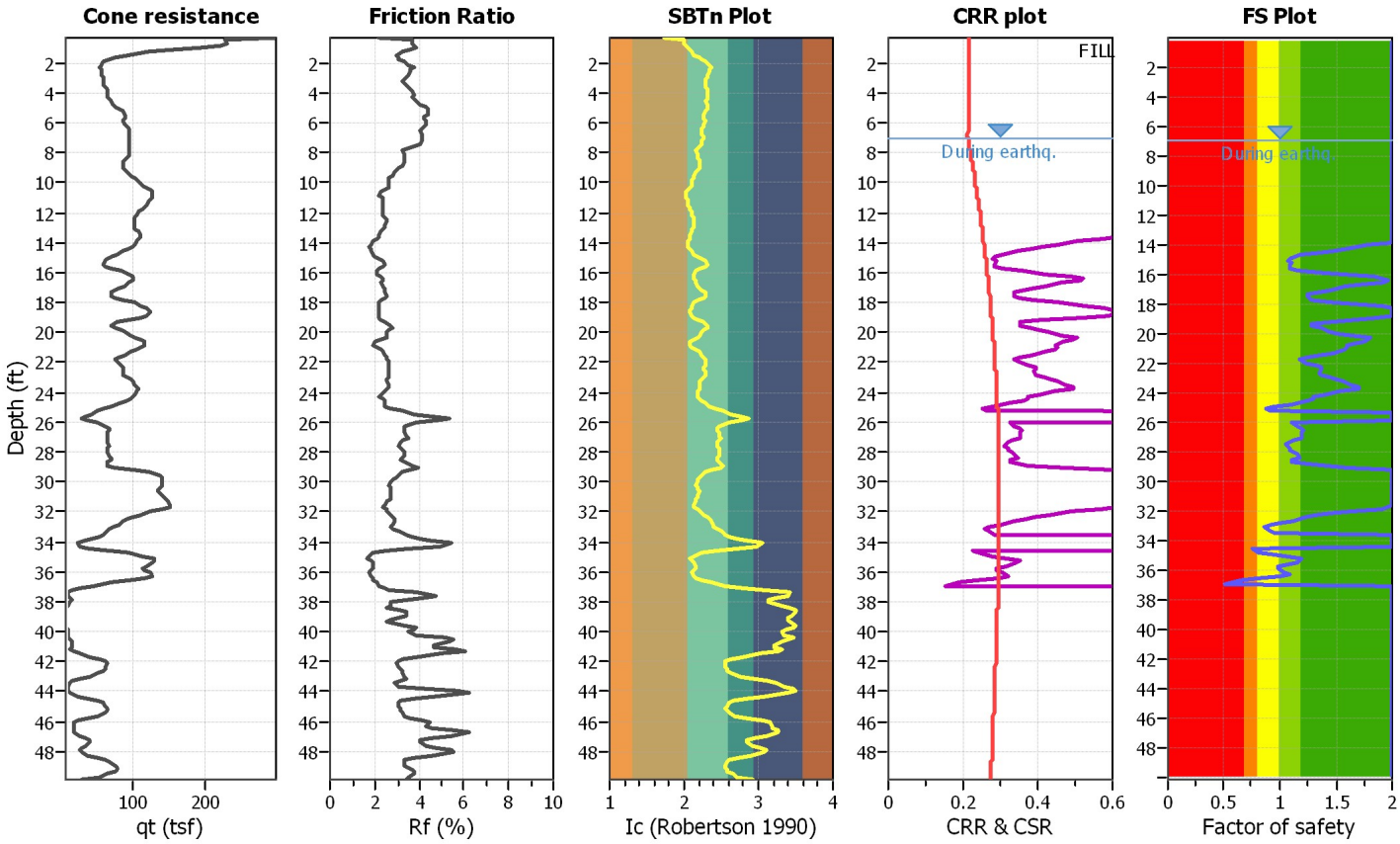
Project title : Zephyr Oceanside

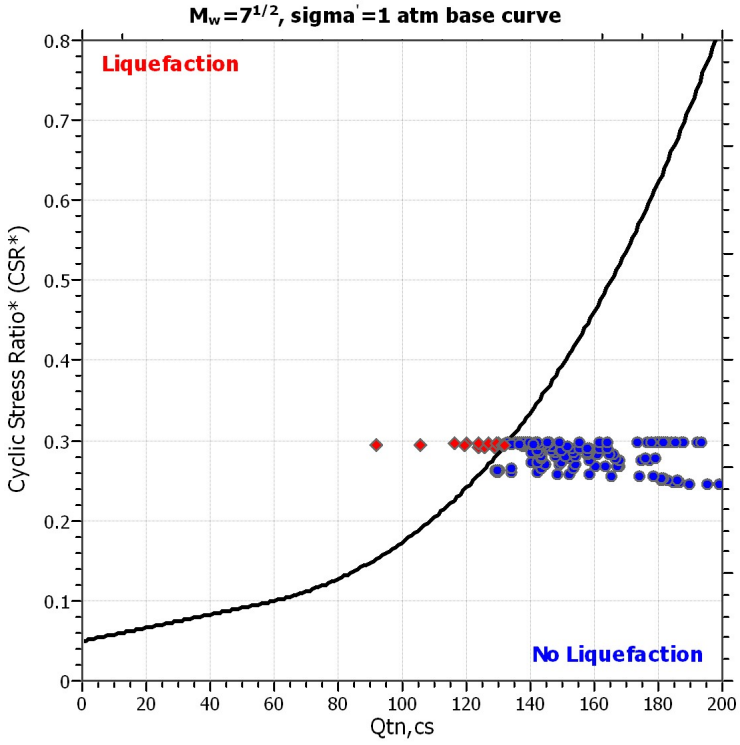
Location : Hwy 76 and Foussat Rd.,Oceanside, Ca.

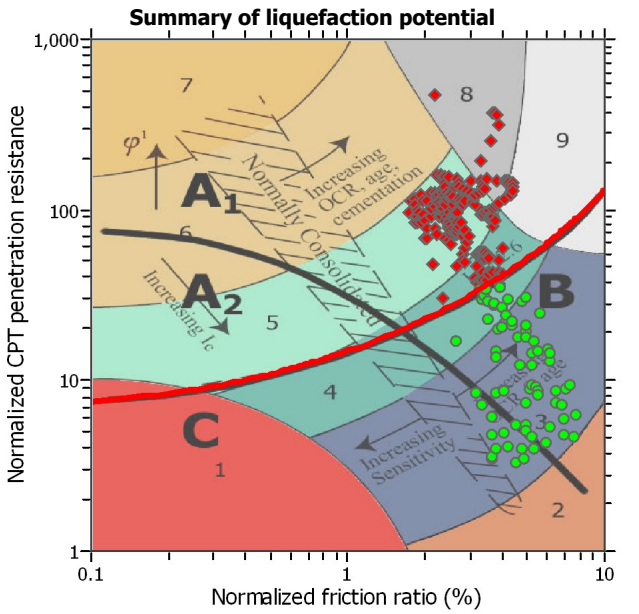
CPT file : CPT-09

Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	10.00 ft	Use fill:	Yes	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	17.00 ft	Fill height:	10.00 ft	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	120.00 lb/ft^3	Limit depth:	50.00 ft
Earthquake magnitude M_w:	6.72	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.45	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		







Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
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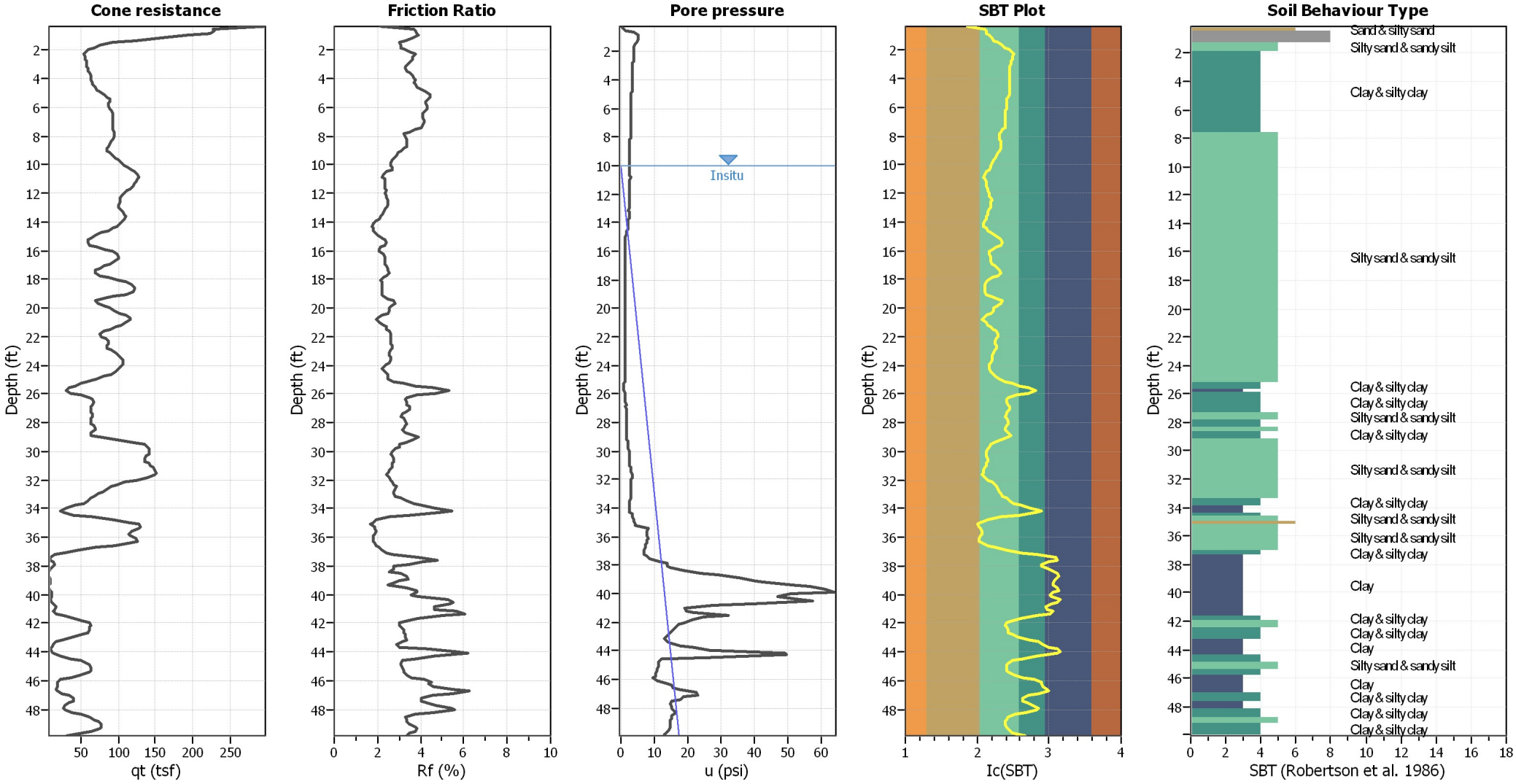
CPT basic interpretation plots



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Peak ground acceleration:	0.45	Use fill:	Yes	Limit depth applied:	Yes
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SBT legend

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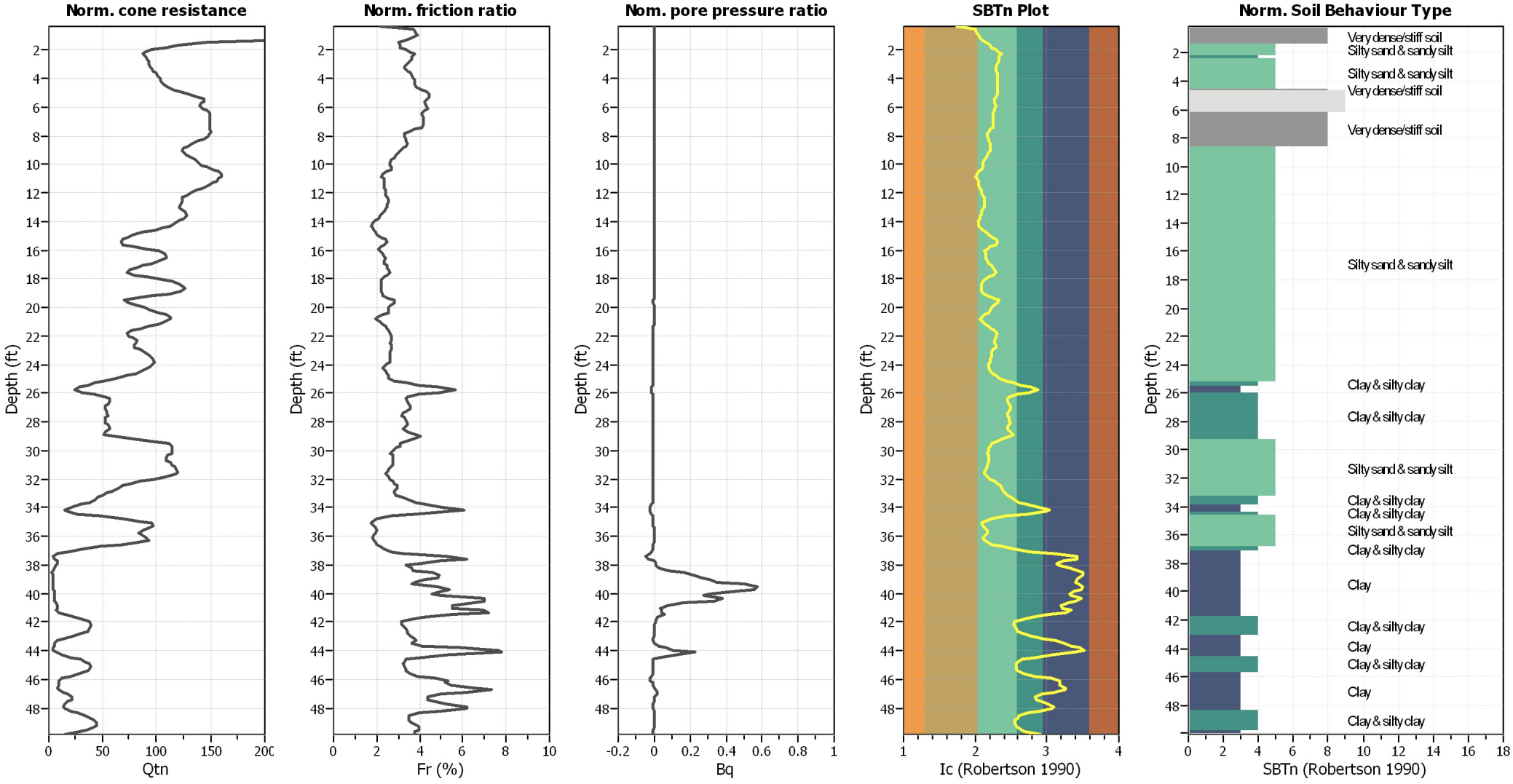
CPT basic interpretation plots (normalized)



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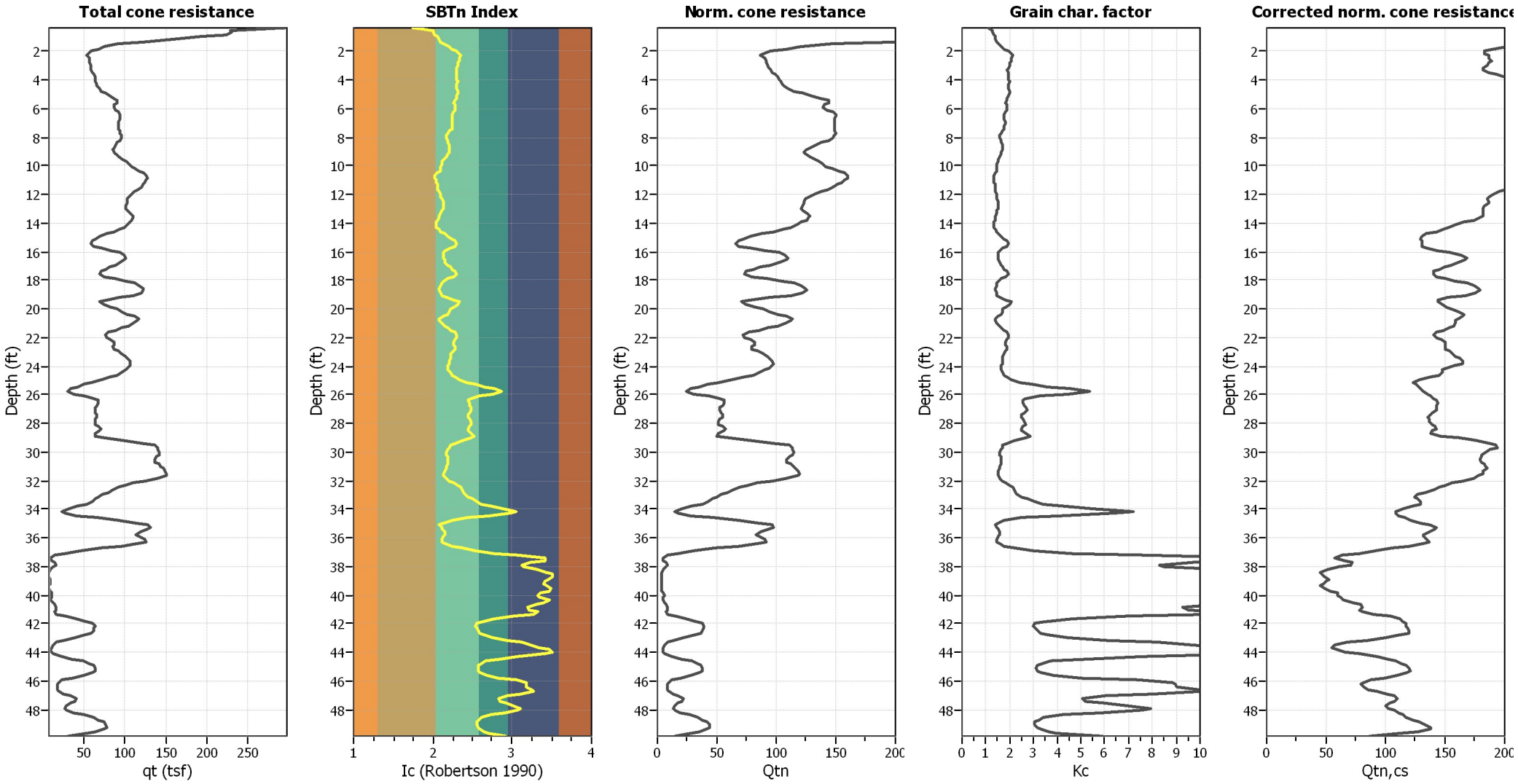
Liquefaction analysis overall plots (intermediate results)



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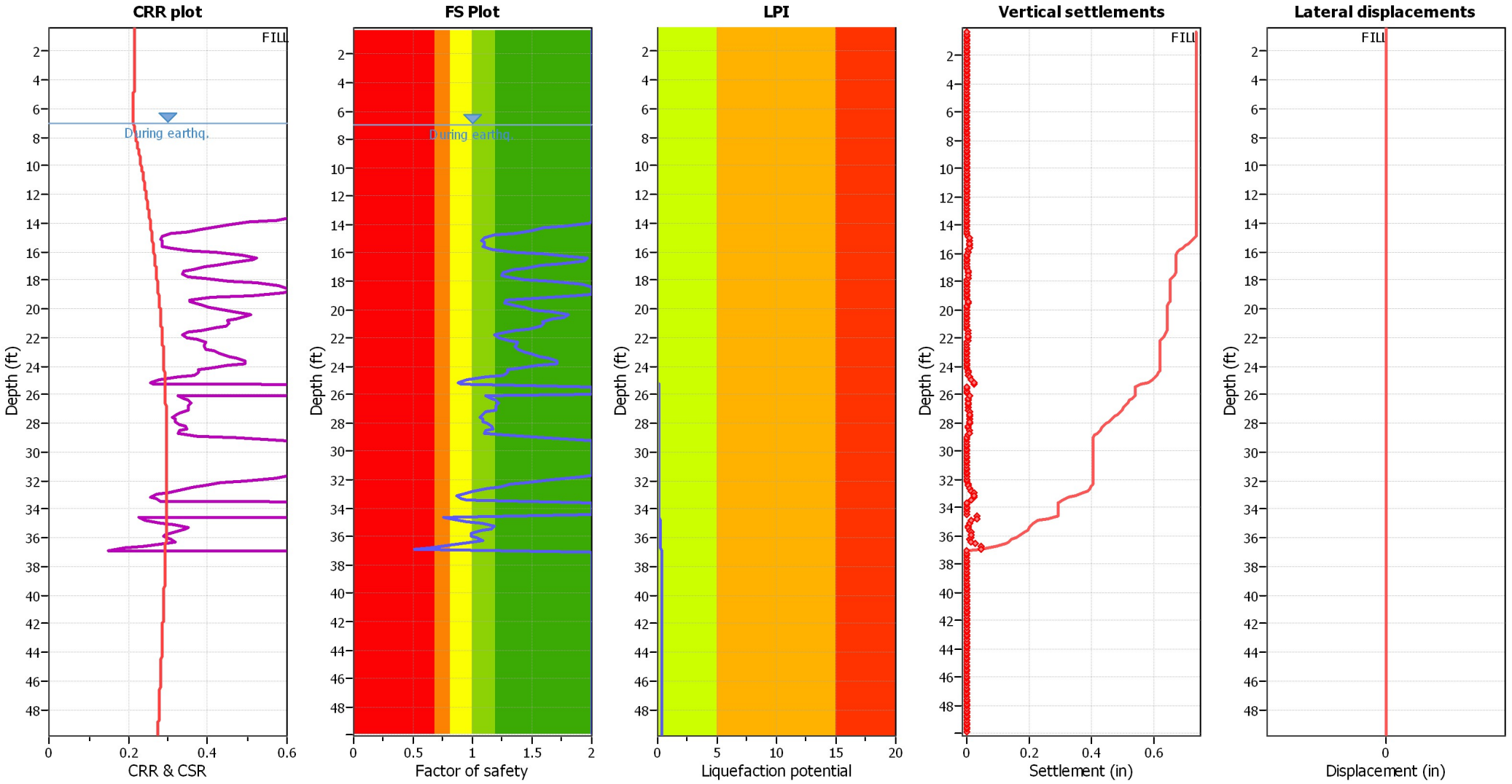
Liquefaction analysis overall plots



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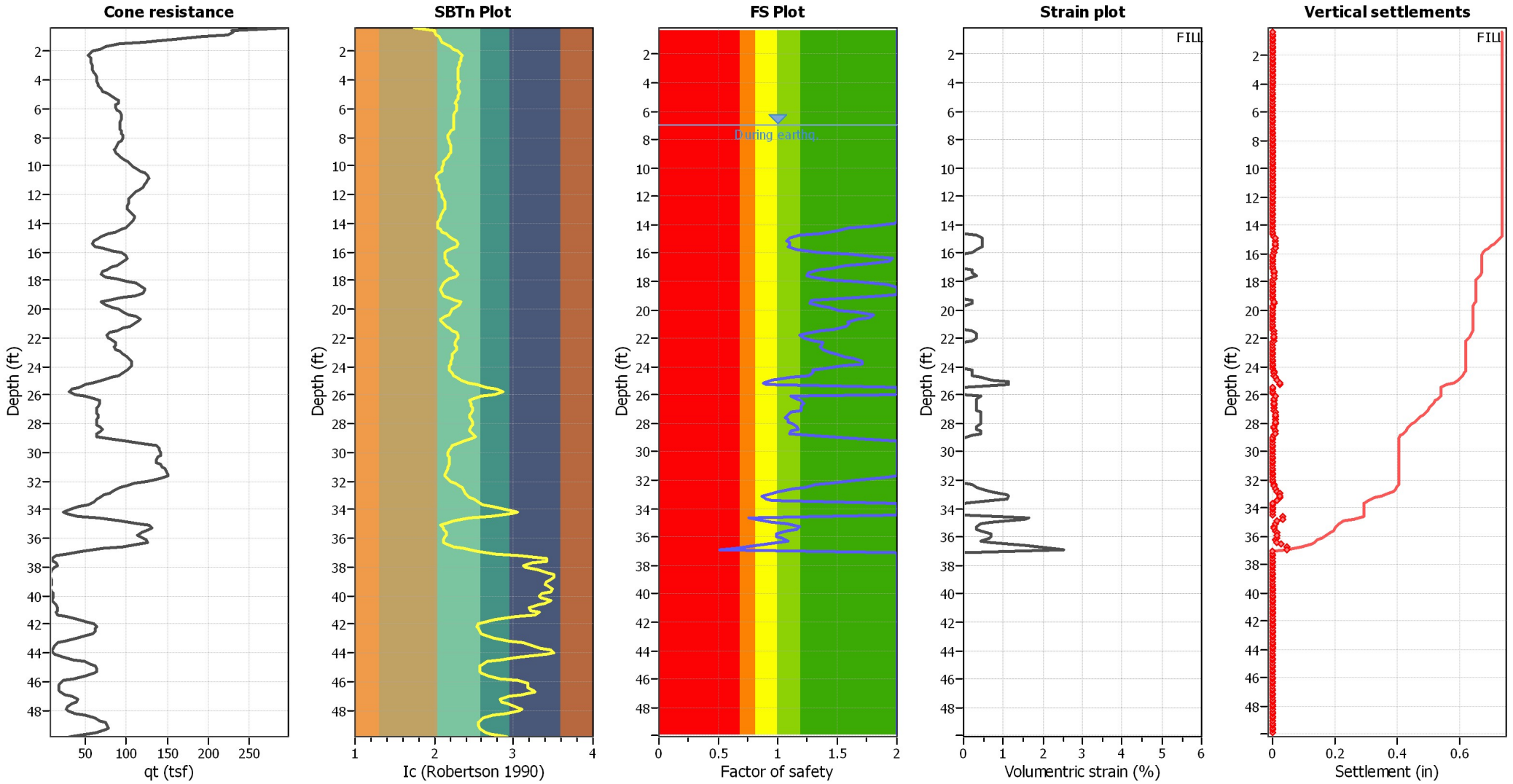

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LIQUEFACTION ANALYSIS REPORT

Project title : Zephyr Oceanside **Location : Hwy 76 and Foussat Rd.,Oceanside, Ca.**

CPT file : CPT-10

Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	10.00 ft	Use fill:	Yes	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	17.00 ft	Fill height:	10.00 ft	Limit depth applied:	Yes
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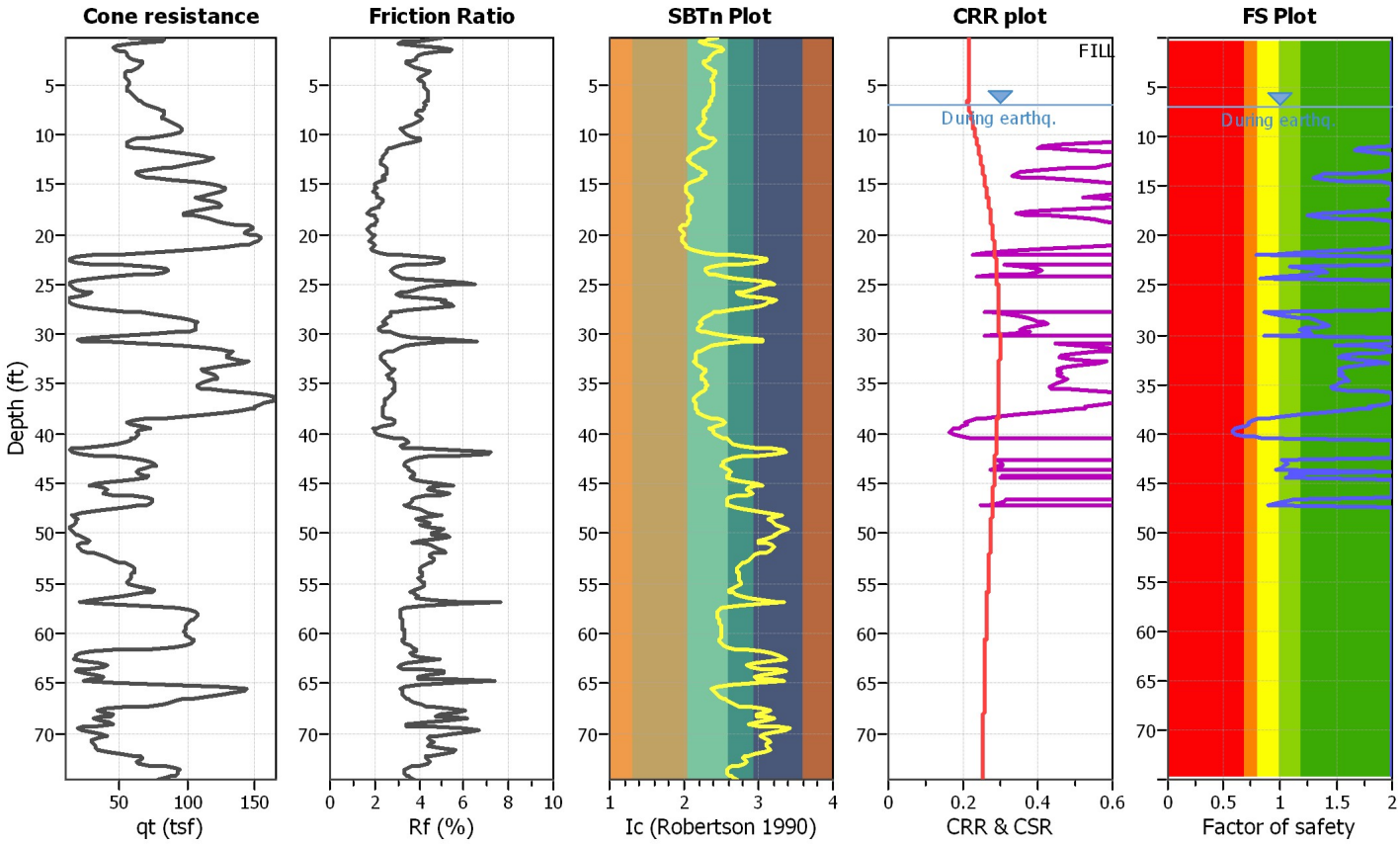
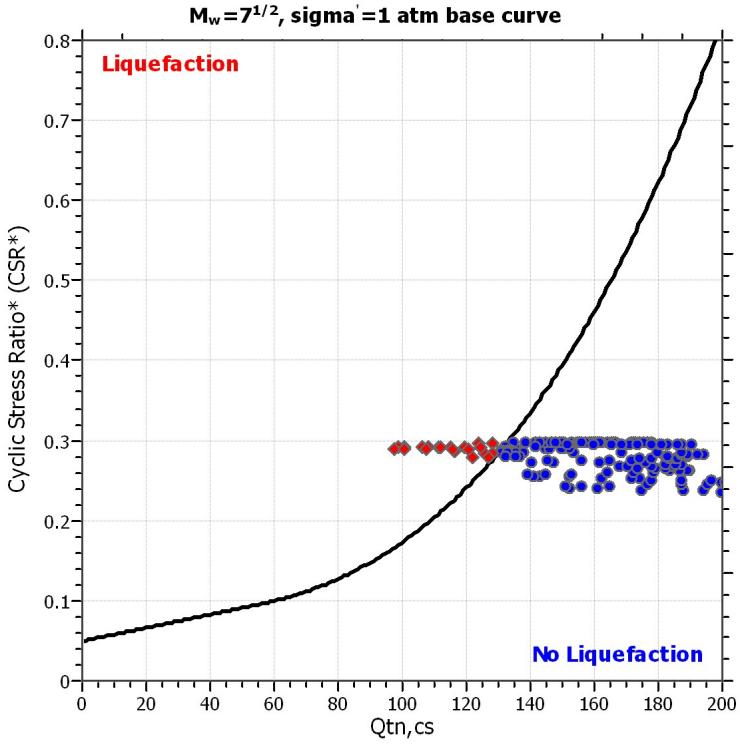
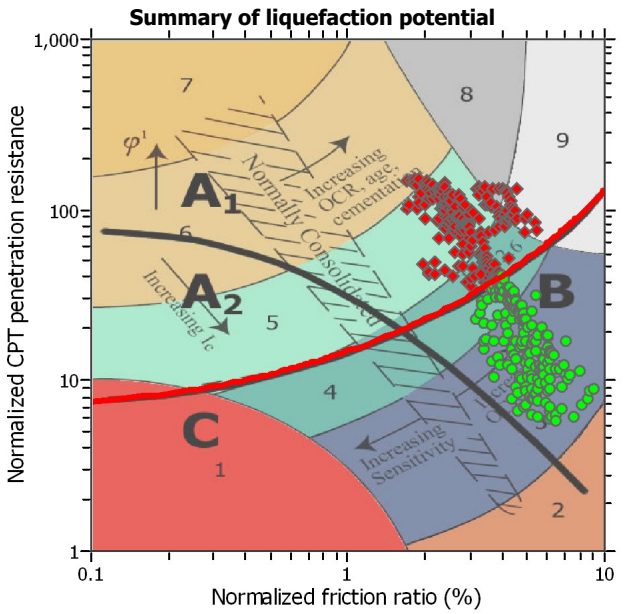
Earthquake magnitude M_w:	6.72	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.45	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

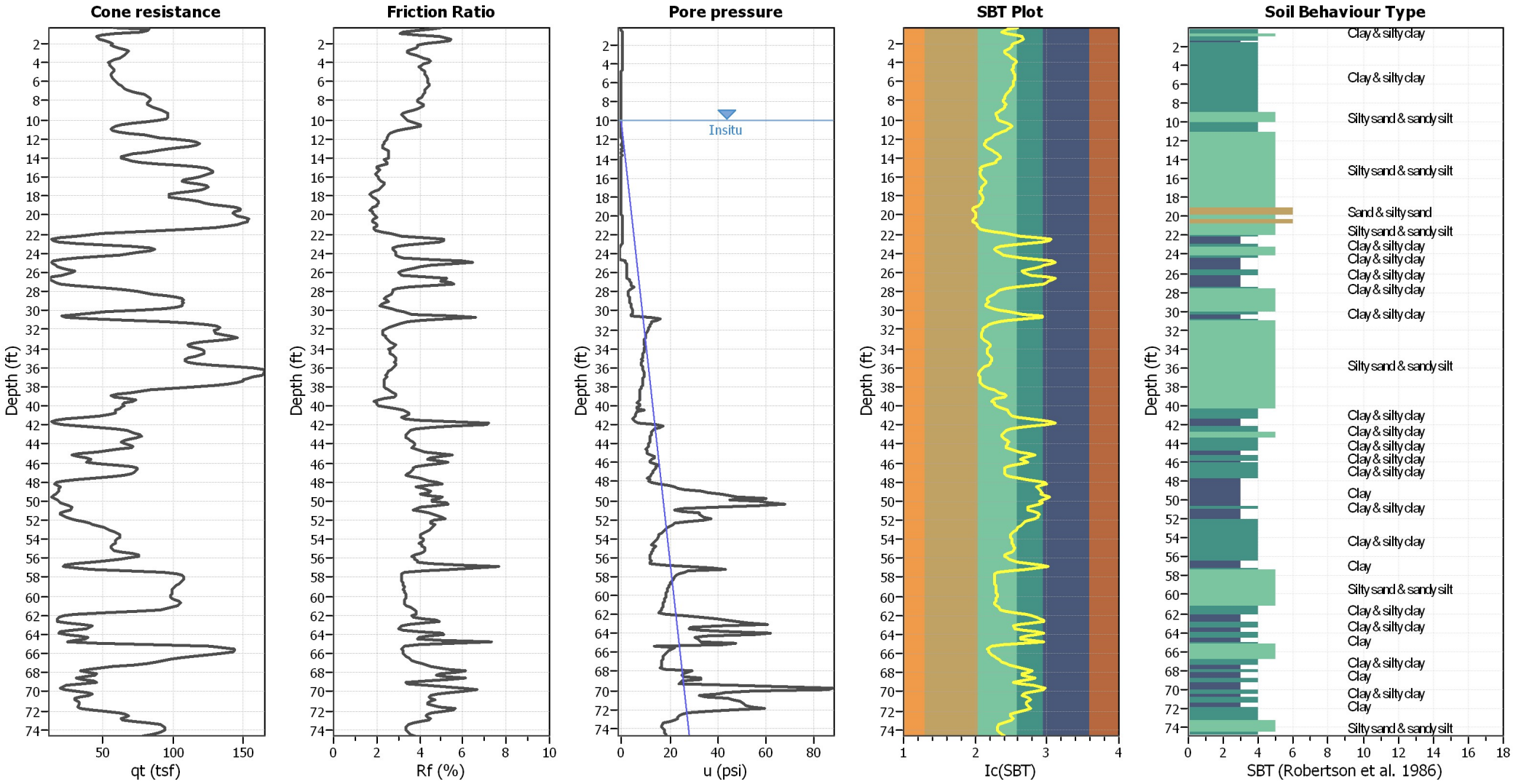






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



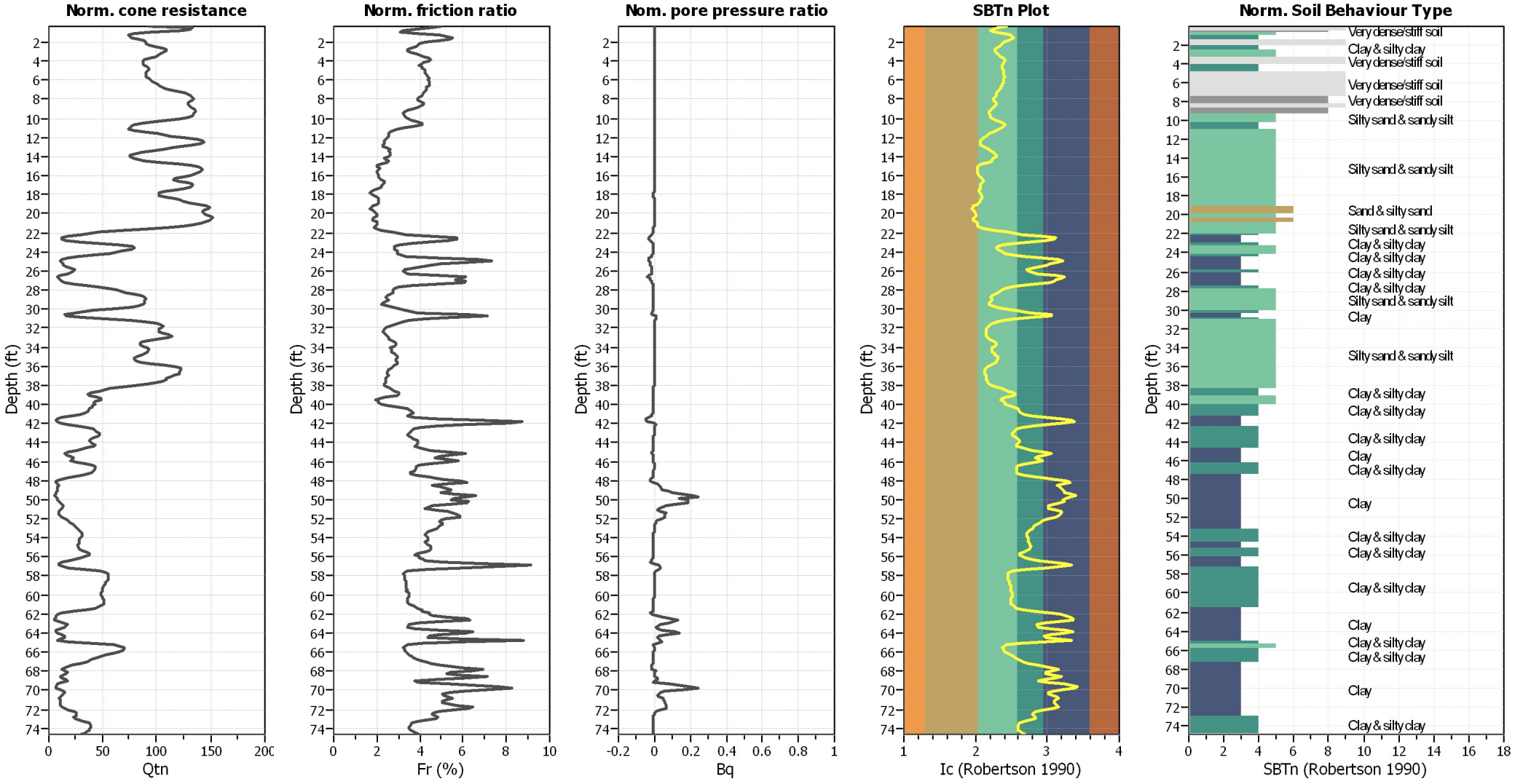
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	17.00 ft	Fill weight:	120.00 lb/ft^3
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_σ applied:	Yes
Earthquake magnitude M_w:	6.72	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.45	Use fill:	Yes	Limit depth applied:	Yes
Depth to water table (insitu):	10.00 ft	Fill height:	10.00 ft	Limit depth:	60.00 ft

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

CPT basic interpretation plots (normalized)



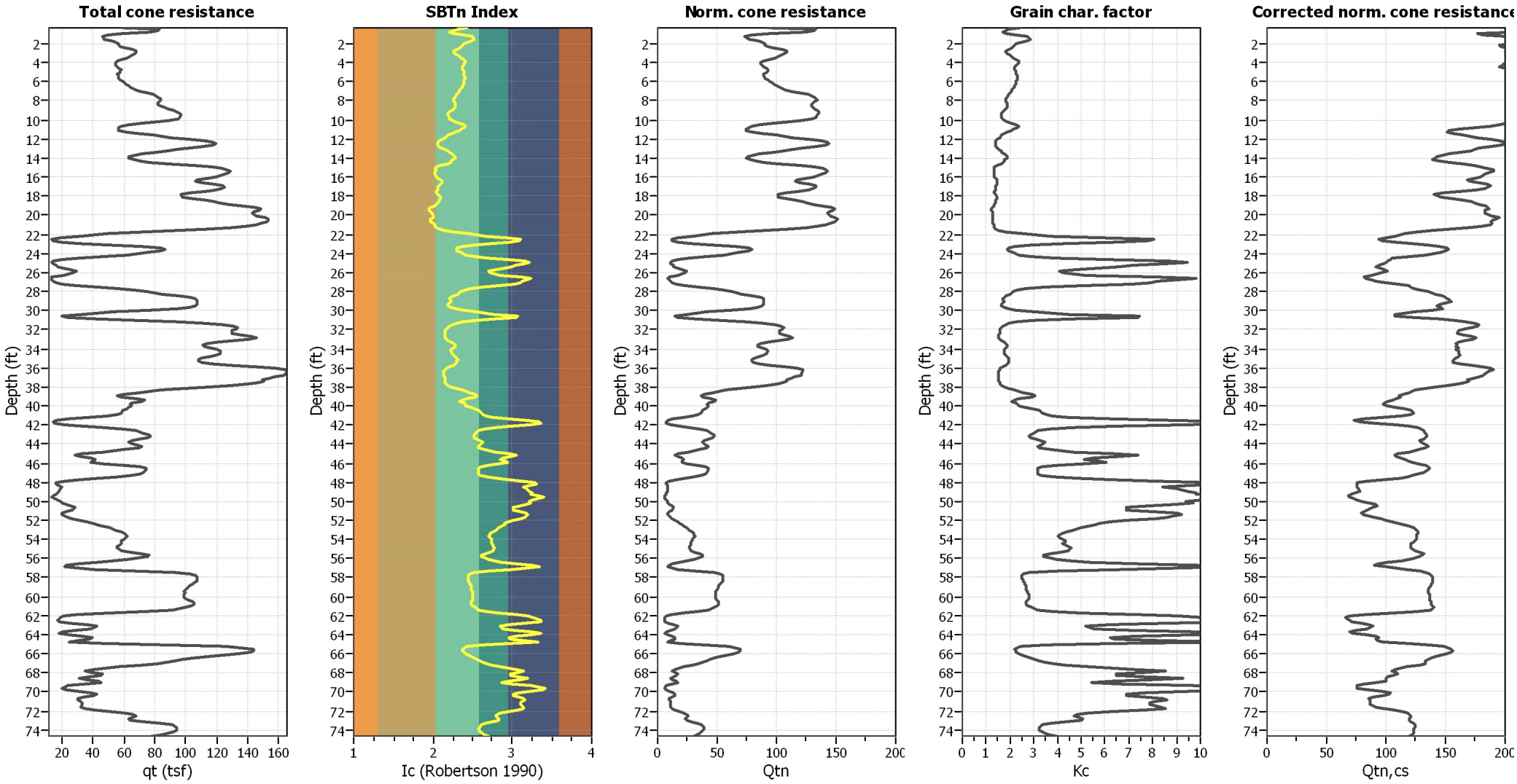
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	17.00 ft	Fill weight:	120.00 lb/ft^3
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_σ applied:	Yes
Earthquake magnitude M_w:	6.72	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.45	Use fill:	Yes	Limit depth applied:	Yes
Depth to water table (insitu):	10.00 ft	Fill height:	10.00 ft	Limit depth:	60.00 ft

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

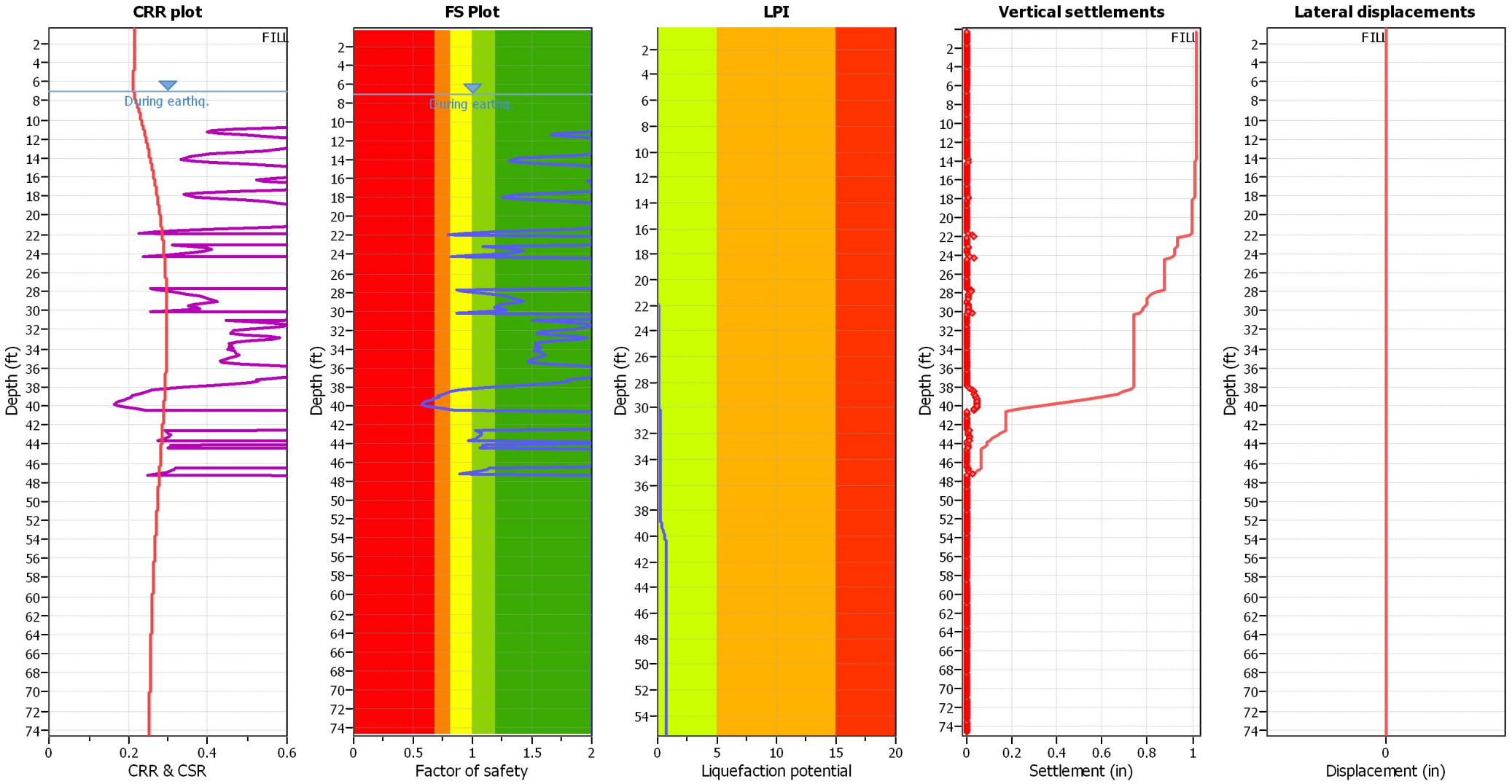
Liquefaction analysis overall plots (intermediate results)



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	17.00 ft	Fill weight:	120.00 lb/ft^3
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_σ applied:	Yes
Earthquake magnitude M_w:	6.72	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.45	Use fill:	Yes	Limit depth applied:	Yes
Depth to water table (insitu):	10.00 ft	Fill height:	10.00 ft	Limit depth:	60.00 ft

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	17.00 ft	Fill weight:	120.00 lb/ft^3
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_σ applied:	Yes
Earthquake magnitude M_w:	6.72	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.45	Use fill:	Yes	Limit depth applied:	Yes
Depth to water table (insitu):	10.00 ft	Fill height:	10.00 ft	Limit depth:	60.00 ft

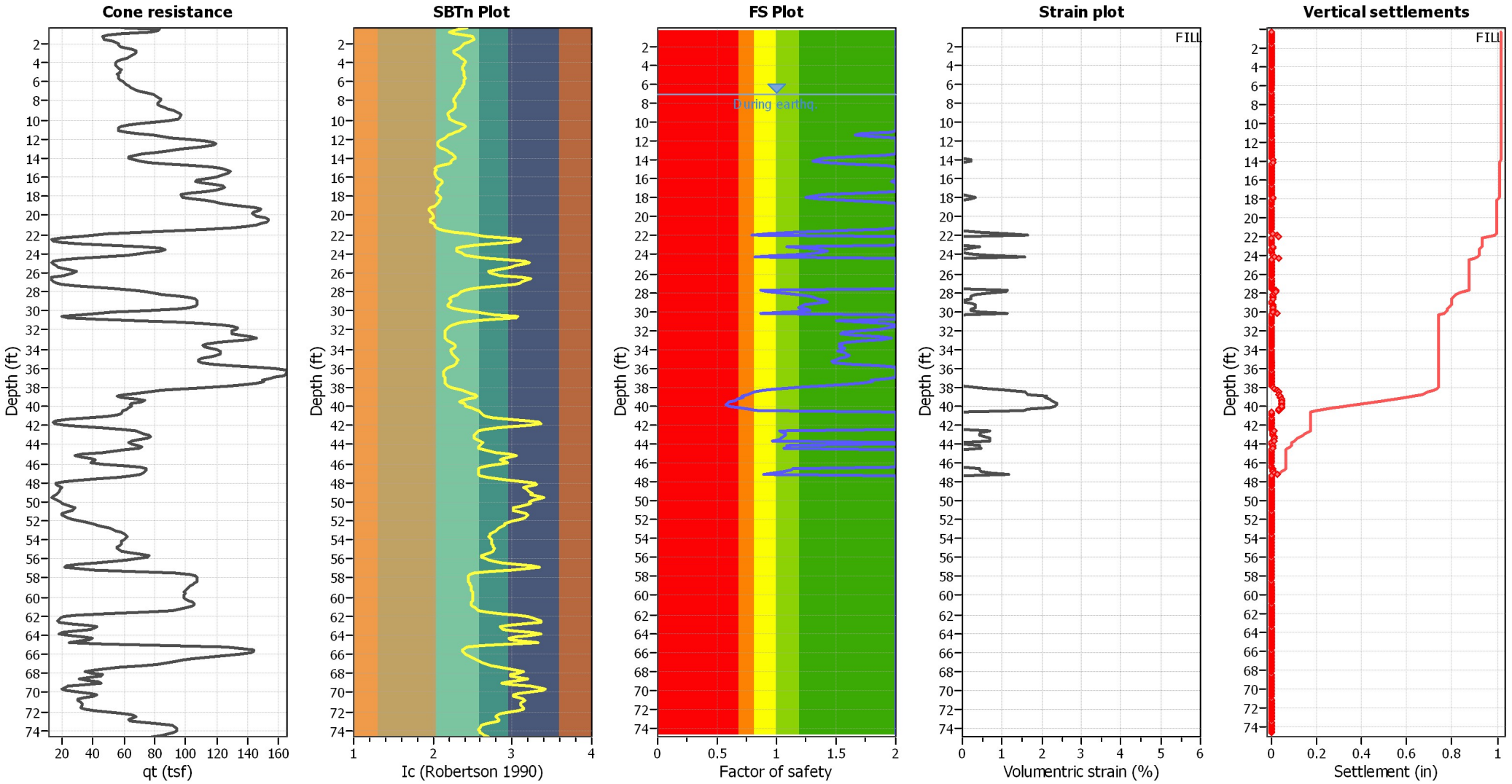
F.S. color scheme

- 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

Estimation of post-earthquake settlements



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
Volumentric strain:	Post-liquefaction volumentric strain

EEI
Geotechnical and Environmental Solutions
Carlsbad, CA

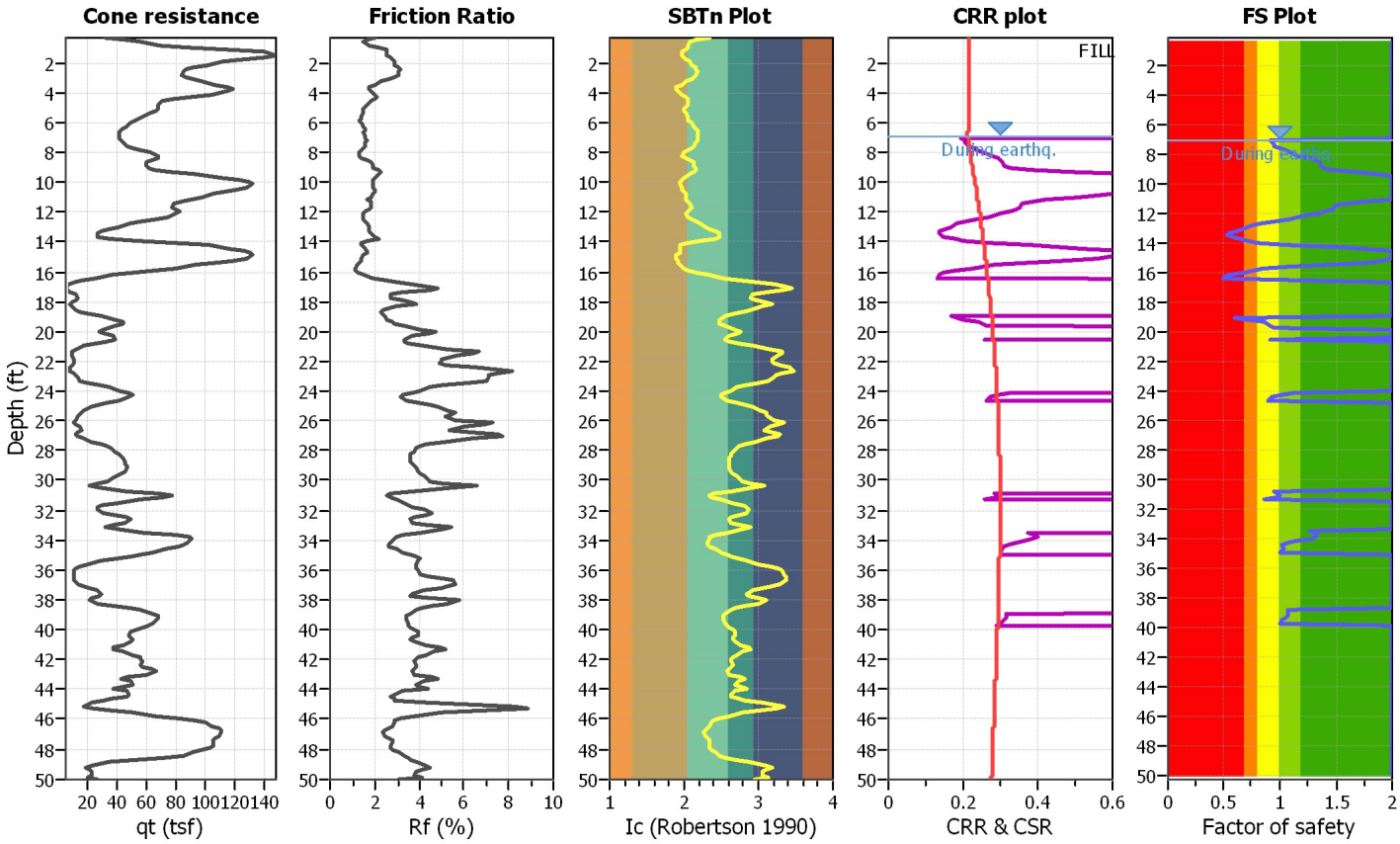
LIQUEFACTION ANALYSIS REPORT

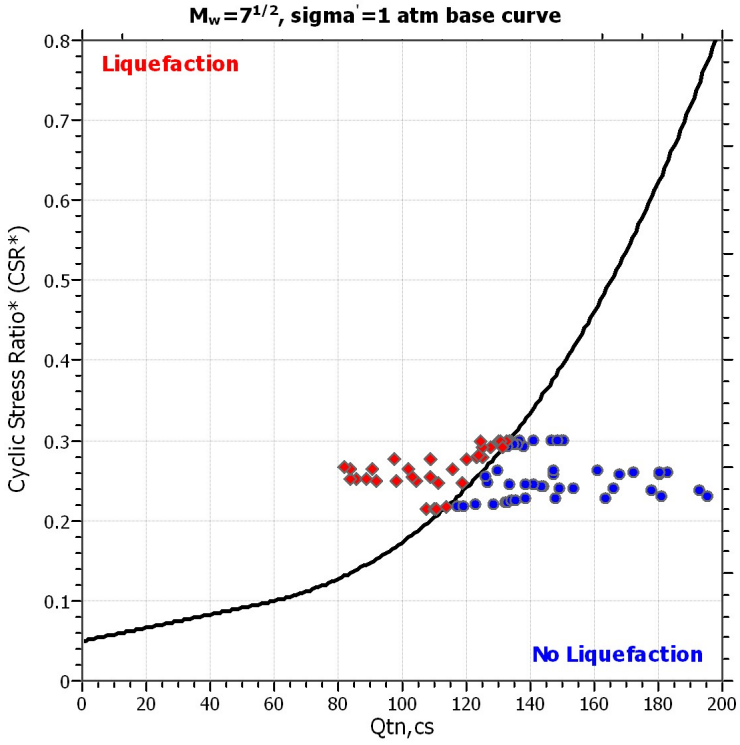
Project title : Zephyr Oceanside **Location : Hwy 76 and Foussat Rd.,Oceanside, Ca.**

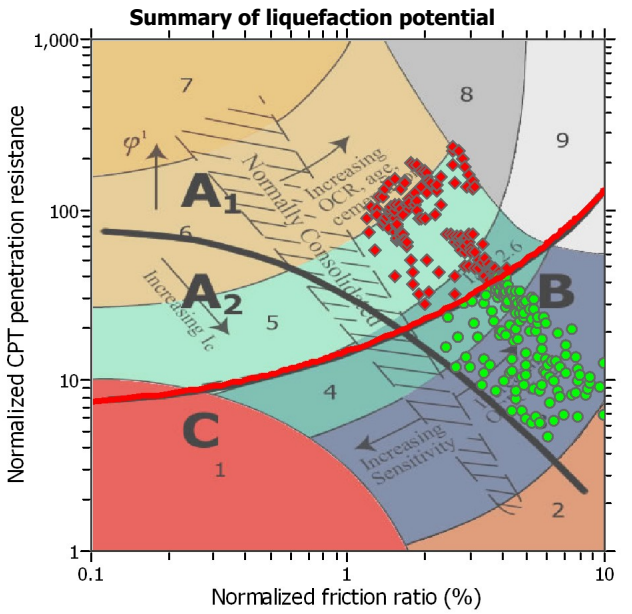
CPT file : CPT-11

Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	10.00 ft	Use fill:	Yes	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	17.00 ft	Fill height:	10.00 ft	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	120.00 lb/ft^3	Limit depth:	50.00 ft
Earthquake magnitude M_w:	6.72	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.45	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

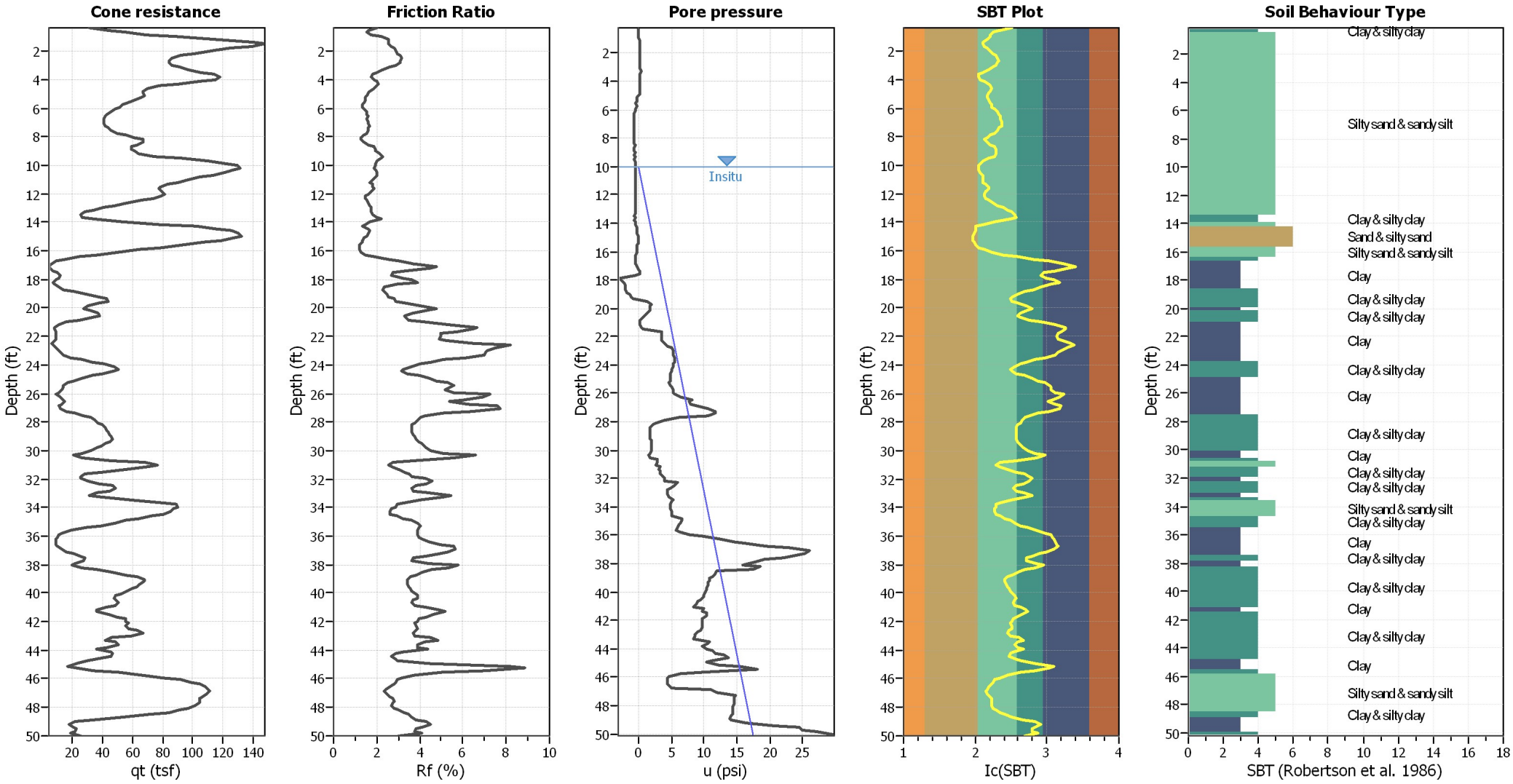






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



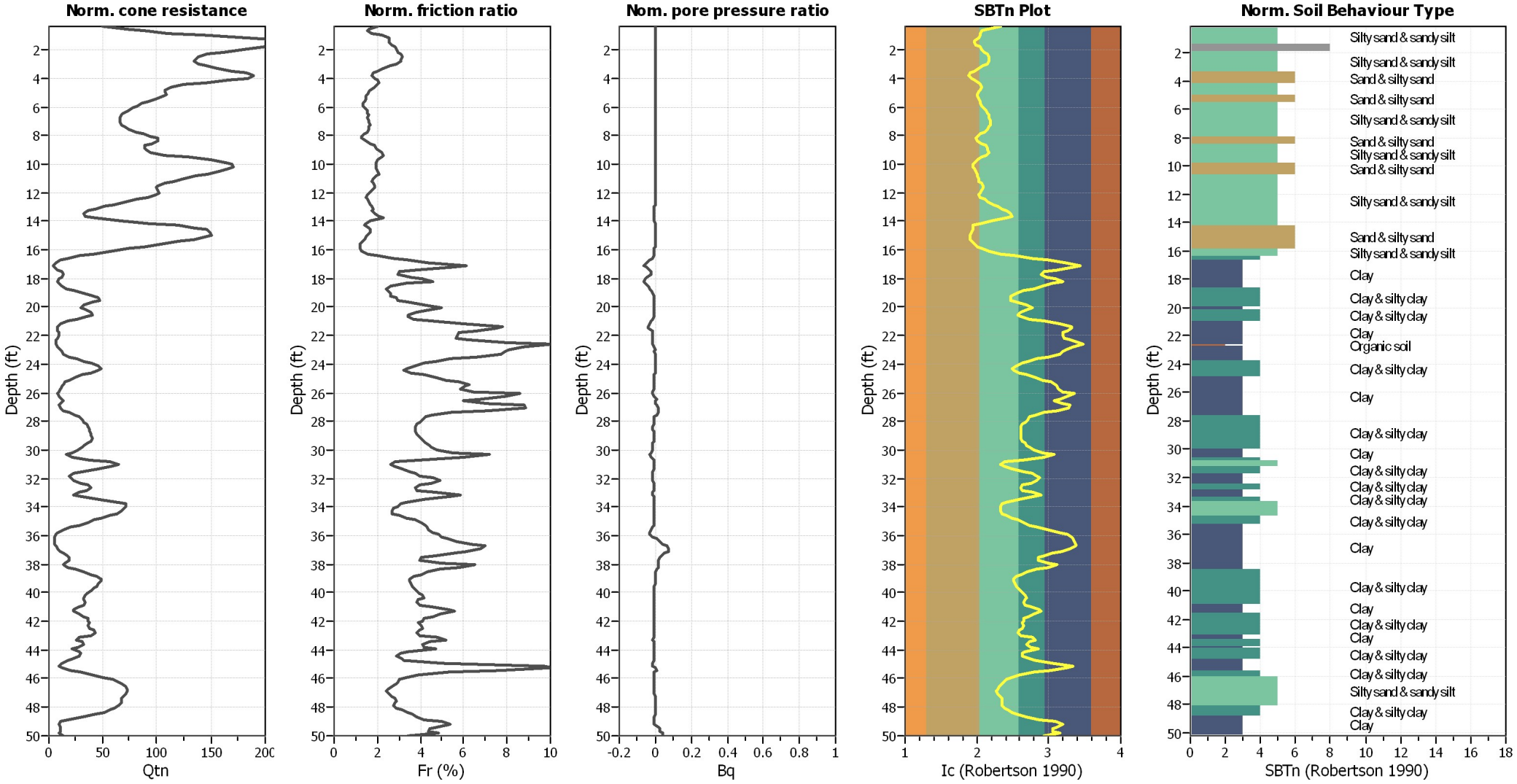
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	17.00 ft	Fill weight:	120.00 lb/ft^3
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_σ applied:	Yes
Earthquake magnitude M_w:	6.72	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.45	Use fill:	Yes	Limit depth applied:	Yes
Depth to water table (insitu):	10.00 ft	Fill height:	10.00 ft	Limit depth:	50.00 ft

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

CPT basic interpretation plots (normalized)



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	17.00 ft	Fill weight:	120.00 lb/ft^3
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_σ applied:	Yes
Earthquake magnitude M_w:	6.72	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.45	Use fill:	Yes	Limit depth applied:	Yes
Depth to water table (insitu):	10.00 ft	Fill height:	10.00 ft	Limit depth:	50.00 ft

SBTn legend

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3. Clay to silty clay
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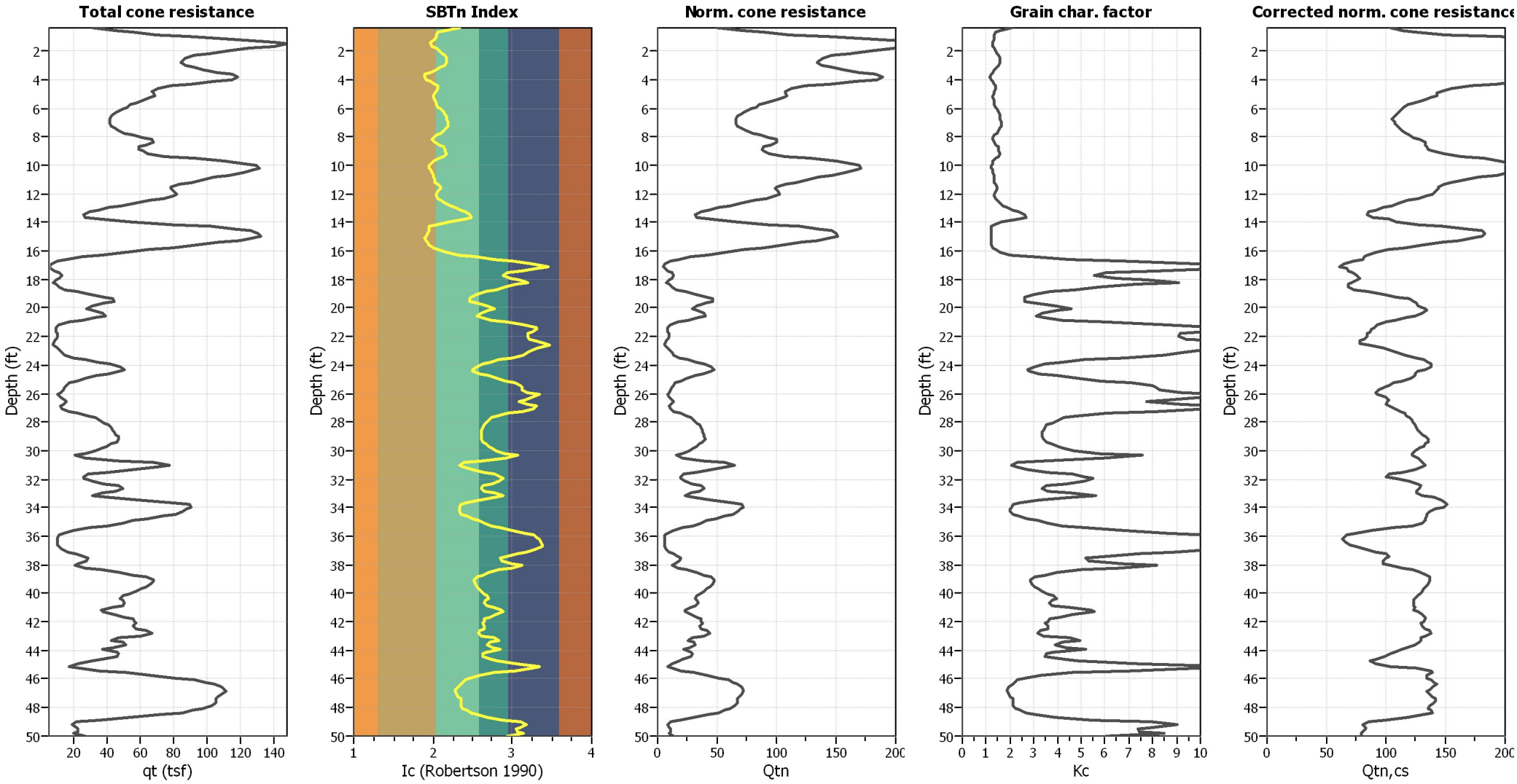
9. Very stiff fine grained

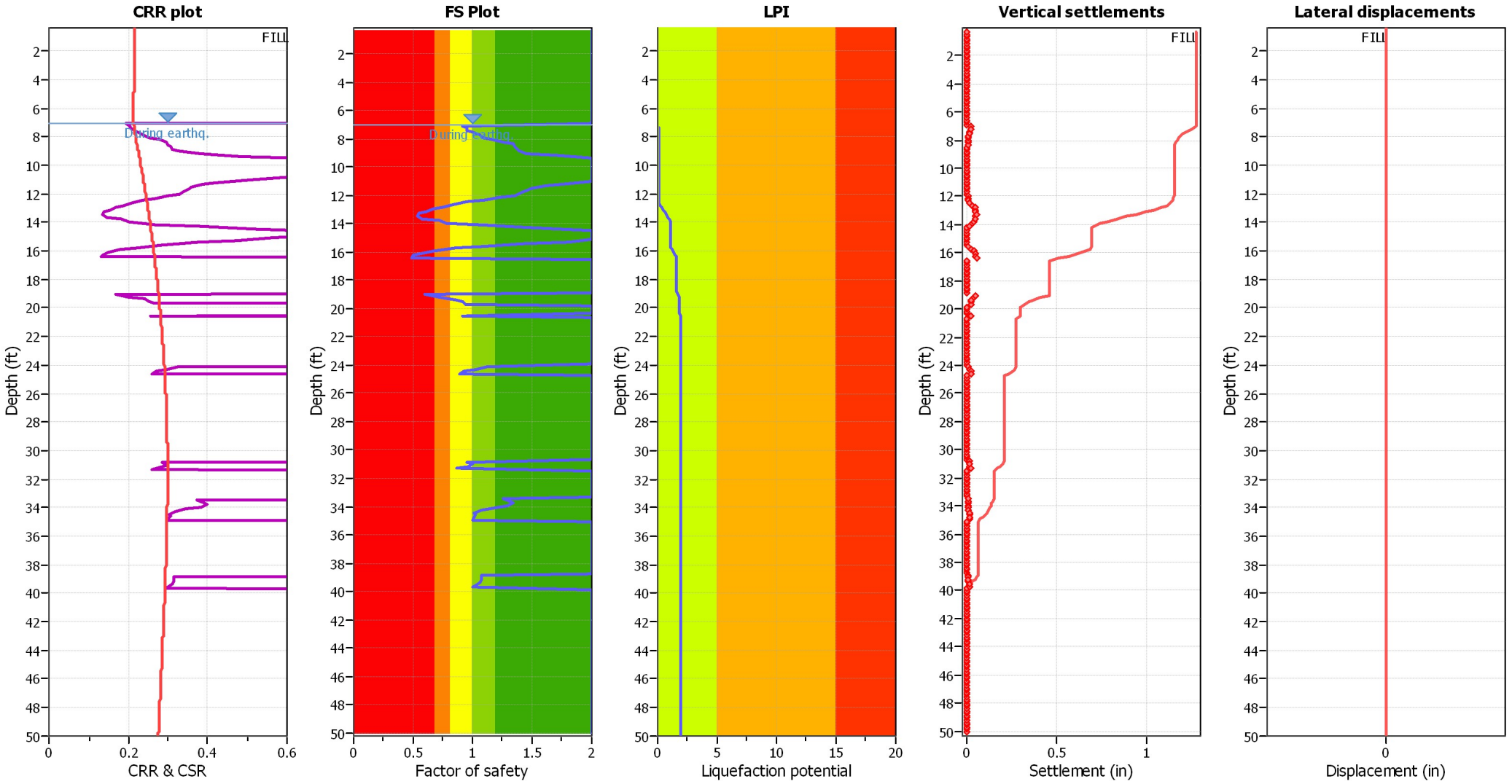
Liquefaction analysis overall plots (intermediate results)



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	17.00 ft	Fill weight:	120.00 lb/ft^3
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_σ applied:	Yes
Earthquake magnitude M_w:	6.72	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.45	Use fill:	Yes	Limit depth applied:	Yes
Depth to water table (insitu):	10.00 ft	Fill height:	10.00 ft	Limit depth:	50.00 ft

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	17.00 ft	Fill weight:	120.00 lb/ft^3
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_σ applied:	Yes
Earthquake magnitude M_w:	6.72	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.45	Use fill:	Yes	Limit depth applied:	Yes
Depth to water table (insitu):	10.00 ft	Fill height:	10.00 ft	Limit depth:	50.00 ft

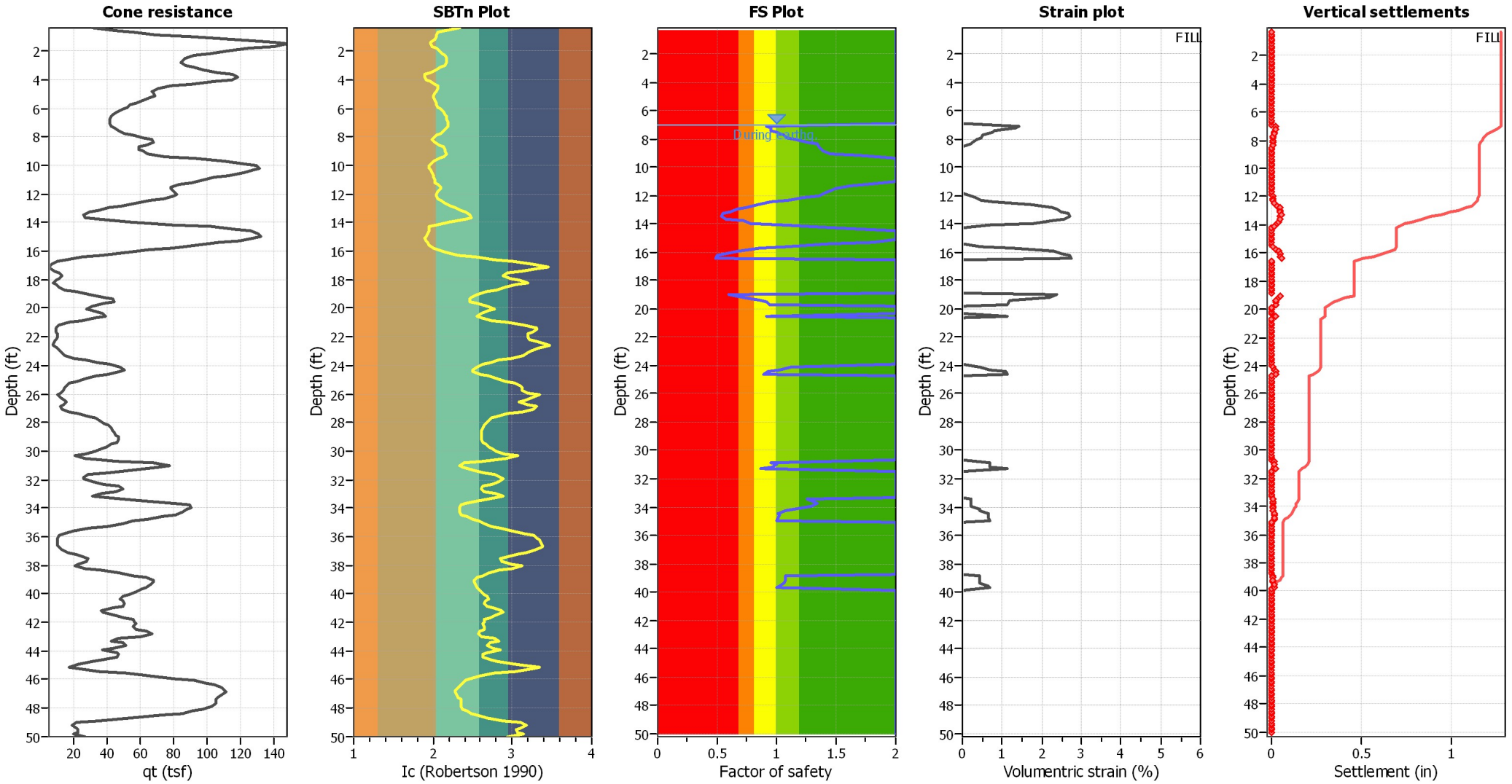
F.S. color scheme

- 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

Estimation of post-earthquake settlements



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
Volumentric strain:	Post-liquefaction volumentric strain

EEI
Geotechnical and Environmental Solutions
Carlsbad, CA

LIQUEFACTION ANALYSIS REPORT

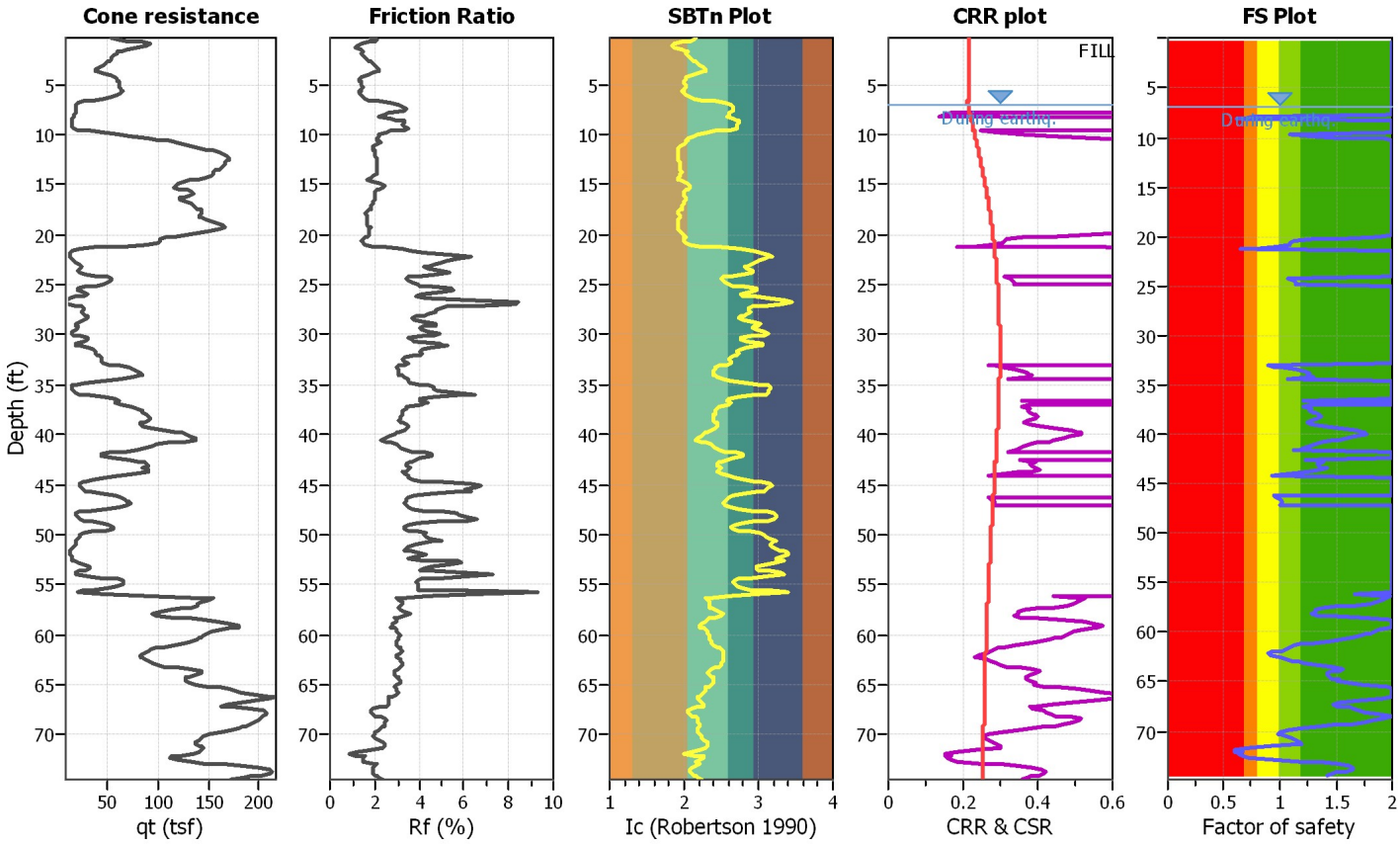
Project title : Zephyr Oceanside

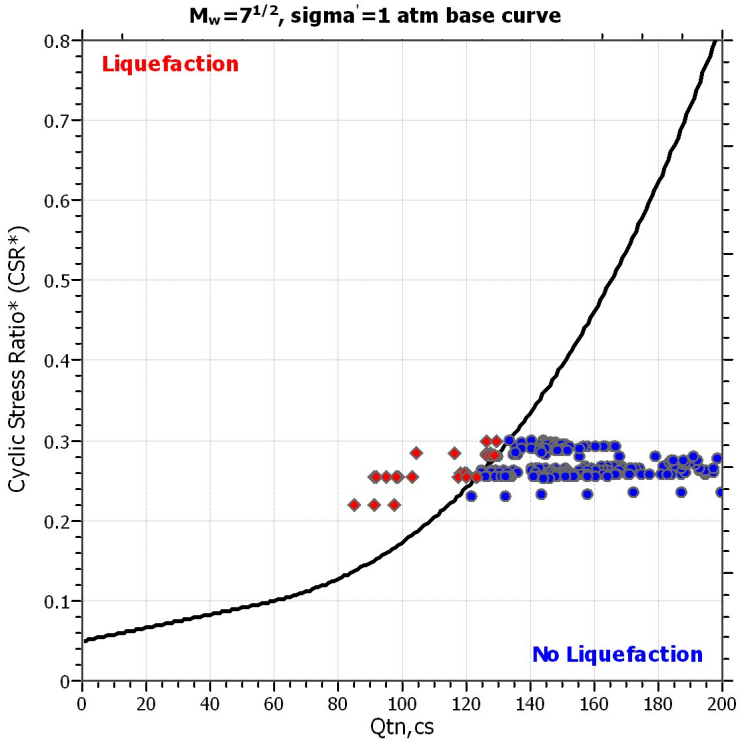
Location : Hwy 76 and Foussat Rd.,Oceanside, Ca.

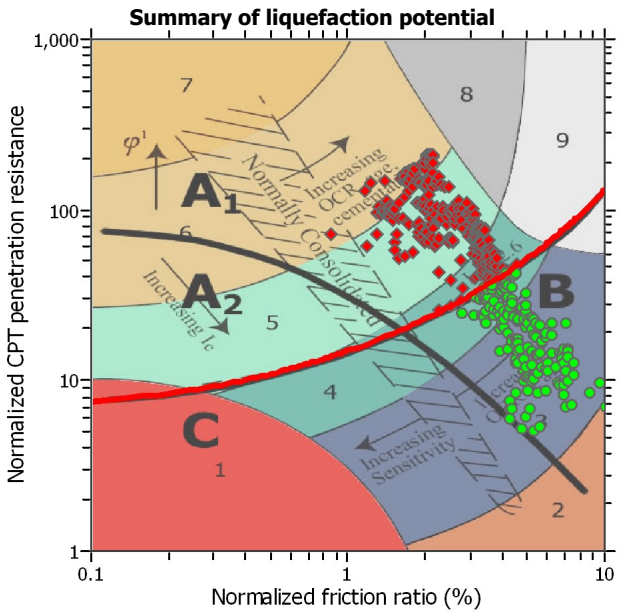
CPT file : CPT-12

Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	10.00 ft	Use fill:	Yes	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	17.00 ft	Fill height:	10.00 ft	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	120.00 lb/ft^3	Limit depth:	N/A
Earthquake magnitude M_w:	6.72	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.45	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		







Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
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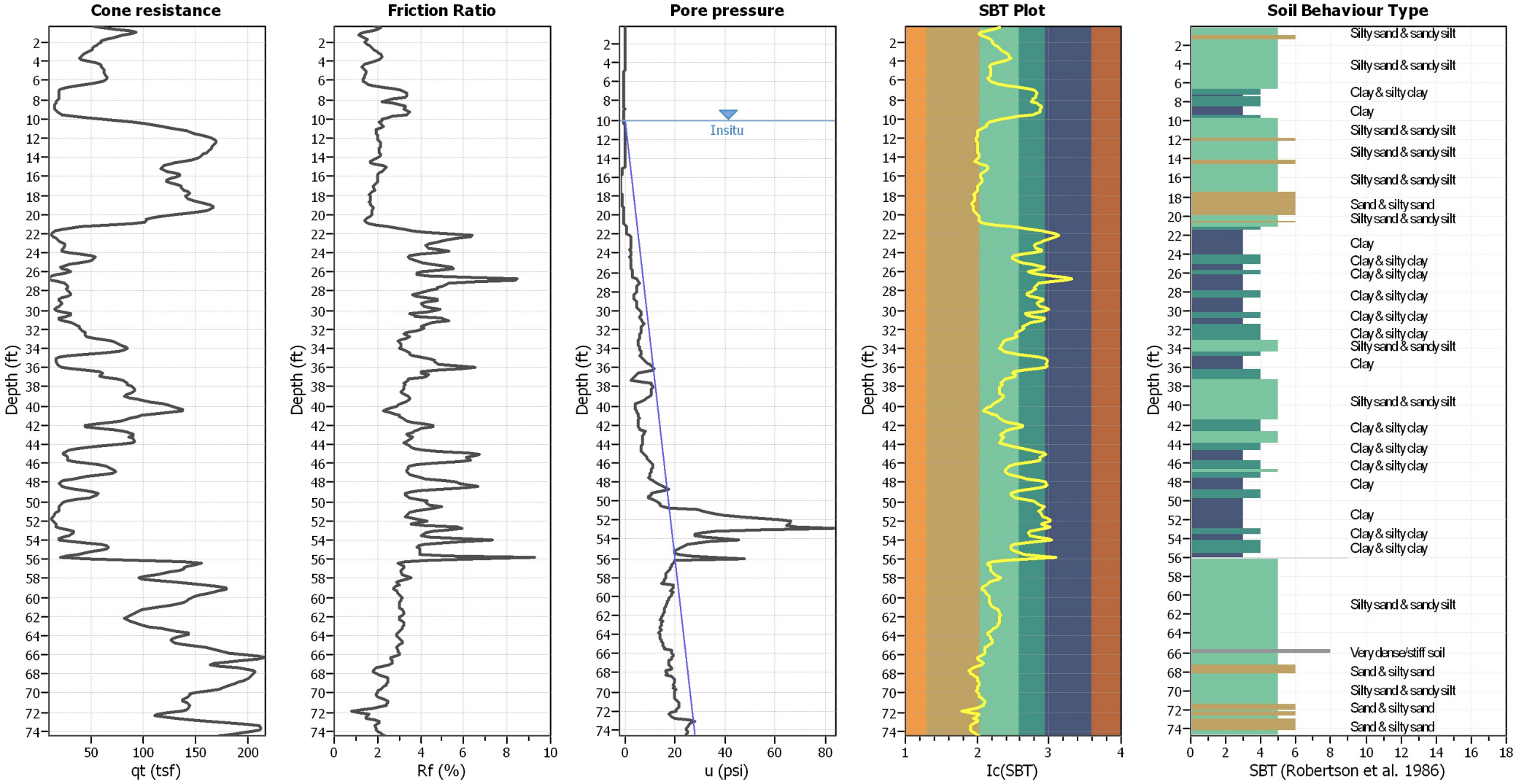
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	17.00 ft	Fill weight:	120.00 lb/ft^3
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_σ applied:	Yes
Earthquake magnitude M_w:	6.72	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.45	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	10.00 ft	Fill height:	10.00 ft	Limit depth:	N/A

SBT legend

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty
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8. Very stiff sand to
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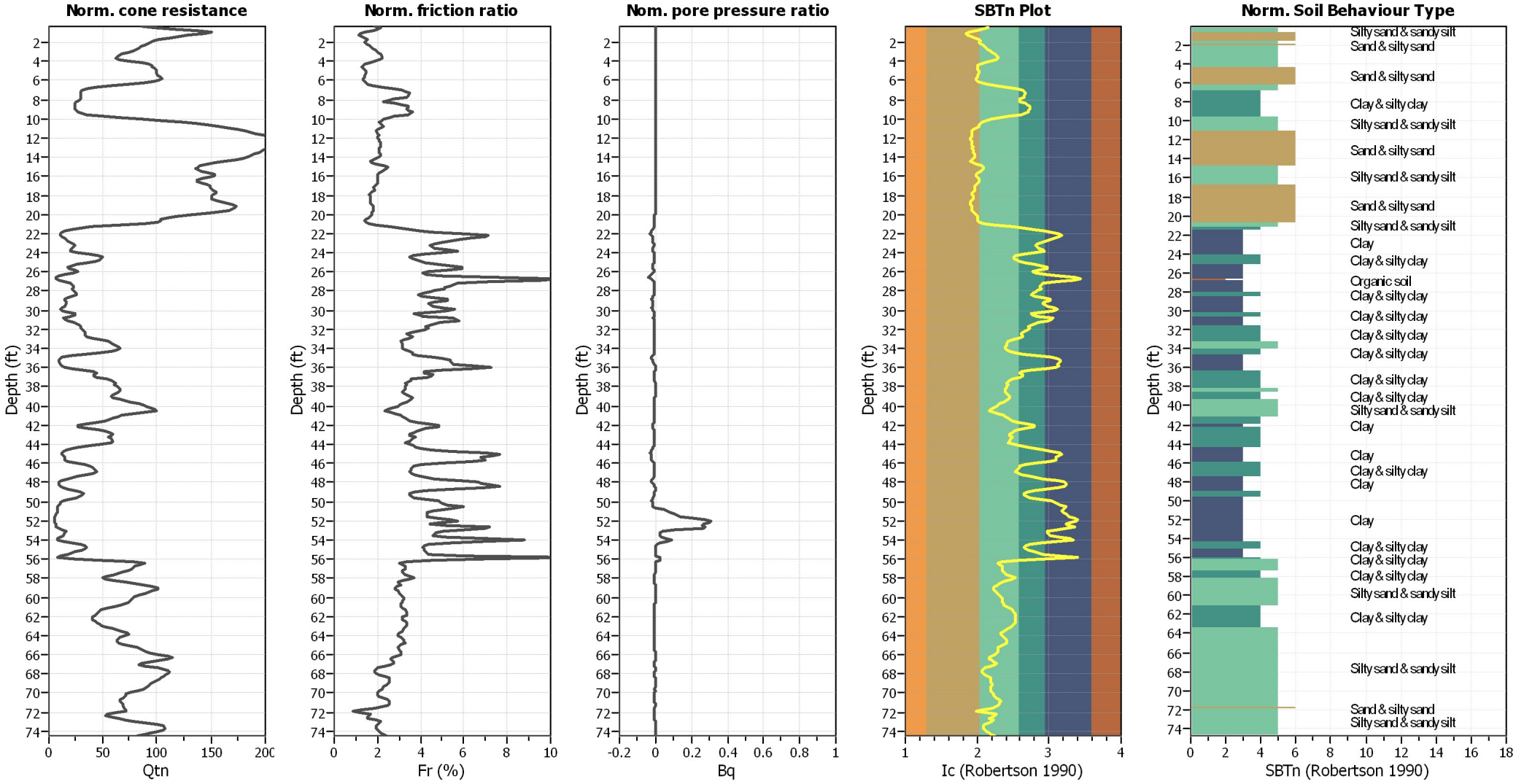
CPT basic interpretation plots (normalized)



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	17.00 ft	Fill weight:	120.00 lb/ft^3
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_σ applied:	Yes
Earthquake magnitude M_w:	6.72	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.45	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	10.00 ft	Fill height:	10.00 ft	Limit depth:	N/A

SBTn legend

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5. Silty sand to sandy silt
6. Clean sand to silty sand
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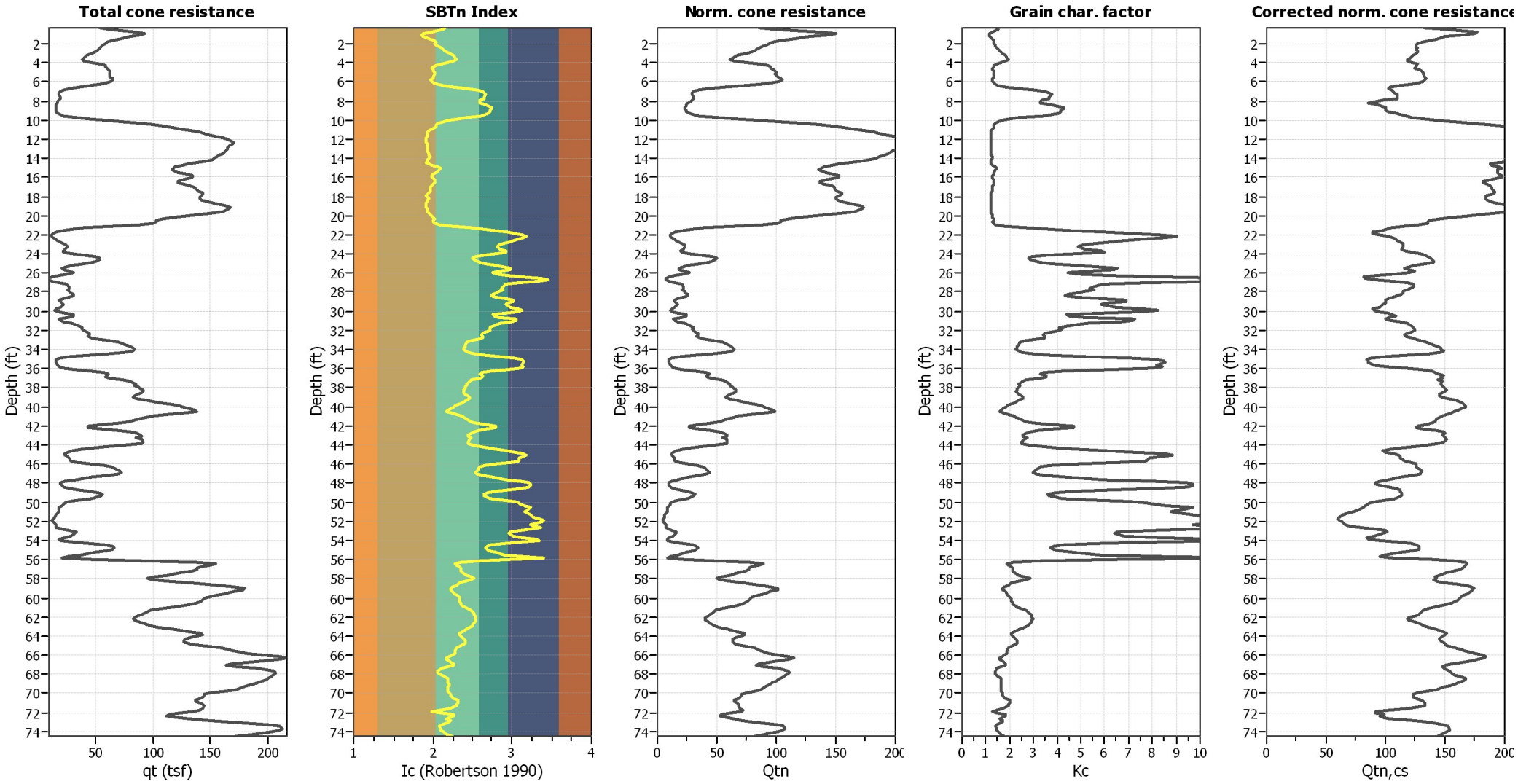
8. Very stiff sand to
9. Very stiff fine grained

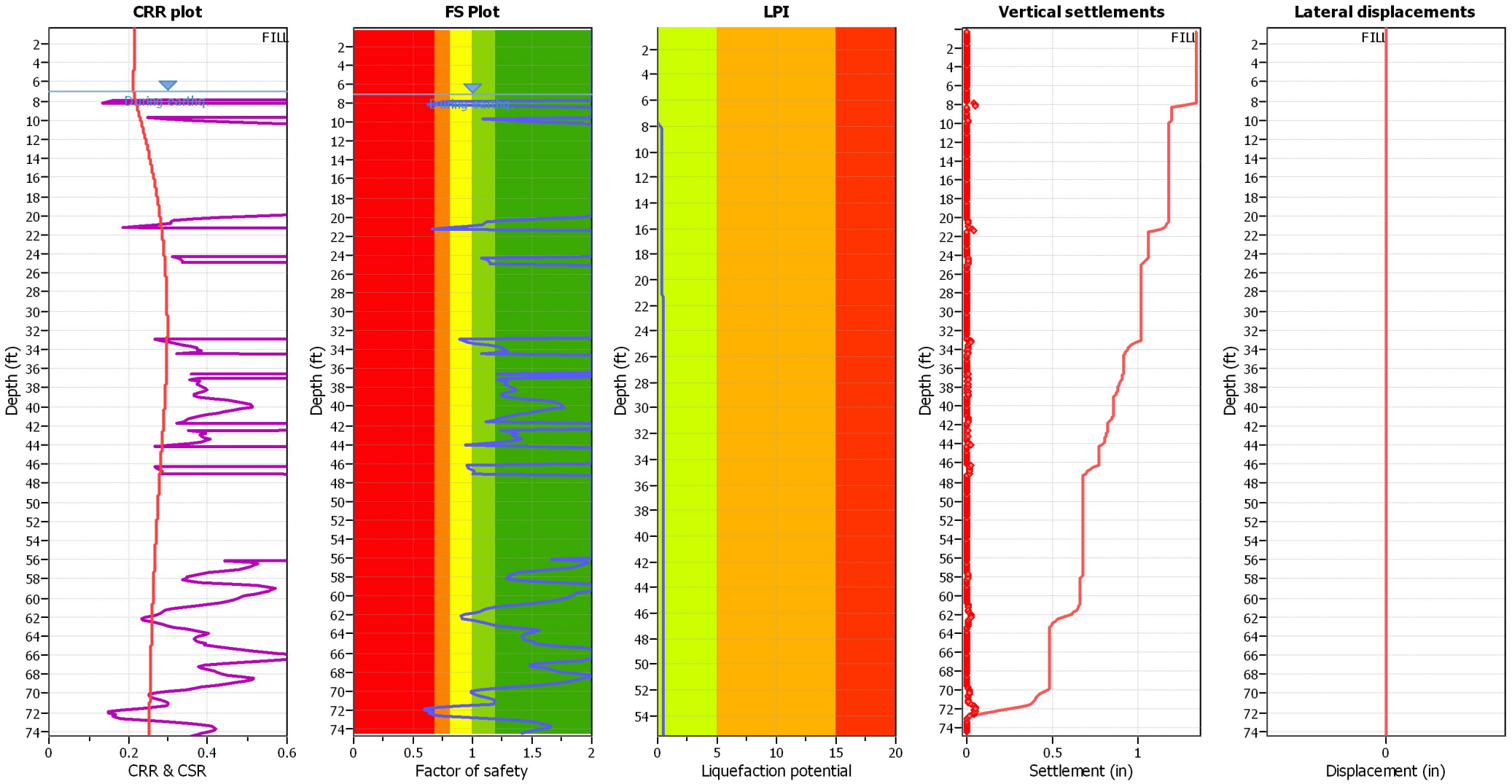
Liquefaction analysis overall plots (intermediate results)



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	17.00 ft	Fill weight:	120.00 lb/ft^3
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_σ applied:	Yes
Earthquake magnitude M_w:	6.72	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.45	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	10.00 ft	Fill height:	10.00 ft	Limit depth:	N/A

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	17.00 ft	Fill weight:	120.00 lb/ft^3
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_σ applied:	Yes
Earthquake magnitude M_w:	6.72	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.45	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	10.00 ft	Fill height:	10.00 ft	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
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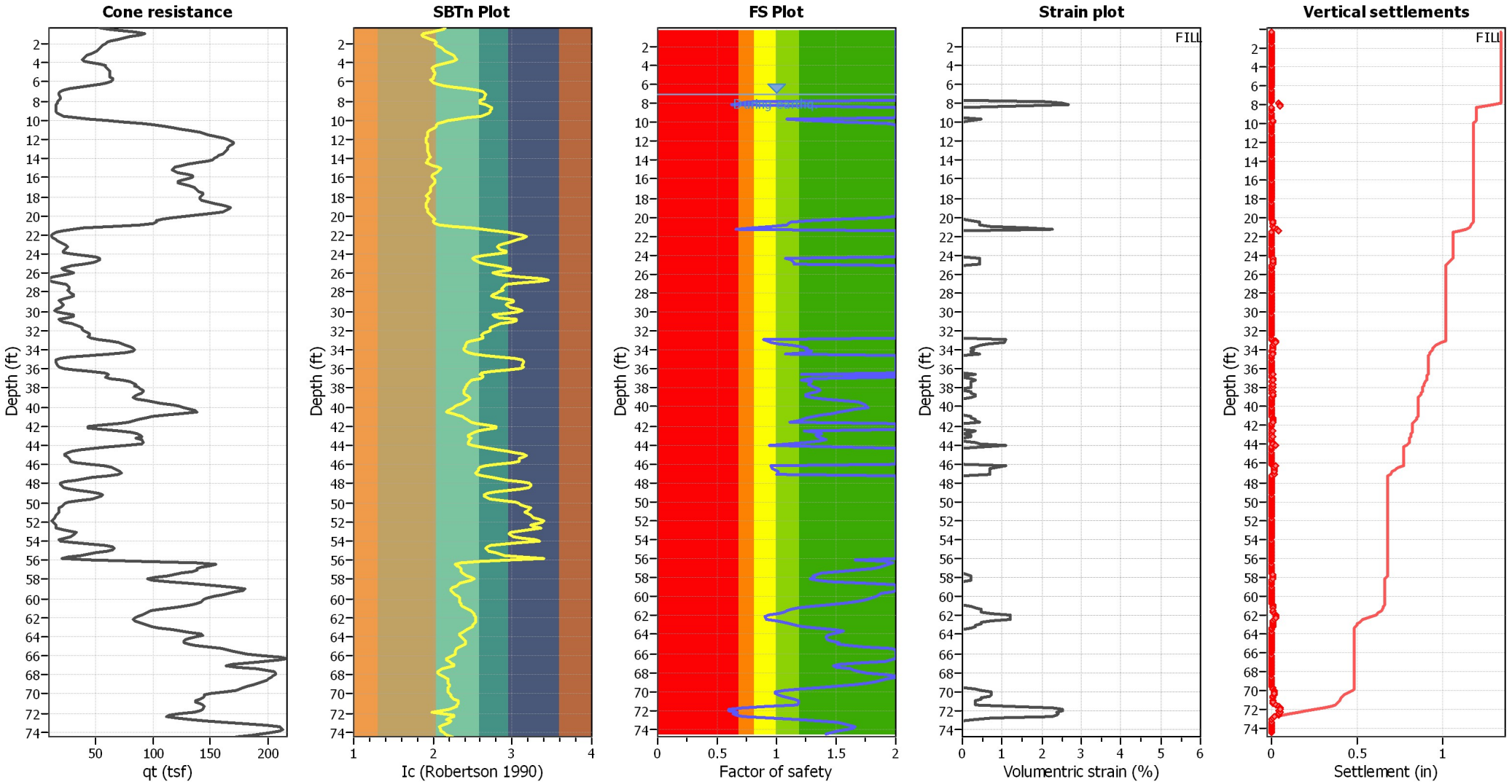
Estimation of post-earthquake settlements



Abbreviations

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I_c:	Soil Behaviour Type Index
FS:	Calculated Factor of Safety against liquefaction
Volumentric strain:	Post-liquefaction volumentric strain

LATERAL SPREAD ANALYSIS

Reference: Youd, T.L., Hansen, C.M., and Bartlett, S.F., 2002, Revised Multilinear Regression Equations for Prediction of Lateral Spread Displacement, ASCE Geotechnical Journal, Vol. 128, No. 12.

Note: This empirical equation is only valid for 1m < Z_T (m) < 10 m, where Z_T (m) is the depth to liquefiable layer

Project Name: Zephyr
Project No: ZEP-72676.4
Boring Location: CPT-5
Date: 9/14/2018

For free-face sites:

$\log D_H = -16.713 + 1.532*M_W - 1.406*\log R^* - 0.012*R + 0.592*\log W + 0.540*\log T_{15} + 3.413*\log (100 - F_{15}) - 0.795*\log((D_{50})_{15} + 0.1mm)$

For gently sloping sites:

$\log D_H = -16.213 + 1.532*M_W - 1.406*\log R - 0.012*R + 0.338*\log S + 0.540*\log T_{15} + 3.413*\log (100 - F_{15}) - 0.795*\log((D_{50})_{15} + 0.11mm)$

D_H = Estimated ground displacement in meters

M_W = Earthquake moment magnitude = 6.72 (6.0 < M_W < 8.0)

R = closest horizontal distance to surface projection seismic energy source (km) = 11 (km)

R* = distance to hypocenter of seismic energy source = $R + 10^{(0.89M - 5.64)}$ 13.2 (km)

W = the ratio of the height of the free face to the horizontal distance between the base of the free face and the point of interest

W = 5 (1.0% < W < 20%)

T_{15} = the cumulative thickness of saturated granular layers with $(N_1)_{60}$ < 15 in meters = 5.2 (m) (1 m < T_{15} < 15 m)

F_{15} = the average fines content for the granular layers comprising T_{15} in percent = 12 (%) (F_{15} and D_{50} should be in the range as on Figure 5)

$(D_{50})_{15}$ = the average mean grain size for the granular layers comprising T_{15} in millimeters = 0.3 (mm) (F_{15} and D_{50} should be in the range as on Figure 5)

S = the ground slope in percent = 2 (%) (0.1% < S < 6%)

Note: Depth to the bottom of liquefiable layer < 15 meters; Not applicable to liquefaction deeper than 15 m (50 ft)

For free-face sites:	D_H =	**0.42** meters	=	**16.72** inches
For gently sloping sites:	D_H =	**0.65** meters	=	**25.8** inches

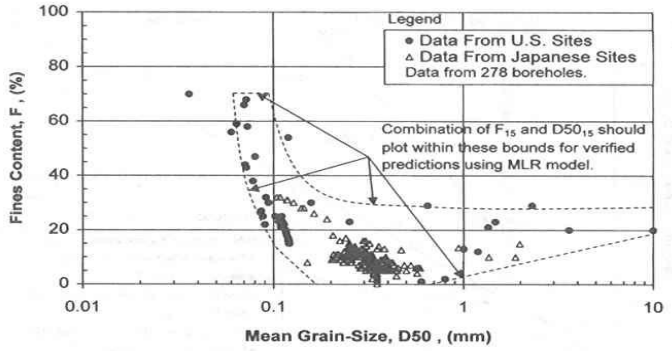

Fig. 5. Compiled grain-size data with ranges of F_{15} and $D50_{15}$ [for which Eq. (6) is applicable]

LATERAL SPREAD ANALYSIS

Reference: Youd, T.L., Hansen, C.M., and Bartlett, S.F., 2002, Revised Multilinear Regression Equations for Prediction of Lateral Spread Displacement, ASCE Geotechnical Journal, Vol. 128, No. 12.

Note: This empirical equation is only valid for 1m < Z_T (m) < 10 m, where Z_T (m) is the depth to liquefiable layer

Project Name: Zephyr
Project No: ZEP-72676.4
Boring Location: CPT-11
Date: 9/14/2018

For free-face sites:

$\log D_H = -16.713 + 1.532*M_W - 1.406*\log R^* - 0.012*R + 0.592*\log W + 0.540*\log T_{15} + 3.413*\log (100 - F_{15}) - 0.795*\log((D_{50})_{15} + 0.1mm)$

For gently sloping sites:

$\log D_H = -16.213 + 1.532*M_W - 1.406*\log R - 0.012*R + 0.338*\log S + 0.540*\log T_{15} + 3.413*\log (100 - F_{15}) - 0.795*\log((D_{50})_{15} + 0.11mm)$

D_H = Estimated ground displacement in meters

M_W = Earthquake moment magnitude = 6.72 (6.0 < M_W < 8.0)

R = closest horizontal distance to surface projection seismic energy source (km) = 11 (km)

R* = distance to hypocenter of seismic energy source = $R + 10^{(0.89M - 5.64)}$ 13.2 (km)

W = the ratio of the height of the free face to the horizontal distance between the base of the free face and the point of interest

W = 18 (1.0% < W < 20%)

T_{15} = the cumulative thickness of saturated granular layers with $(N_1)_{60}$ < 15 in meters = 5 (m) (1 m < T_{15} < 15 m)

F_{15} = the average fines content for the granular layers comprising T_{15} in percent = 12 (%) (F_{15} and D_{50} should be in the range as on Figure 5)

$(D_{50})_{15}$ = the average mean grain size for the granular layers comprising T_{15} in millimeters = 0.3 (mm) (F_{15} and D_{50} should be in the range as on Figure 5)

S = the ground slope in percent = 2 (%) (0.1% < S < 6%)

Note: Depth to the bottom of liquefiable layer < 15 meters; Not applicable to liquefaction deeper than 15 m (50 ft)

For free-face sites:	D_H =	**0.89** meters	=	**34.95** inches
For gently sloping sites:	D_H =	**0.64** meters	=	**25.2** inches

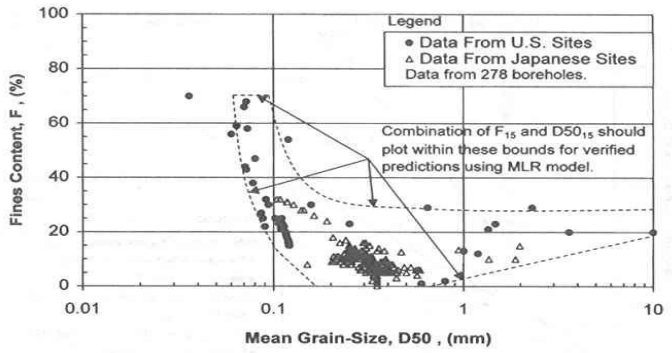

Fig. 5. Compiled grain-size data with ranges of F_{15} and $D50_{15}$ [for which Eq. (6) is applicable]

LATERAL SPREAD ANALYSIS

Reference: Youd, T.L., Hansen, C.M., and Bartlett, S.F., 2002, Revised Multilinear Regression Equations for Prediction of Lateral Spread Displacement, ASCE Geotechnical Journal, Vol. 128, No. 12.

Note: This empirical equation is only valid for 1m < Z_T (m) < 10 m, where Z_T (m) is the depth to liquefiable layer

Project Name: Zephyr
Project No: ZEP-72676.4
Boring Location: CPT-12
Date: 9/14/2018

For free-face sites:

$\log D_H = -16.713 + 1.532*M_W - 1.406*\log R^* - 0.012*R + 0.592*\log W + 0.540*\log T_{15} + 3.413*\log (100 - F_{15}) - 0.795*\log((D_{50})_{15} + 0.1mm)$

For gently sloping sites:

$\log D_H = -16.213 + 1.532*M_W - 1.406*\log R - 0.012*R + 0.338*\log S + 0.540*\log T_{15} + 3.413*\log (100 - F_{15}) - 0.795*\log((D_{50})_{15} + 0.11mm)$

D_H = Estimated ground displacement in meters

M_W = Earthquake moment magnitude =	6.72	(6.0 < M_W < 8.0)		
R = closest horizontal distance to surface projection seismic energy source (km) =			11	(km)
R* = distance to hypocenter of seismic energy source = R + $10^{(0.89M - 5.64)}$			13.2	(km)
W = the ratio of the height of the free face to the horizontal distance between the base of the free face and the point of interest				
W =	18	(1.0% < W < 20%)		
T_{15} = the cumulative thickness of saturated granular layers with $(N_1)_{60}$ < 15 in meters =			5	(m) (1 m < T_{15} < 15 m)
F_{15} = the average fines content for the granular layers comprising T_{15} in percent =			12	(%) (F_{15} and D_{50} should be in the range as on Figure 5)
$(D_{50})_{15}$ = the average mean grain size for the granular layers comprising T_{15} in millimeters =			0.3	(mm) (F_{15} and D_{50} should be in the range as on Figure 5)
S = the ground slope in percent =	2	(%) (0.1% < S < 6%)		

Note: Depth to the bottom of liquefiable layer < 15 meters; Not applicable to liquefaction deeper than 15 m (50 ft)

For free-face sites:	D_H =	**0.89** meters	=	**34.95** inches
For gently sloping sites:	D_H =	**0.64** meters	=	**25.2** inches

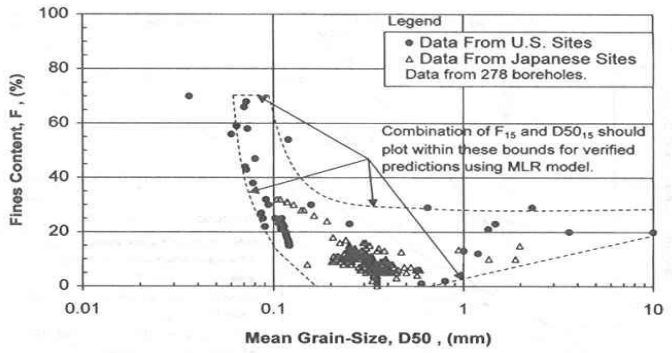

Fig. 5. Compiled grain-size data with ranges of F_{15} and $D50_{15}$ [for which Eq. (6) is applicable]

APPENDIX D
FORM I-8

Categorization of Infiltration Feasibility Condition	Form I-8

Part 1 - Full Infiltration Feasibility Screening Criteria

Would infiltration of the full design volume be feasible from a physical perspective without any undesirable consequences that cannot be reasonably mitigated?

Criteria	Screening Question	Yes	No
1	**Is the estimated reliable infiltration rate below proposed facility locations greater than 0.5 inches per hour?** The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.2 and Appendix D.	X	

Provide basis:

Based on our percolation testing at the site, the calculated Infiltration Rates ranged from 2.44 to 4.95 in/hr with a factor of safety of 2.0 applied.

Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.

2	**Can infiltration greater than 0.5 inches per hour be allowed without increasing risk of geotechnical hazards (slope stability, groundwater mounding, utilities, or other factors) that cannot be mitigated to an acceptable level?** The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.2.		X

Provide basis:

See discussion of site conditions, geologic hazards, and ground water provided in our Geotechnical Evaluation report herein. The onsite soils at the site are subject to liquefaction and lateral spreading. The groundwater varies between 7 and 28 feet below the surface. Given the risk of liquefaction, infiltration of stormwater in any capacity is not recommended.

Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.

Form I-8 Page 2 of 4			
Criteria	Screening Question	**Yes**	**No**
3	**Can infiltration greater than 0.5 inches per hour be allowed without increasing risk of groundwater contamination (shallow water table, storm water pollutants or other factors) that cannot be mitigated to an acceptable level?** The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.3.	X	
Provide basis: Groundwater was encountered at depths of 11 to 20 feet below ground. Previous subsurface explorations found the depth of groundwater across the property to range between 7 and 28 feet below ground. There are no known contaminants present at the site. Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.			
4	**Can infiltration greater than 0.5 inches per hour be allowed without causing potential water balance issues such as change of seasonality of ephemeral streams or increased discharge of contaminated groundwater to surface waters?** The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.3.	X	
Provide basis: There are no apparent ephemeral streams located on the subject site. Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.			
Part 1 Result *	If all answers to rows 1 - 4 are "**Yes**" a full infiltration design is potentially feasible. The feasibility screening category is **Full Infiltration** If any answer from row 1-4 is "**No**", infiltration may be possible to some extent but would not generally be feasible or desirable to achieve a "full infiltration" design. Proceed to Part 2	No: Full Infiltration is not considered to be feasible	

*To be completed using gathered site information and best professional judgment considering the definition of MEP in the MS4 Permit. Additional testing and/or studies may be required by Agency/Jurisdictions to substantiate findings

Form I-8 Page 3 of 4

Part 2 – Partial Infiltration vs. No Infiltration Feasibility Screening Criteria

Would infiltration of water in any appreciable amount be physically feasible without any negative consequences that cannot be reasonably mitigated?

Criteria	Screening Question	Yes	No
5	**Do soil and geologic conditions allow for infiltration in any appreciable rate or volume?** The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.2 and Appendix D.	X	

Provide basis:

See Criteria 1

Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability and why it was not feasible to mitigate low infiltration rates.

6	**Can Infiltration in any appreciable quantity be allowed without increasing risk of geotechnical hazards (slope stability, groundwater mounding, utilities, or other factors) that cannot be mitigated to an acceptable level**? The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.2.		X

Provide basis:

Per Criteria 2, the potential for liquefaction of the onsite soils and the shallow groundwater pose geotechnical hazards that infiltration, in any capacity, could exacerbte.

Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability and why it was not feasible to mitigate low infiltration rates.

Form I-8 Page 4 of 4			
Criteria	Screening Question	**Yes**	**No**
7	**Can Infiltration in any appreciable quantity be allowed without posing significant risk for groundwater related concerns (shallow water table, storm water pollutants or other factors)?** The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.3.	X	
Provide basis: See Criteria 3 Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability and why it was not feasible to mitigate low infiltration rates.			
8	**Can infiltration be allowed without violating downstream water rights**? The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.3.		
Provide basis: This question requires the expertise of water-rights lawyers to determine if any violation can be expected downstream by reducing the run-off slightly via infiltration of the water into bioretention or stormwater devices Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability and why it was not feasible to mitigate low infiltration rates.			
Part 2 Result*	If all answers from row 1-4 are yes then partial infiltration design is potentially feasible. The feasibility screening category is **Partial Infiltration.** If any answer from row 5-8 is no, then infiltration of any volume is considered to be **infeasible** within the drainage area. The feasibility screening category is **No Infiltration.**	No, Partial Infiltration is not considered to be feasible	

*To be completed using gathered site information and best professional judgment considering the definition of MEP in the MS4 Permit. Additional testing and/or studies may be required by Agency/Jurisdictions to substantiate findings

APPENDIX E
EARTHWORK AND GRADING GUIDELINES

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EARTHWORK AND GRADING GUIDELINES

GENERAL

These guidelines present general procedures and recommendations for earthwork and grading as required on the approved grading plans, including preparation of areas to be filled, placement of fill and installation of subdrains and excavations. The recommendations contained in the geotechnical report are applicable to each specific project, are part of the earthwork and grading guidelines and would supersede the provisions contained hereafter in the case of conflict. Observations and/or testing performed by the consultant during the course of grading may result in revised recommendations which could supersede these guidelines or the recommendations contained in the geotechnical report. Figures A through O are provided at the back of this appendix, exhibiting generalized cross sections relating to these guidelines.

The contractor is responsible for the satisfactory completion of all earthworks in accordance with provisions of the project plans and specifications. The project soil engineer and engineering geologist (geotechnical consultant) or their representatives should provide observation and testing services, and geotechnical consultation throughout the duration of the project.

EARTHWORK OBSERVATIONS AND TESTING

Geotechnical Consultant

Prior to the commencement of grading, a qualified geotechnical consultant (a soil engineer and engineering geologist) should be employed for the purpose of observing earthwork procedures and testing the fills for conformance with the recommendations of the geotechnical report, the approved grading plans, and applicable grading codes and ordinances.

The geotechnical consultant should provide testing and observation so that determination may be made that the work is being completed as specified. It is the responsibility of the contractor to assist the consultant and keep them aware of work schedules and predicted changes, so that the consultant may schedule their personnel accordingly.

All removals, prepared ground to receive fill, key excavations, and subdrains should be observed and documented by the project engineering geologist and/or soil engineer prior to placing any fill. It is the contractor's responsibility to notify the engineering geologist and soil engineer when such areas are ready for observation.

Laboratory and Field Tests

Maximum dry density tests to determine the degree of compaction should be performed in accordance with American Standard Testing Materials test method ASTM designation D-1557-78. Random field compaction tests should be performed in accordance with test method ASTM designations D-1556-82, D-2937 or D-2922 & D-3017, at intervals of approximately two (2) feet of fill height per 10,000 sq. ft. or every one thousand cubic yards of fill placed. These criteria would vary depending on the soil conditions and the size of the project. The location and frequency of testing would be at the discretion of the geotechnical consultant

Contractor's Responsibility

All clearing, site preparation, and earthwork performed on the project should be conducted by the contractor, with observation by geotechnical consultants and staged approval by the appropriate governing agencies. It is the contractor's responsibility to prepare the ground surface to receive the fill to the satisfaction of the soil engineer, and to place, spread, moisture condition, mix and compact the fill in accordance with the recommendations of the soil engineer. The contractor should also remove all major deleterious material considered unsatisfactory by the soil engineer.

It is the sole responsibility of the contractor to provide adequate equipment and methods to accomplish the earthwork in accordance with applicable grading guidelines, codes or agency ordinances, and approved grading plans. Sufficient watering apparatus and compaction equipment should be provided by the contractor with due consideration for the fill material, rate of placement, and climatic conditions. If, in the opinion of the geotechnical consultant, unsatisfactory conditions such as questionable weather, excessive oversized rock, deleterious material or insufficient support equipment are resulting in a quality of work that is not acceptable, the consultant will inform the contractor, and the contractor is expected to rectify the conditions, and if necessary, stop work until conditions are satisfactory.

The contractor will properly grade all surfaces to maintain good drainage and prevent ponding of water. The contractor will take action to control surface water and to prevent erosion control measures that have been installed.

SITE PREPARATION

All vegetation including brush, trees, thick grasses, organic debris, and other deleterious material should be removed and disposed of offsite, and must be concluded prior to placing fill. Existing fill, soil, alluvium, colluvium, or rock materials determined by the soil engineer or engineering geologist as unsuitable for structural in-place support should be removed prior to fill placement. Depending upon the soil conditions, these materials may be reused as compacted fills. Any materials incorporated as part of the compacted fills should be approved by the soil engineer.

Any underground structures such as cesspools, cisterns, mining shafts, tunnels, septic tanks, wells, pipelines, or other structures not located prior to grading are to be removed or treated in a manner recommended by the soil engineer. Soft, dry, spongy, highly fractured, or otherwise unsuitable ground extending to such a depth that surface processing cannot adequately improve the condition should be over excavated down to firm ground and approved by the soil engineer before compaction and filling operations continue. Over excavated and processed soils which have been properly mixed and moisture-conditioned should be recompacted to the minimum relative compaction as specified in these guidelines.

Existing ground which is determined to be satisfactory for support of the fills should be scarified to a minimum depth of six (6) inches, or as directed by the soil engineer. After the scarified ground is brought to optimum moisture (or greater) and mixed, the materials should be compacted as specified herein. If the scarified zone is greater than 6 inches in depth, it may be necessary to remove the excess and place the material in lifts restricted to six (6) inches in compacted thickness.

Existing grind which is not satisfactory to support compacted fill should be over excavated as required in the geotechnical report or by the onsite soils engineer and/or engineering geologists. Scarification, discing, or other acceptable form of mixing should continue until the soils are broken down and free of large fragments or clods, until the working surface is reasonably uniform and free from ruts, hollows, hummocks, or other uneven features which would inhibit compaction as described above.

Where fills are to be placed on ground with slopes steeper than 5:1 (horizontal to vertical) gradient, the ground should be benched. The lowest bench, which will act as a key, should be a minimum of 12 feet wide and should be at least two (2) feet deep into competent material, approved by the soil engineer and/or engineering geologist. In fill over cut slope conditions, the recommended minimum width of the lowest bench or key is at least 15 feet with the key excavated on competent material, as designated by the Geotechnical Consultant. As a general rule, unless superseded by the Soil Engineer, the minimum width of fill keys should be approximately equal to one-half (½) the height of the slope.

Standard benching is typically four feet (minimum) vertically, exposing competent material. Benching may be used to remove unsuitable materials, although it is understood that the vertical height of the bench may exceed four feet. Pre stripping may be considered for removal of unsuitable materials in excess of four feet in thickness.

All areas to receive fill, including processed areas, removal areas, and toe of fill benches should be observed and approved by the soil engineer and/or engineering geologist prior to placement of fill. Fills may then be properly placed and compacted until design grades are attained.

COMPACTED FILLS

Earth materials imported or excavated on the property may be utilized as fill provided that each soil type has been accepted by the soil engineer. These materials should be free of roots, tree branches, other organic matter or other deleterious materials. All unsuitable materials should be removed from the fill as directed by the soil engineer. Soils of poor gradation, undesirable expansion potential, or substandard strength characteristics may be designated unsuitable by the consultant and may require mixing with other earth materials to serve as a satisfactory fill material.

Fill materials generated from benching operations should be dispersed throughout the fill area. Benching operations should not result in the benched material being placed only within a single equipment width away from the fill/bedrock contact.

Oversized materials, defined as rock or other irreducible materials with a maximum size exceeding 12 inches in one dimension, should not be buried or placed in fills unless the location of materials and disposal methods are specifically approved by the soil engineer. Oversized material should be taken offsite or placed in accordance with recommendations of the soil engineer in areas designated as suitable for rock disposal. Oversized material should not be placed vertically within 10 feet of finish grade or horizontally within 20 feet of slope faces.

To facilitate trenching, rock should not be placed within the range of foundation excavations or future utilities unless specifically approved by the soil engineer and/or the representative developers.

If import fill material is required for grading, representative samples of the material should be analyzed in the laboratory by the soil engineer to determine its physical properties. If any material other than that previously analyzed is imported to the fill or encountered during grading, analysis of this material should be conducted by the soil engineer as soon as practical.

Fill material should be placed in areas prepared to receive fill in near-horizontal layers that should not exceed six (6) inches compacted in thickness. The soil engineer may approve thicker lifts if testing indicates the grading procedures are such that adequate compaction is being achieved. Each layer should be spread evenly and mixed to attain uniformity of material and moisture suitable for compaction.

Fill materials at moisture content less than optimum should be watered and mixed, and "wet" fill materials should be aerated by scarification, or should be mixed with drier material. Moisture conditioning and mixing of fill materials should continue until the fill materials have uniform moisture content at or above optimum moisture.

After each layer has been evenly spread, moisture-conditioned and mixed, it should be uniformly compacted to a minimum of 90 percent of maximum density as determined by ASTM test designation, D 1557-78, or as otherwise recommended by the soil engineer. Compaction equipment should be adequately sized and should be reliable to efficiently achieve the required degree of compaction.

Where tests indicate that the density of any layer of fill, or portion thereof, is below the required relative compaction or improper moisture content, the particular layer or portion will be reworked until the required density and/or moisture content has been attained. No additional fill will be placed in an area until the last placed lift of fill has been tested and found to meet the density and moisture requirements, and is approved by the soil engineer.

Compaction of slopes should be accomplished by over-building the outside edge a minimum of three (3) feet horizontally, and subsequently trimming back to the finish design slope configuration. Testing will be performed as the fill is horizontally placed to evaluate compaction as the fill core is being developed. Special efforts may be necessary to attain the specified compaction in the fill slope zone. Final slope shaping should be performed by trimming and removing loose materials with appropriate equipment. A final determination of fill slope compaction should be based on observation and/or testing of the finished slope face.

If an alternative to over-building and cutting back the compacted fill slope is selected, then additional efforts should be made to achieve the required compaction in the outer 10 feet of each lift of fill by undertaking the following:

- Equipment consisting of a heavy short-shanked sheepsfoot should be used to roll (horizontal) parallel to the slopes continuously as fill is placed. The sheepsfoot roller should also be used to roll perpendicular to the slopes, and extend out over the slope to provide adequate compaction to the face slope.

- Loose fill should not be spilled out over the face of the slope as each lift is compacted. Any loose fill spilled over a previously completed slope face should be trimmed off or be subject to re-rolling.

- Field compaction tests will be made in the outer two (2) to five (5) feet of the slope at two (2) to three (3) foot vertical intervals, subsequent to compaction operations.

- After completion of the slope, the slope face should be shaped with a small dozer and then re-rolled with a sheepsfoot to achieve compaction to near the slope face. Subsequent to testing to verify compaction, the slopes should be grid-rolled to achieve adequate compaction to the slope face. Final testing should be used to confirm compaction after grid rolling.

- Where testing indicates less than adequate compaction, the contractor will be responsible to process, moisture condition, mix and recompact the slope materials as necessary to achieve compaction. Additional testing should be performed to verify compaction.

- Erosion control and drainage devices should be designed by the project civil engineer in compliance with the ordinances of the controlling governmental agencies, and/or in accordance with the recommendations of the soil engineer or engineering geologist.

EXCAVATIONS

Excavations and cut slopes should be observed and mapped during grading by the engineering geologist. If directed by the engineering geologist, further excavations or over-excavation and refilling of cut areas should be performed. When fills over cut slopes are to be graded, the cut portion of the slope should be observed by the engineering geologist prior to placement of the overlying fill portion of the slope. The engineering geologist should observe all cut slopes and should be notified by the contractor when cut slopes are started.

If, during the course of grading, unanticipated adverse or potentially adverse geologic conditions are encountered, the engineering geologist and soil engineer should investigate, evaluate and make recommendations to mitigate (or limit) these conditions. The need for cut slope buttressing or stabilizing should be based on as-grading evaluations by the engineering geologist, whether anticipated previously or not.

Unless otherwise specified in soil and geological reports, no cut slopes should be excavated higher or steeper than that allowed by the ordinances of controlling governmental agencies. Additionally, short-term stability of temporary cut slopes is the contractor’s responsibility.

Erosion control and drainage devices should be designed by the project civil engineer and should be constructed in compliance with the ordinances of the controlling governmental agencies, and/or in accordance with the recommendations of the soil engineer or engineering geologist.

SUBDRAIN INSTALLATION

Subdrains should be installed in accordance with the approved embedment material, alignment and details indicated by the geotechnical consultant. Subdrain locations or construction materials should not be changed or modified without approval of the geotechnical consultant. The soil engineer and/or engineering geologist may recommend and direct changes in subdrain line, grade and drain material in the field, pending exposed conditions. The location of constructed subdrains should be recorded by the project civil engineer.

COMPLETION

Consultation, observation and testing by the geotechnical consultant should be completed during grading operations in order to state an opinion that all cut and filled areas are graded in accordance with the approved project specifications.

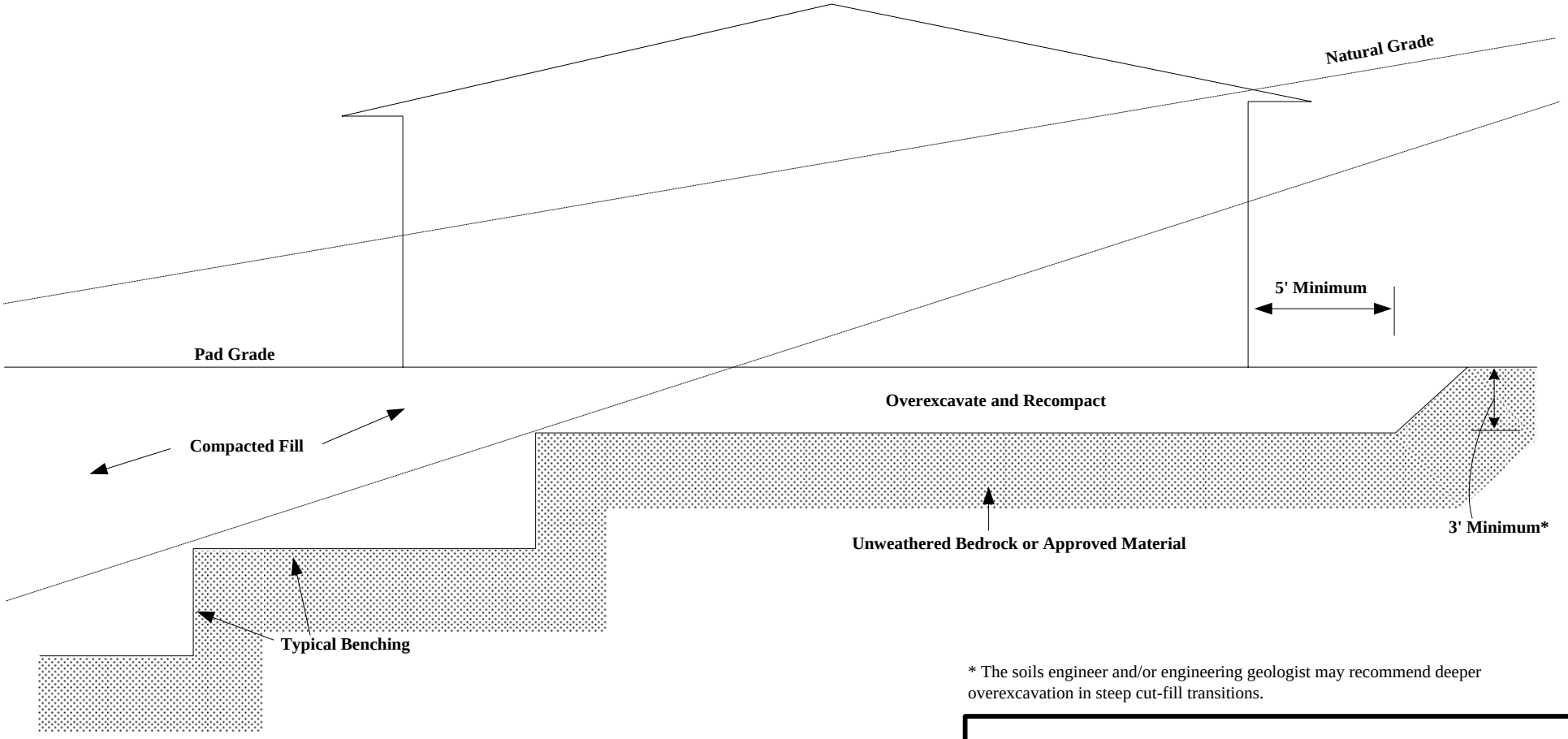
After completion of grading and after the soil engineer and engineering geologist have finished their observations, final reports should be submitted subject to review by the controlling governmental agencies. No additional grading should be undertaken without prior notification of the soil engineer and/or engineering geologist.

All finished cut and fill slopes should be protected from erosion, including but not limited to planting in accordance with the plan design specifications and/or as recommended by a landscape architect. Such protection and/or planning should be undertaken as soon as possible after completion of grading.

ATTACHMENTS

Figure A – Transition Lot Detail Cut Lot
Figure B – Transition Lot Detail Cut - Fill
Figure C – Rock Disposal Pits
Figure D – Detail for Fill Slope Toeing out on a Flat Alluviated Canyon
Figure E – Removal Adjacent to Existing Fill
Figure F – Daylight Cut Lot Detail
Figure G – Skin Fill of Natural Ground
Figure H – Typical Stabilization Buttress Fill Design
Figure I – Stabilization Fill for Unstable Material Exposed in Portion of Cut Slope
Figure J – Fill Over Cut Detail
Figure K – Fill Over Natural Detail
Figure L – Oversize Rock Disposal
Figure M – Canyon Subdrain Detail
Figure N – Canyon Subdrain Alternate Details
Figure O – Typical Stabilization Buttress Subdrain Detail
Figure P – Retaining Wall Backfill

TRANSITION LOT DETAIL
CUT LOT – MATERIAL TYPE TRANSITION



* The soils engineer and/or engineering geologist may recommend deeper overexcavation in steep cut-fill transitions.

Note: Figure not to scale

EARTHWORK AND GRADING GUIDELINES
TRANSITION LOT DETAIL
CUT LOT – MATERIAL TYPE TRANSITION

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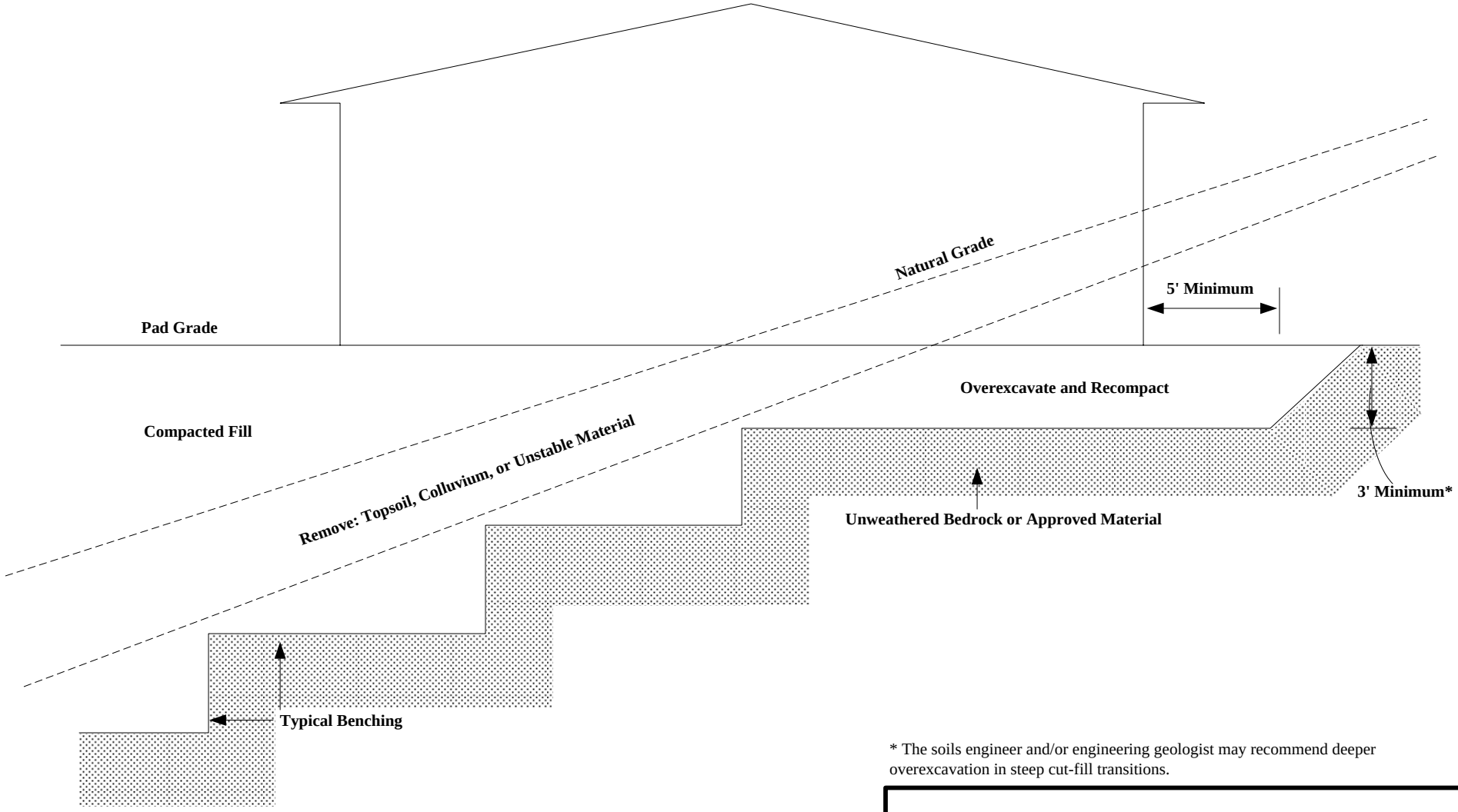
FIGURE A

TRANSITION LOT DETAIL
CUT – FILL – DAYLIGHT TRANSITION



* The soils engineer and/or engineering geologist may recommend deeper overexcavation in steep cut-fill transitions.

EARTHWORK AND GRADING GUIDELINES
TRANSITION LOT DETAIL
CUT – FILL – DAYLIGHT TRANSITION

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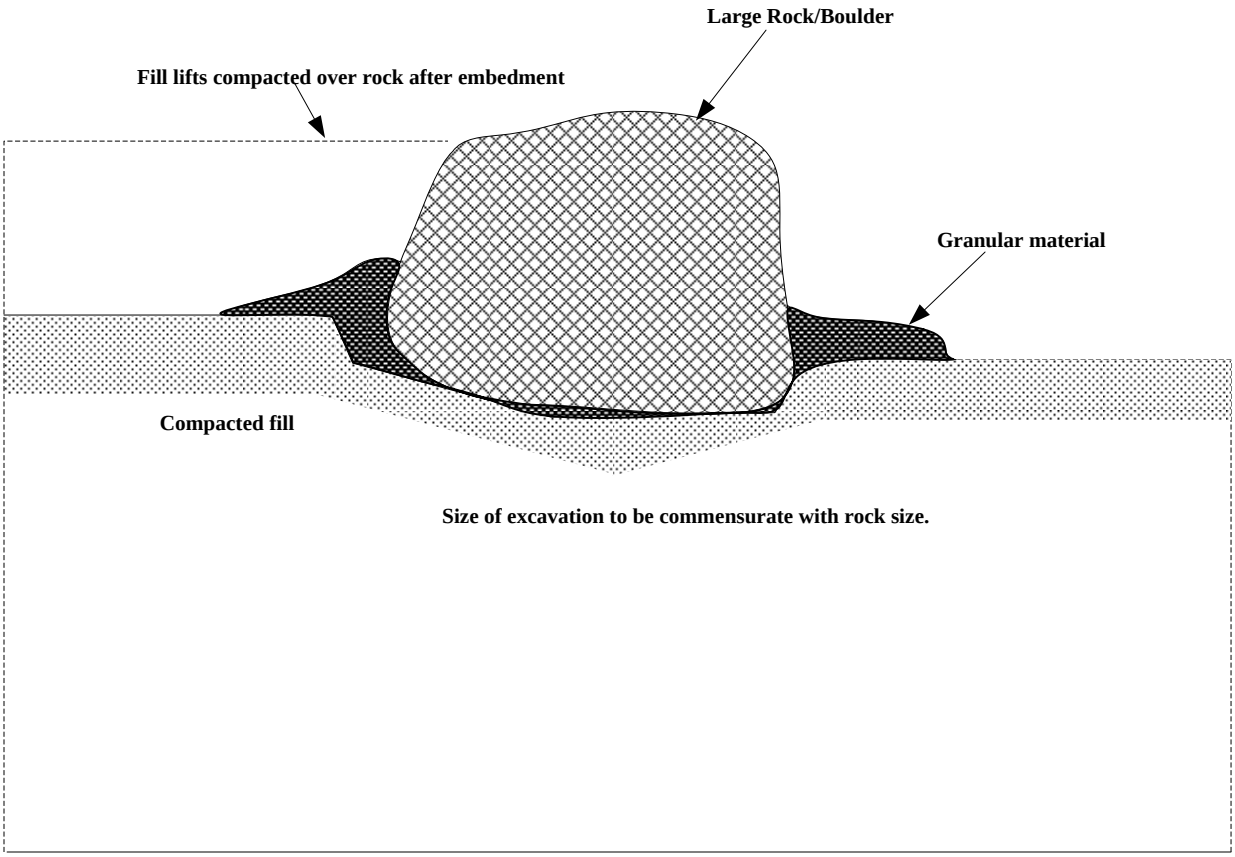
FIGURE B

Note: Figure not to scale

ROCK DISPOSAL PITS



Note: (1) Large rock is defined as having a diameter larger than 3 feet in maximum size.
(2) Pit shall be excavated into compacted fill to a depth equal to half of the rock size.
(3) Granular soil shall be pushed into the pit and then flooded around the rock using a sheepsfoot to help with compaction.
(4) A minimum of 3 feet of compacted fill should be laid over each pit.
(5) Pits shall have at least 15 feet of separation between one another, horizontally.
(6) Pits shall be placed at least 20 feet from any fill slope.
(7) Pits shall be used only in deep fill areas.

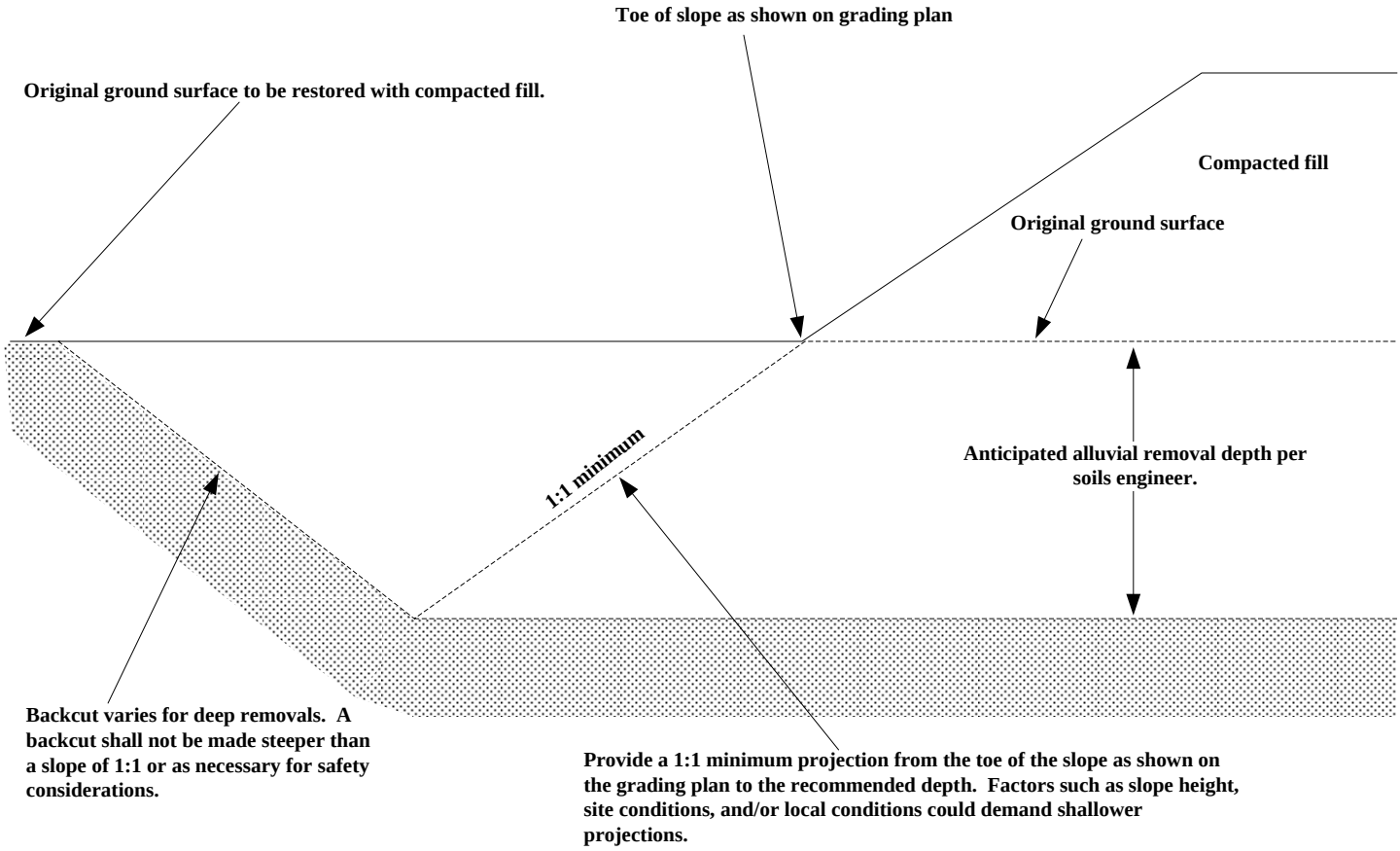
Note: Figure not to scale

EARTHWORK AND GRADING GUIDELINES
ROCK DISPOSAL PITS

EEI
Expertise . . Service . . ***Solutions***

FIGURE C

DETAIL FOR FILL SLOPE TOEING OUT ON FLAT ALLUVIATED CANYON



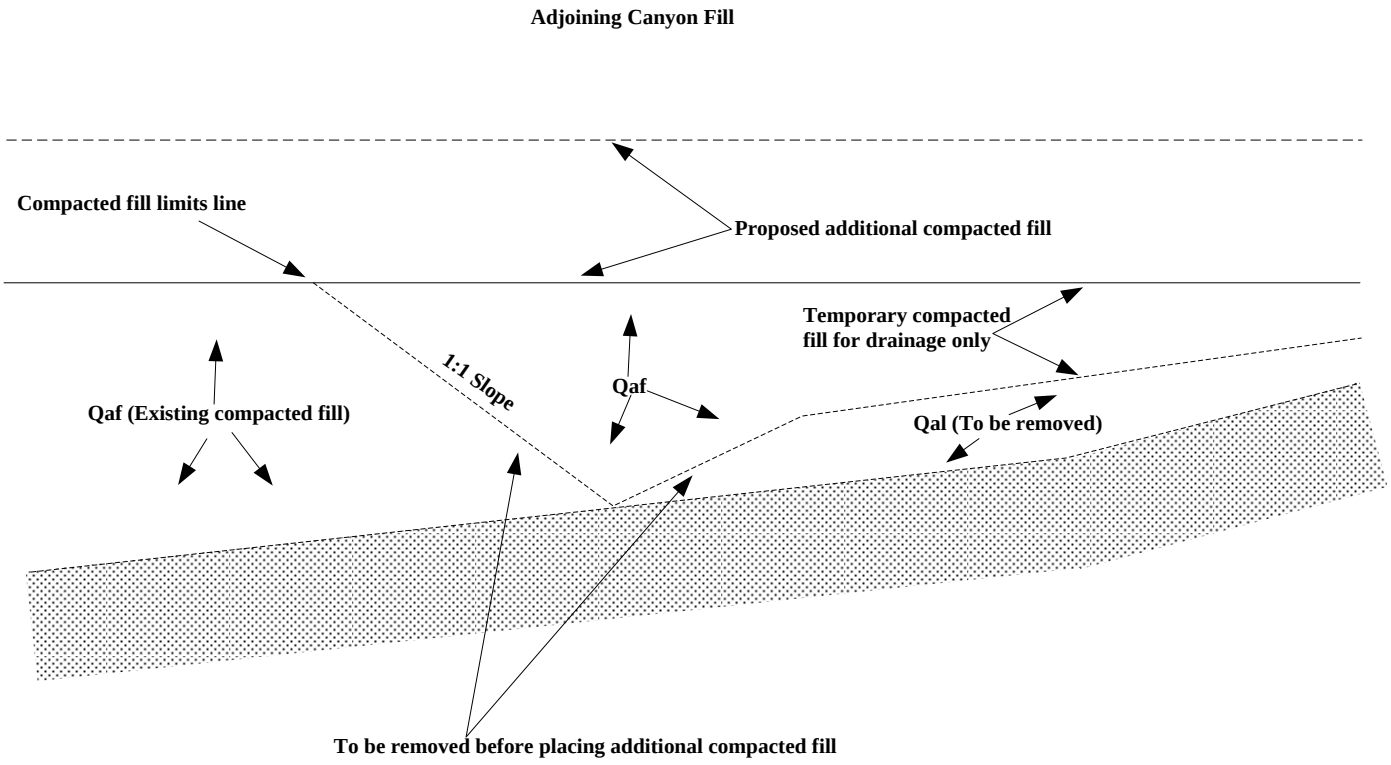
Note: Figure not to scale

EARTHWORK AND GRADING GUIDELINES
DETAIL FOR FILL SLOPE TOEING OUT ON A FLAT ALLUVIATED CANYON

EEI
Expertise . . Service . . ***Solutions***

FIGURE D

REMOVAL ADJACENT TO EXISTING FILL



Legend

Qaf - Artificial Fill

Qal - Alluvium

Note: Figure not to scale

EARTHWORK AND GRADING GUIDELINES
REMOVAL ADJACENT TO EXISTING FILL

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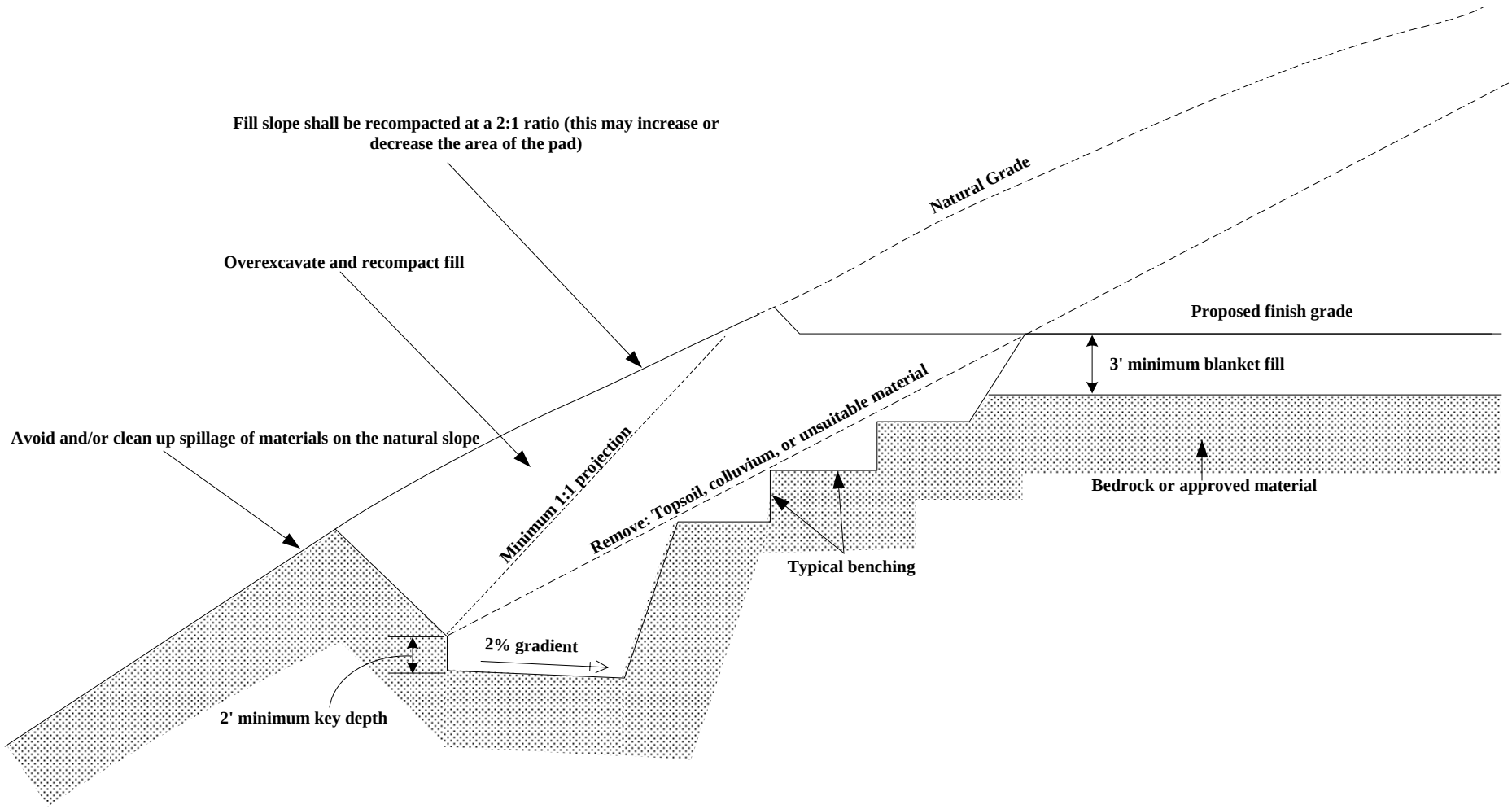
FIGURE E

DAYLIGHT CUT LOT DETAIL



Note: (1) Subdrain and key width requirements shall be determined based on exposed subsurface conditions and the thickness of overburden.

(2) Pad overexcavation and recompaction shall be completed if determined as necessary by the soils engineer and/or engineering geologist.

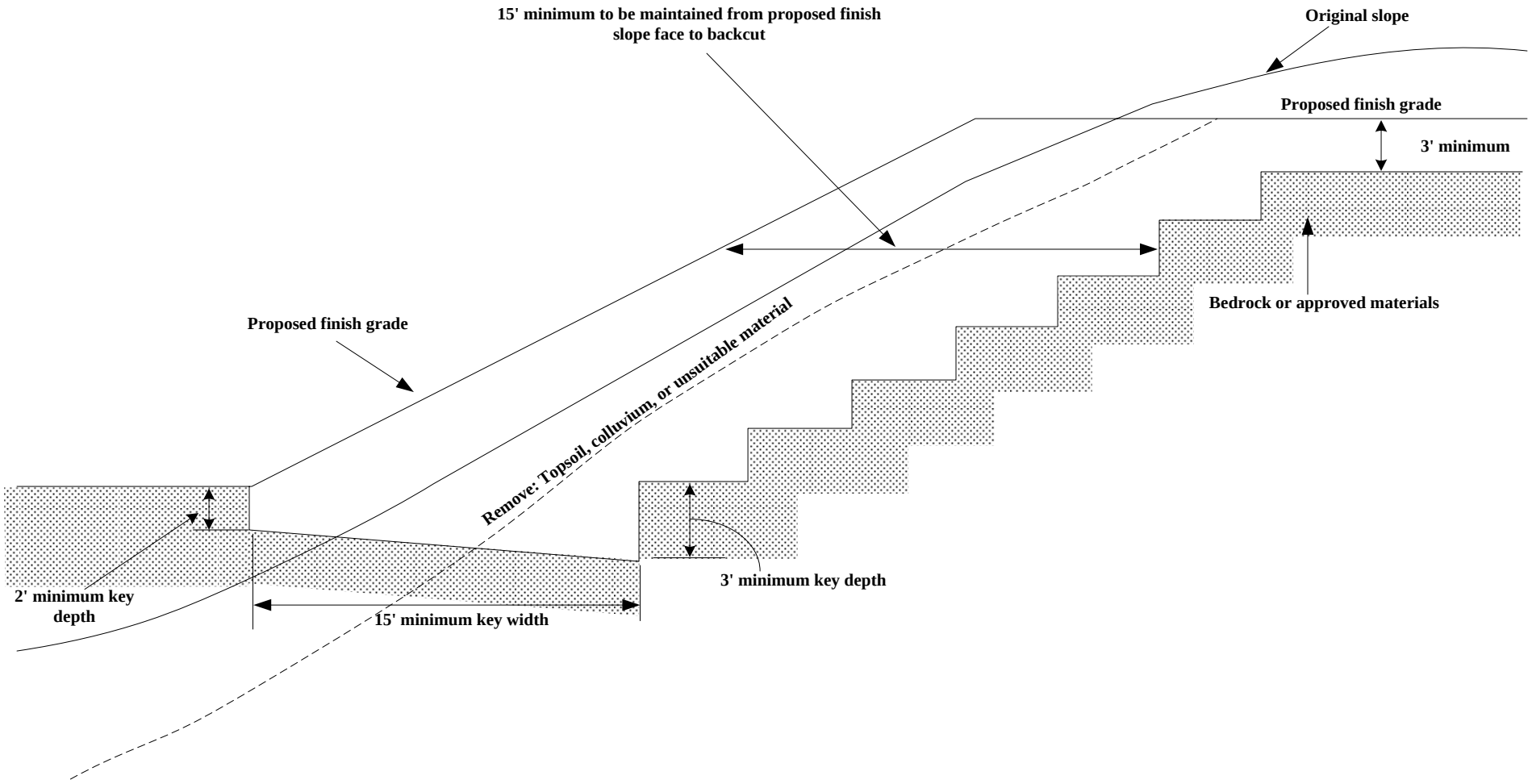
Note: Figure not to scale

EARTHWORK AND GRADING GUIDELINES
DAYLIGHT CUT LOT DETAIL

EEI
Expertise . . Service . . ***Solutions***

FIGURE F

SKIN FILL OF NATURAL GROUND



Note: (1) The need and disposition of drains will be determined by the soils engineer and/or engineering geologist based on site conditions.

(2) Pad overexcavation and recompaction shall be completed if determined as necessary by the soils engineer and/or engineering geologist.

Note: Figure not to scale

EARTHWORK AND GRADING GUIDELINES
SKIN FILL OF NATURAL GROUND

EEI
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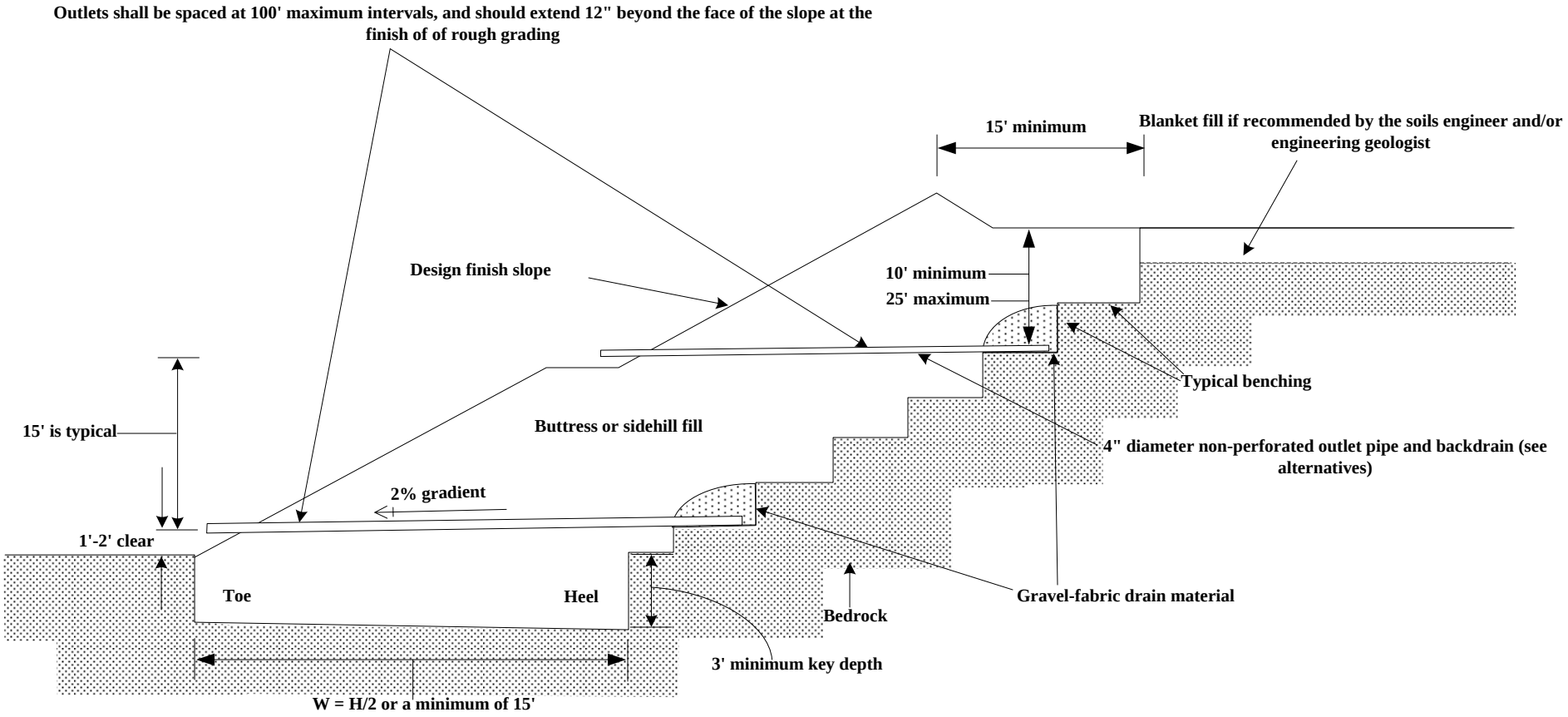
FIGURE G

TYPICAL STABILIZATION BUTTRESS FILL DESIGN



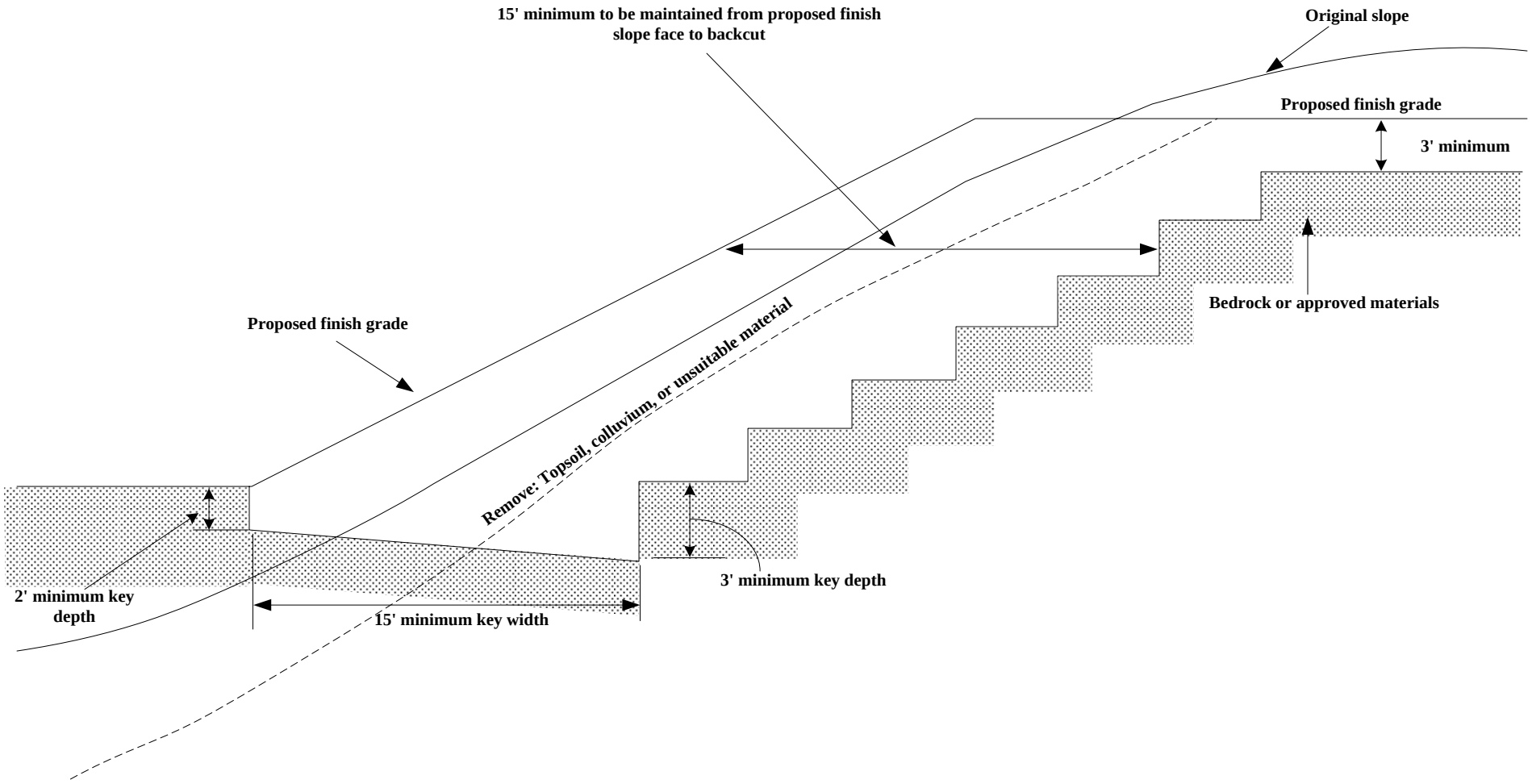
Note: Figure not to scale

EARTHWORK AND GRADING GUIDELINES
TYPICAL STABILIZATION BUTTRESS FILL DESIGN

EEI
Expertise . . Service . . *Solutions*

FIGURE H

SKIN FILL OF NATURAL GROUND



Note: (1) The need and disposition of drains will be determined by the soils engineer and/or engineering geologist based on site conditions.

(2) Pad overexcavation and recompaction shall be completed if determined as necessary by the soils engineer and/or engineering geologist.

Note: Figure not to scale

EARTHWORK AND GRADING GUIDELINES
SKIN FILL OF NATURAL GROUND

EEI
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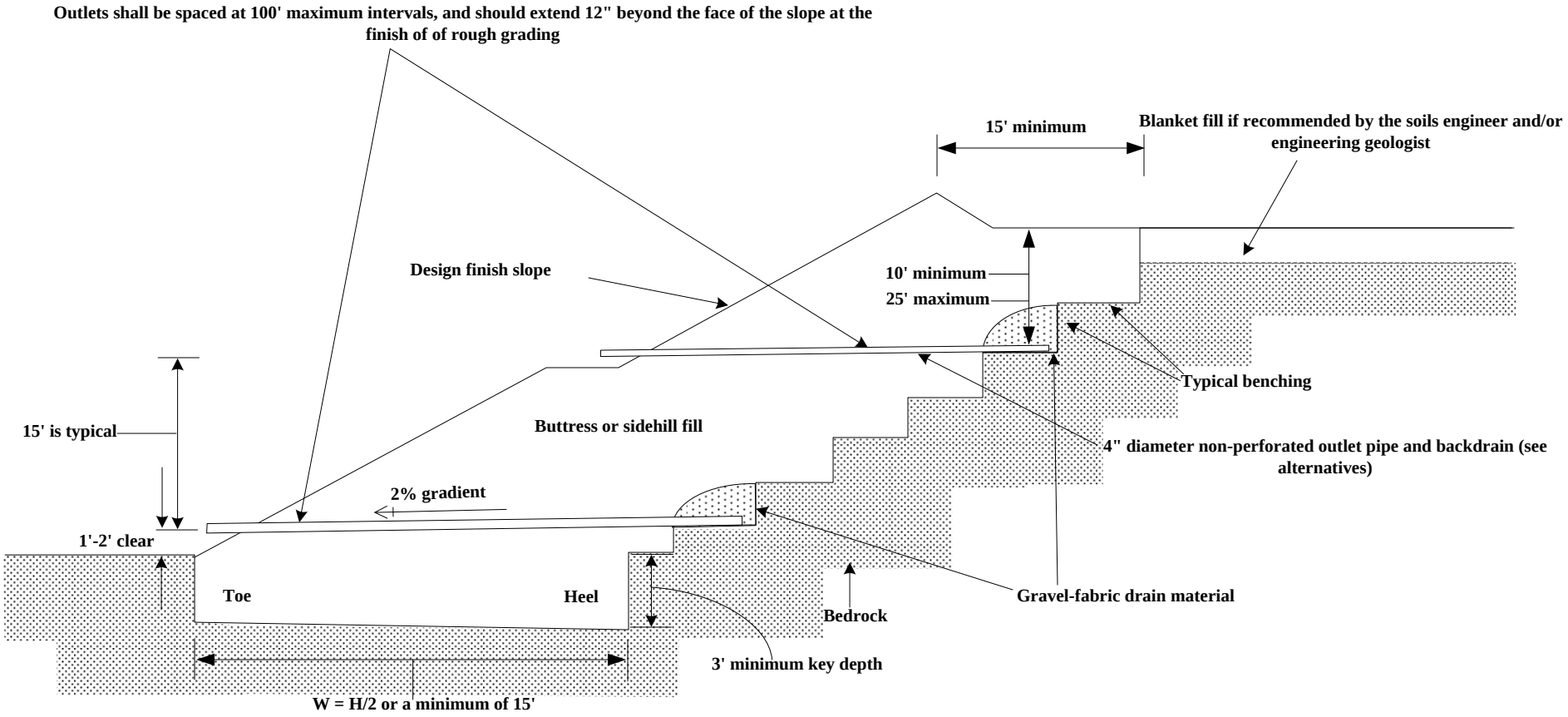
FIGURE G

TYPICAL STABILIZATION BUTTRESS FILL DESIGN



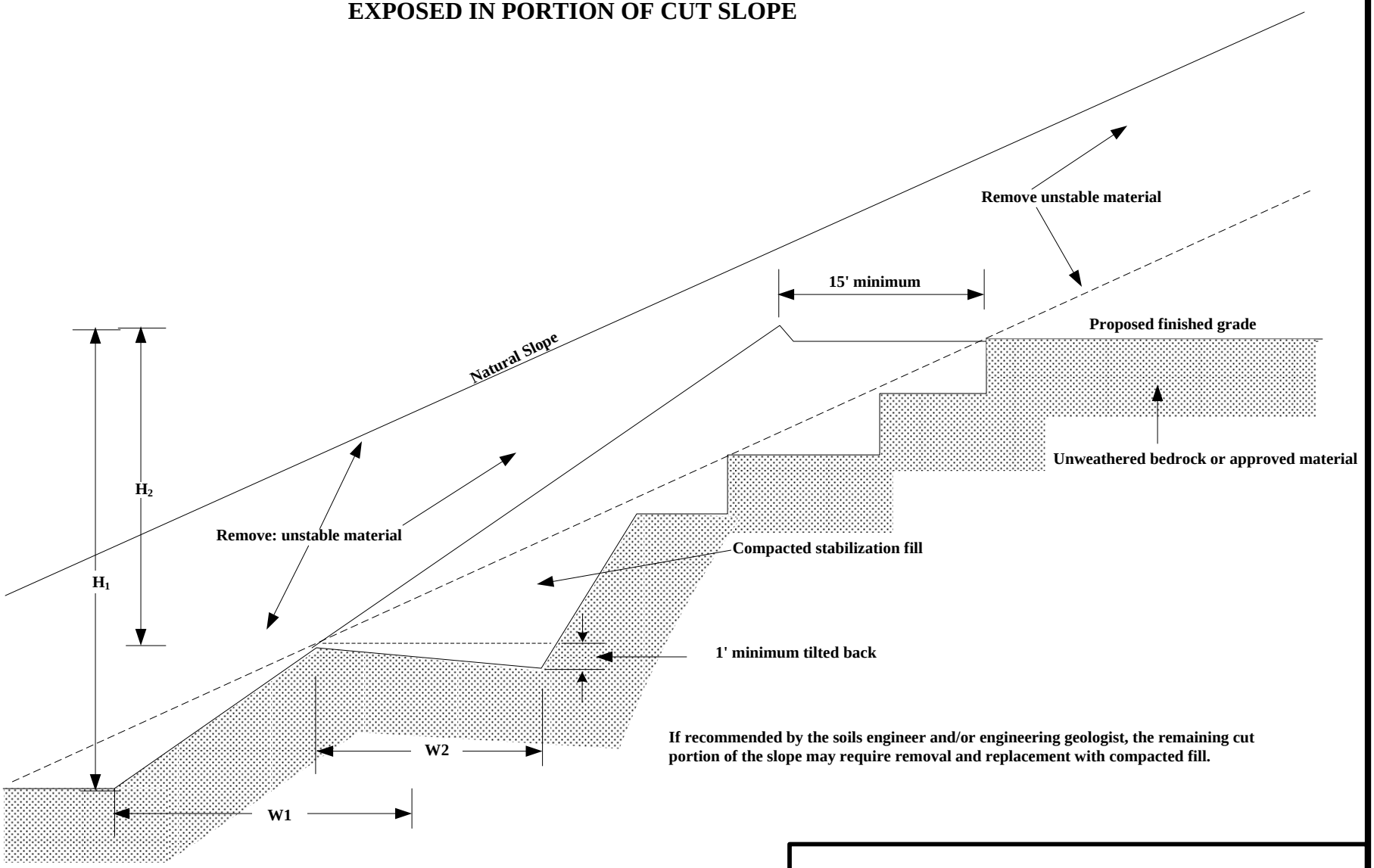
Note: Figure not to scale

EARTHWORK AND GRADING GUIDELINES
TYPICAL STABILIZATION BUTTRESS FILL DESIGN

EEI
Expertise . . Service . . *Solutions*

FIGURE H

STABILIZATION FILL FOR UNSTABLE MATERIAL EXPOSED IN PORTION OF CUT SLOPE



Note: (1) Subdrains are required only if specified by the soils engineer and/or engineering geologist.

(2) "W" shall be the equipment width (15') for slope heights less than 25 feet. For slopes greater than 25 feet "W" shall be determined by the project soils engineer and/or the engineering geologist. "W" shall never be less than H/2.

Note: Figure not to scale

EARTHWORK AND GRADING GUIDELINES

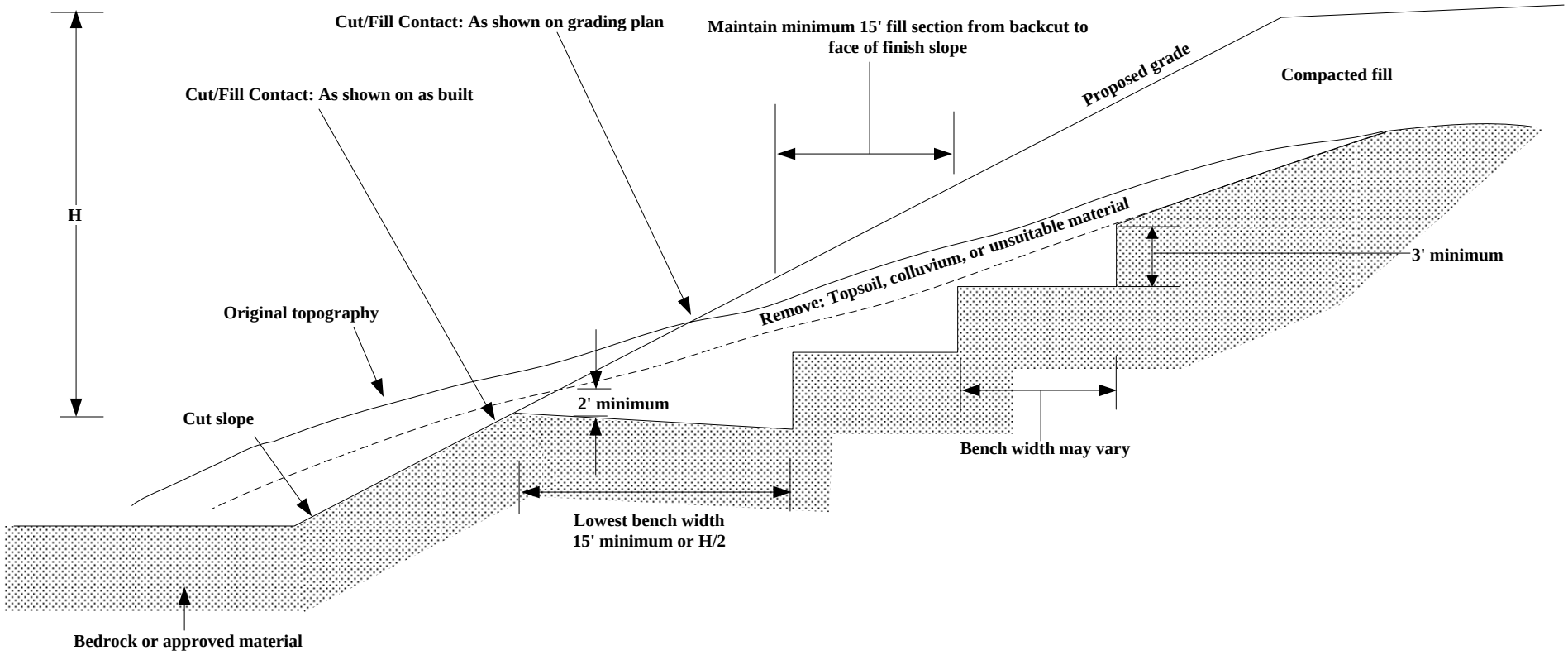
STABILIZATION FILL FOR UNSTABLE MATERIAL EXPOSED IN PORTION OF CUT SLOPE

EEI

Expertise . . Service . . *Solutions*

FIGURE I

FILL OVER CUT DETAIL



Note: The cut sectioin shall be excavated and evaluated by the soils engineer/engineering geologist prior to constructing the fill portion.

Note: Figure not to scale

EARTHWORK AND GRADING GUIDELINES
FILL OVER CUT DETAIL

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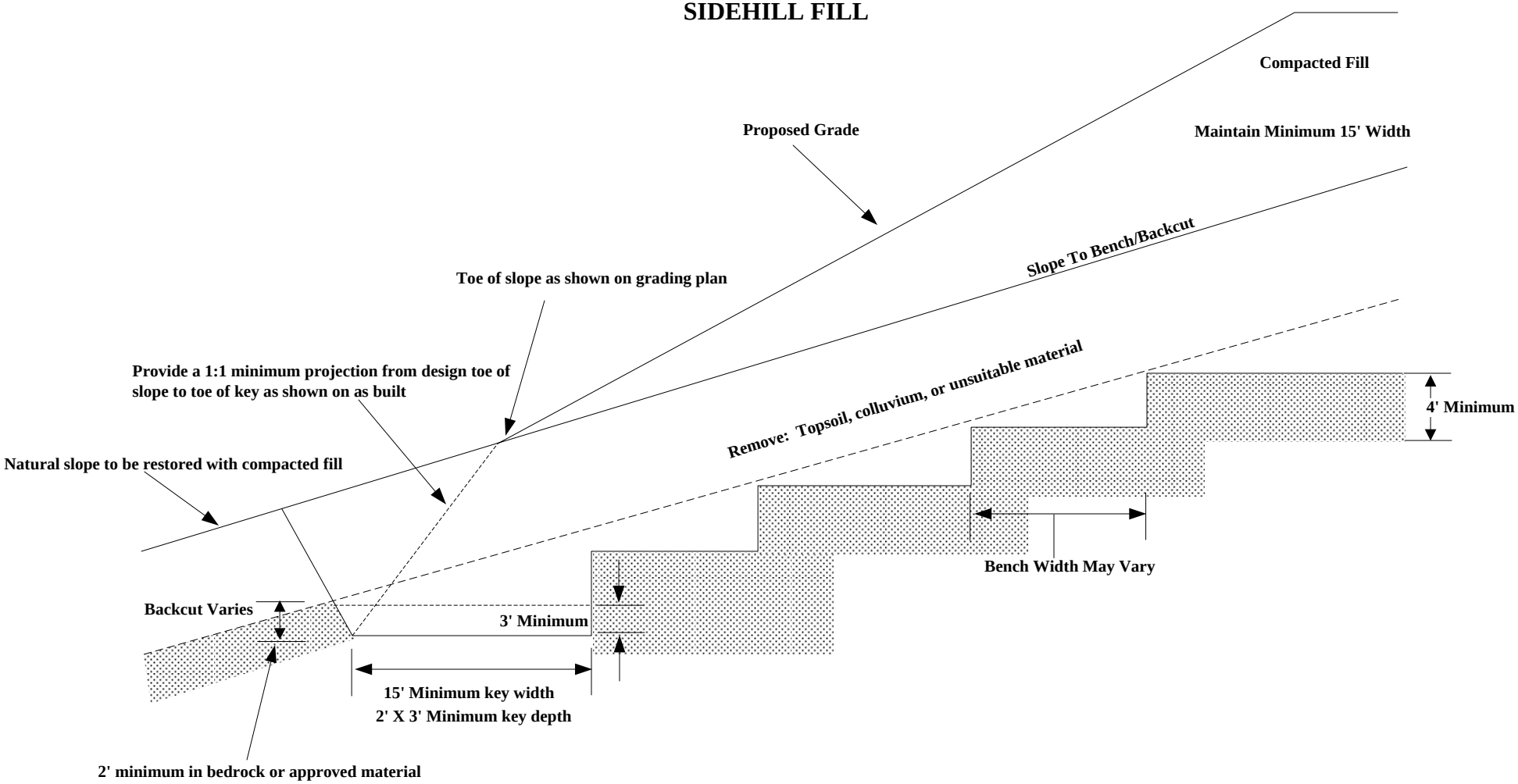
FIGURE J

FILL OVER NATURAL DETAIL
SIDEHILL FILL



Note: (1) Special recommendations shall be provided by the soils engineer/engineering geologist where the natural slope approaches or exceeds the design slope ratio.
(2) The need for and disposition of drains would be determined by the soils engineer/engineering geologist based upon exposed conditions.

Note: Figures not to scale

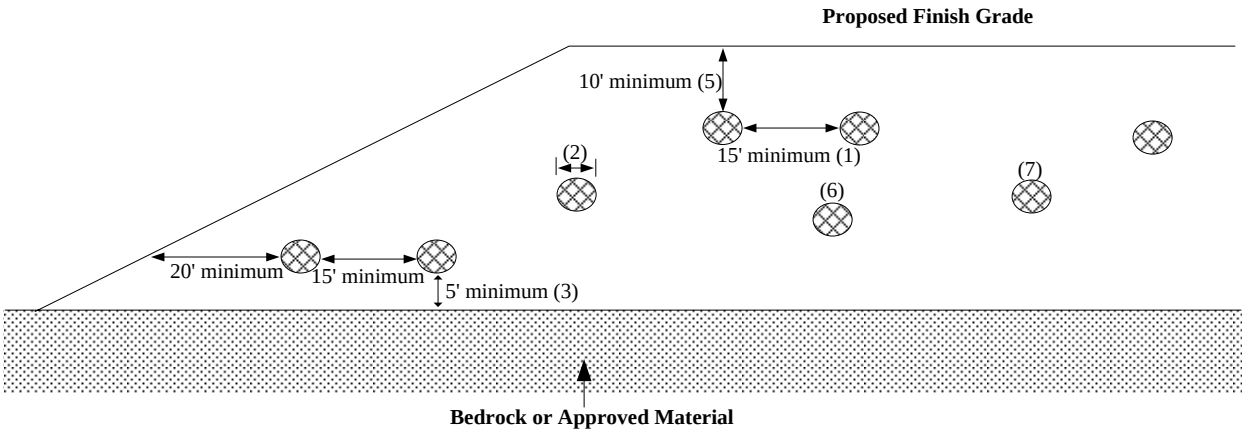
EARTHWORK AND GRADING GUIDELINES
FILL OVER NATURAL DETAIL
SIDEHILL FILL

EEI
Expertise . . Service . . ***Solutions***

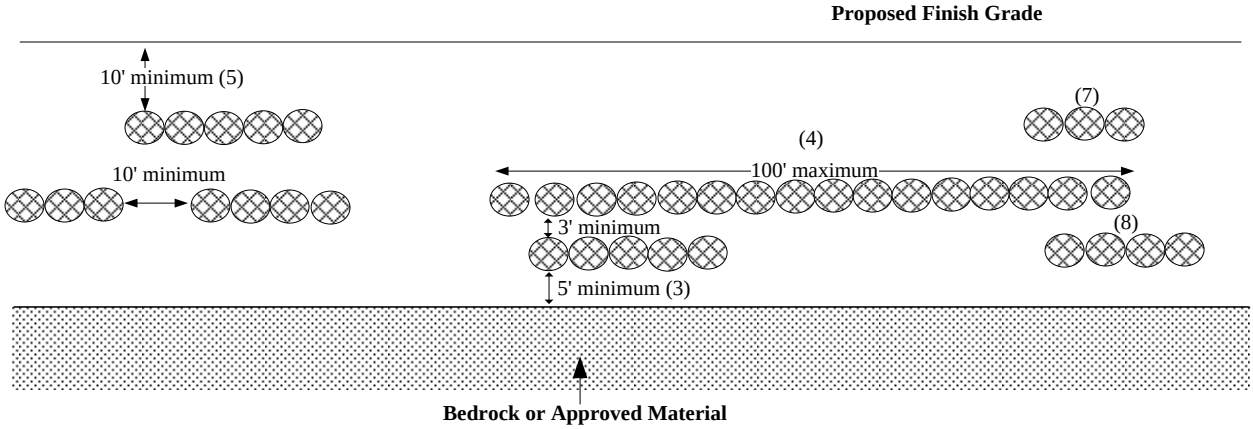
FIGURE K

OVERSIZE ROCK DISPOSAL

View Normal to Slope Face

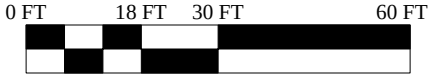


View Parallel to Slope Face



Note:
(1) One Equipment width or a minimum of 15 feet.
(2) Height and width may vary depending on rock size and type of equipment used. Length of windrow shall be no greater than 100 feet maximum.
(3) If approved by the soils engineer and/or engineering geologist.
(4) Orientation of windrows may vary but shall be as recommended by the soils engineer and/or engineering geologist. Unless recommended staggering of windrows is not necessary.
(5) Areas shall be cleared for utility trenches, foundations, and swimming pools.
(6) Voids in windrows shall be filled by flooding granular soil into place. Granular soil shall be any soil which has a unified soil classification system (Universal Building Code (UBC) 29-1). Designation of SM, SP, SW, GP, or GW.
(7) After fill between windrows is placed and compacted with the lift of fill covering windrow, windrow shall be proof rolled with a D-9 dozer or equivalent.
(8) Oversized rock is defined as larger than 12", and less than 4 feet in size.

Approximate Scale: 1" = 30'



Note: All distances are approximate

EARTHWORK AND GRADING GUIDELINES
OVERSIZE ROCK DISPOSAL

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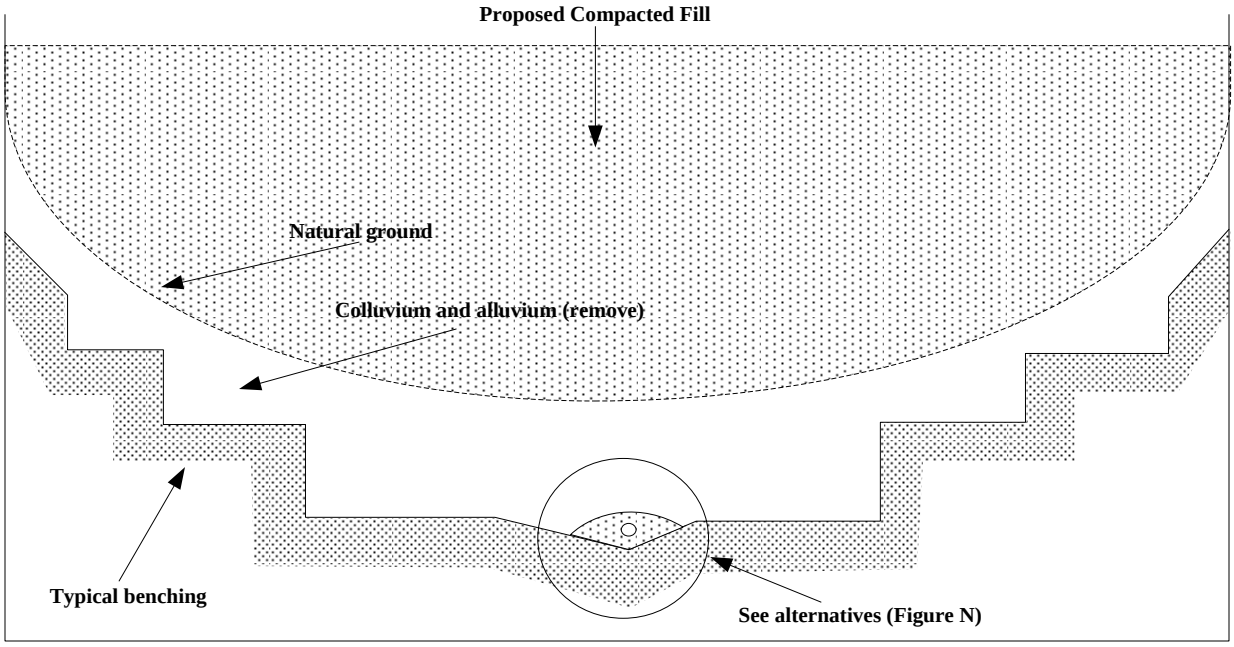
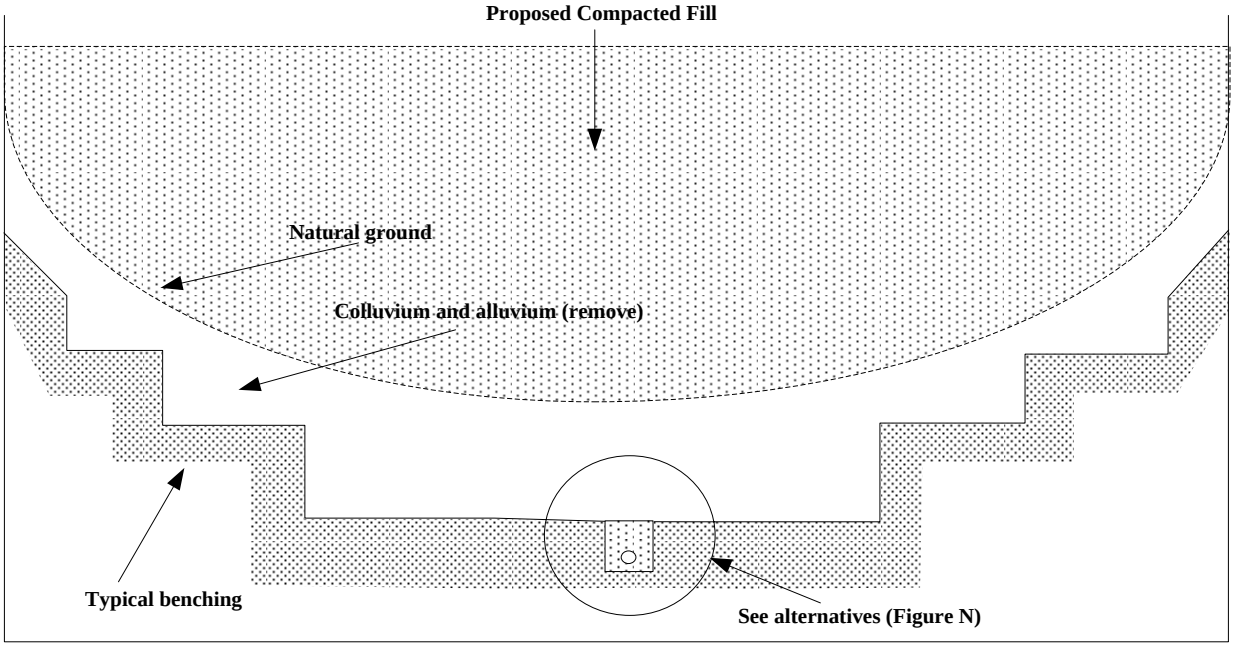
FIGURE L

CANYON SUBDRAIN DETAIL

Type A



Type B



Note: Alternatives, locations, and extent of subdrains should be determined by the soils engineer and/or engineering geologist during actual grading.

Note: Figures not to scale

EARTHWORK AND GRADING GUIDELINES
CANYON SUBDRAIN DETAIL

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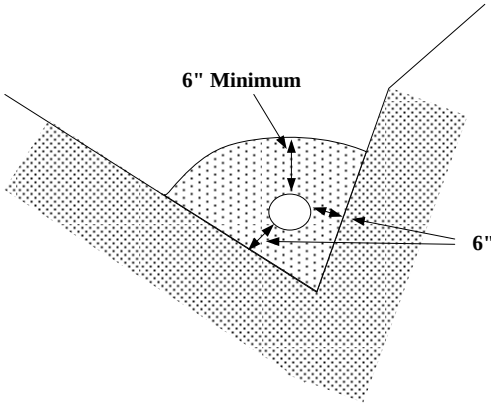
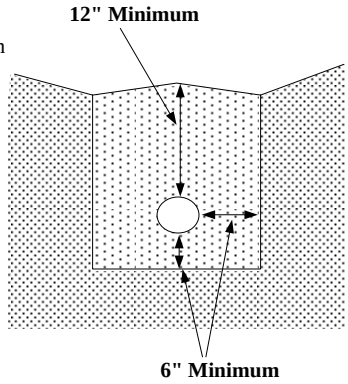
FIGURE M

CANYON SUBDRAIN ALTERNATE DETAILS

Alternate 1: Perforated Pipe and Filter Material



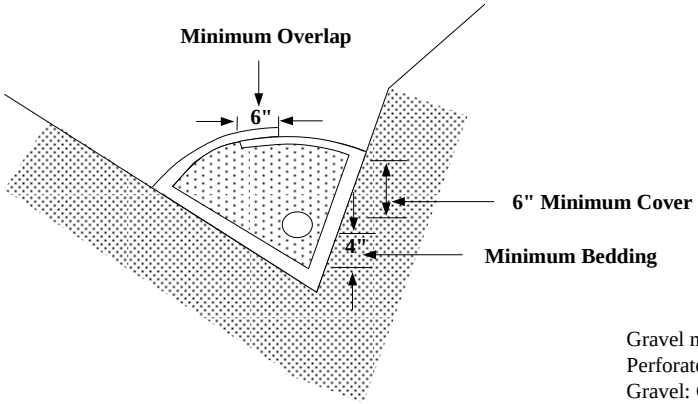
Filter material: Minimum volume of 9 feet^3/linear foot.
6" diameter ABS or PVC pipe or approved substitute with minimum 8 (¼" diameter) perforations per linear foot in bottom half of pipe.
ASTM D 2751, SDR 35 or ASTM D 1527, Schedule 40.
ASTM D 3034, SDR 35 or ASTM D 1785, Schedule 40.
For continuous run in excess of 500 feet use 8" diameter pipe.

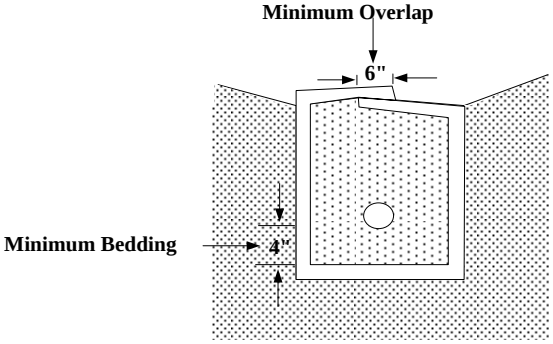


Filter Material

Sieve Size	Percent Passing
1"	100
¾"	90-100
3/8"	40-100
No. 4	25-40
No. 8	18-33
No. 30	5-15
No. 50	0-7
No. 200	0-3

Alternate 2: Perforated Pipe, Gravel and Filter Fabric





Gravel material 9 feet^3/linear foot.
Perforated pipe: see alternate 1.
Gravel: Clean ¾" rock or approved substitute.
Filter Fabric: Mirafi 140 or approved substitute.

Note: Figures not to scale

EARTHWORK AND GRADING GUIDELINES
CANYON SUBDRAIN ALTERNATE DETAILS

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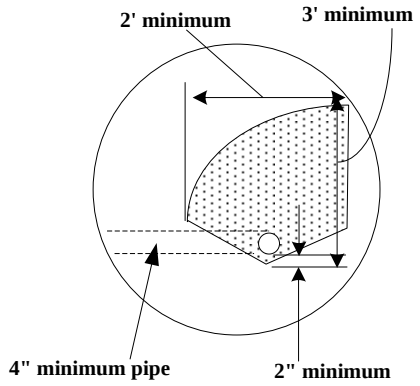
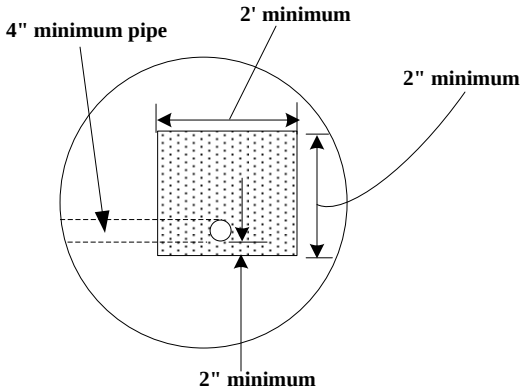
FIGURE N

TYPICAL STABILIZATION BUTTRESS SUBDRAIN DETAIL





Filter Material: Minimum of 5 ft^3/linear foot of pipe or 4 ft^3/linear foot of pipe when placed in square cut trench.

Alternative In Lieu Of Filter Material: Gravel may be encased in approved filter fabric. Filter fabric shall be mirafi 140 or equivalent. Filter fabric shall be lapped a minimum of 12" on all joints.

Minimum 4" Diameter Pipe: ABS-ASTM D-2751, SDR 35 or ASTM D-1527 schedule 40 PVC-ASTM D-3034, SDR 35 or ASTM D-1785 schedule 40 with a crushing strength of 1,000 pounds minimum, and a minimum of 8 uniformly spaced perforations per foot of pipe installed with perforations at bottom of pipe. Provide cap at upstream end of pipe. Slope at 2% to outlet pipe. Outlet pipe shall be connected to the subdrain pipe with tee or elbow.

Note: (1) Trench for outlet pipes shall be backfilled with onsite soil.
(2) Backdrains and lateral drains shall be located at the elevation of every bench drain. First drain shall be located at the elevation just above the lower lot grade. Additional drains may be required at the discretion of the soils engineer and/or engineering geologist.

Filter Material – Shall be of the following specification or an approved equivalent:

Filter Material

Sieve Size	Percent Passing
1"	100
¾"	90-100
3/8"	40-100
No. 4	25-40
No. 8	18-33
No. 30	5-15
No. 50	0-7
No. 200	0-3

Gravel - Shall be of the following specification or an approved equivalent:

Filter Material

Sieve Size	Percent Passing
1½"	100
No. 4	50
No. 200	8

Sand equivalent: Minimum of 50

Note: Figures not to scale

EARTHWORK AND GRADING GUIDELINES
TYPICAL STABILIZATION BUTTRESS SUBDRAIN DETAIL

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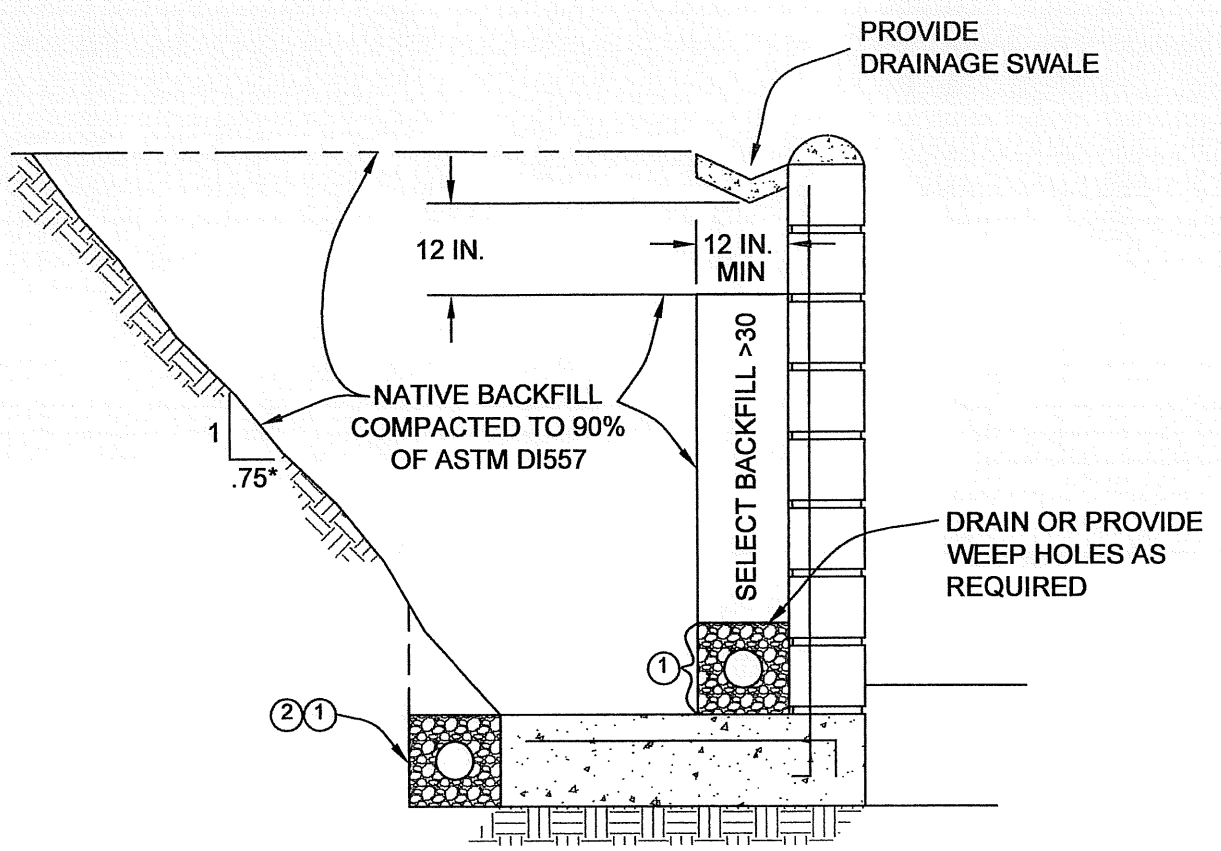
FIGURE O



* OR AS REQUIRED FOR SAFETY

NOTES

(1) 4-INCH PERFORATED PVC SCHEDULE 40 OR APPROVED ALTERNATE. PLACE PERFORATION DOWN AND SURROUND WITH A MINIMUM OF 1 CUBIC FOOT PER LINEAL FOOT (1 FT. /FT.) OF 3/4 INCH ROCK OR APPROVED ALTERNATE AND WRAPPED IN FILTER FABRIC.

(2) PLACE DRAIN AS SHOWN WHERE MOISTURE MIGRATION THROUGH THE WALL IS UNDESIRABLE.

NOTE: FIGURE NOT TO SCALE

EARTHWORK & GRADING GUIDELINES

TYPICAL RETAINING WALL BACKFILL

EEI

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FIGURE P

ATTACHMENT 7
Storm Water Quality Assessment Form

This is the cover sheet for Attachment 7.

City of Oceanside – Engineering Division – Clean Water Program

STORM WATER QUALITY ASSESSMENT FOR PLANNING, ENGINEERING, AND BUILDING PERMIT APPLICATIONS

All applications for Planning, Engineering, or Building Division permits are required to complete this assessment form and include it as part of the initial permit application submittal. Staff will review the permit application content to determine the applicability of State and City storm water requirements. Please note a storm water assessment cannot be provided without a complete permit application package.

Section 1 – Project Information	
Applicant Name: Zephyr Oceanside, LLC	Phone Number: (858) 558-3650
Project Name: Zephyr Oceanside	Email Address (Optional):
Project Site Address: 3480 Mission Avenue Oceanside, CA 92058	Street Intersection: SR 76 & Foussat Road
Assessor Parcel Number(s): 160-270-31, 82, 79, & 160-280-14, 48-51, 53-55, & 160-290-58, 60, 63 & 160-270-77	Total Parcel Area (acres or square feet): 92 acres
Project Description: Mixed use – resort, retail, residential.	Proposed Project Impervious Area (acres or square feet): 44 acres

	Section 2 – Identify Project Type
☐	New Development Project – go to Section 3
☒	Redevelopment Project – go to Section 3
☐	None of the above – Skip Section 3 and go to Section 4

	Section 3 – Identify Applicable Priority Development Project Categories
☐	**New Development Project** – A project that creates 10,000 square feet or more of impervious surfaces (collectively over the entire project site). This includes commercial, industrial, residential, mixed-use, and public development projects on public or private land.
☒	**Redevelopment Project** – A project that creates and/or replaces 5,000 square feet or more of impervious surface (collectively over the entire project site on an existing site of 10,000 square feet or more of impervious surfaces). This includes commercial, industrial, residential, mixed-use, and public development projects on public or private land.
☒	**Restaurants** – Category is defined as a facility that sells prepared foods and drinks for consumption, including stationary lunch counters and refreshment stands selling prepared foods and drinks for immediate consumption (SIC code 5812); where new or redevelopment projects that create and/or replace 5,000 square feet or more impervious surface (collectively over the entire project site).
☐	**Hillside Development** – Category includes development on any natural slope that is twenty-five percent or greater; where new or redevelopment projects that create and/or replace 5,000 square feet or more impervious surface (collectively over the entire project site).
☒	**Parking Lots** – Category is defined as a land area or facility for the temporary parking or storage of motor vehicles used personally, for business, or for commerce; where new or redevelopment projects that create and/or replace 5,000 square feet or more impervious surface (collectively over the entire project site).
☒	**Streets, Roads, Highways, Freeways, and Driveways** – Category is defined as any paved impervious surface used for the transportation of automobiles, trucks, motorcycles, and other vehicles; where new or redevelopment projects that create and/or replace 5,000 square feet or more impervious surface (collectively over the entire project site).
☐	**Water Quality Environmentally Sensitive Area** – New or redevelopment projects that create and/or replace 2,500 square feet or more of impervious surface (collectively over the entire project site), and discharging directly to a Water Quality Environmentally Sensitive Area (WQESA). "Discharging directly to" includes flow that is conveyed overland a distance of 200 feet or less from the project to the WQESA, or conveyed in a pipe or open channel any distance as an isolated flow from the project to the ESA (i.e. not commingled with flows from adjacent lands).
☐	**Automotive Repair Shop** – Category is defined as a facility that is categorized in any one of the following Standard Industrial Classification (SIC) codes: 5013, 5014, 5541, 7532-7534, or 7536-7539, where new or redevelopment projects that create and/or replace 5,000 square feet or more impervious surface (collectively over the entire project site).
☐	**Retail Gasoline Outlet (RGOs)** – Category includes RGOs that meet the following criteria (a) 5,000 square feet or more or (b) a projected Average Daily Traffic (ADT) of 100 or more vehicles per day; where new or redevelopment projects that create and/or replace 5,000 square feet or more impervious surface (collectively over the entire project site).
☒	**Development Projects greater than one acre** – New or redevelopment projects that result in the disturbance of one or more acres of land and are expected to generate pollutants post construction.
☐	**None of the Above**

STORM WATER QUALITY ASSESSMENT FOR PLANNING, ENGINEERING, AND BUILDING PERMIT APPLICATIONS

Section 4 – Identify Permit Application Type	
☒	**Discretionary Permit Application**: Specific Plan (S), General Plan Amendment (GPA), Zone Amendment (ZA), Tentative Map (T), Tentative Parcel Map (P), Development Plan (D), Conditional Use Permit (CUP), Variance (V), Regular Coastal Permit (RC), Historic Permit (H), Reclamation Plan, Planned Development Permit, Planned Unit Development Permit, Planning Commission Approval of Plans, Site Plan Review, Tentative Map Amendments to Conditions of Approval or Time Extension, Variance.
☐	**Administrative Permit Application**: Administrative Clearing Permit, Lot Line Adjustment, Final Map Modification, Grading Plan (including modification or renewal), Improvement Plan (including modification), Landscape Plan, Building Permit, Construction Right-of-Way Permit, Encroachment Permit, Excavation Permit, On-site Wastewater System Permit, Underground Tank Permit, Well Permit, or etc.

Section 5 – Applicant Certification	
Name of Responsible Party: Michael Grehl	Phone Number: Director of Development
Email Address (optional)	FAX Number (optional):
I understand and acknowledge the City of Oceanside has adopted minimum requirements, as mandated by the San Diego Regional Water Quality Control Board – Order No. R9-2013-0001, as amended by Order Nos. R9-2015-0001 and R9-2015-0100 (NPDES NO. CAS0109266) for mitigating impacts associated with urban runoff, including storm water from construction and land development activities. I certify this assessment has been accurately completed to the best of my knowledge and is consistent with the proposed project. I acknowledge that non-compliance with the City Best Management Practice (BMP) Design Manual, Grading Ordinance, and Erosion Control Ordinance may result in enforcement action by the City, the California State Water Resources Control Board, and/or the San Diego Regional Water Quality Control Board. Enforcement action may include stop work orders, notice of violation, fines, or other actions.	
Applicant Signature:	Date:

Completion Guidance

Please note – the Applicant is requested to complete this form and submit as part of the project application. For assistance, please contact Development Services at (760) 435-4373.

Section 1 – Project Information

1. Applicant Name – provide name of Individual completing form, i.e. Owner or Owner Representative
2. Phone Number – provide phone number of Individual completing form, i.e. Owner or Owner Representative
3. Project Name – provide project name (consistent with project application) i.e. Jones Residence, Example Commercial Development, and etc
4. Email Address (Optional) – provide email address if you want to receive a digital copy of the project Storm Water Determination
5. Project Site Address – provide a physical address for the proposed project
6. Street Intersection – provide nearest intersecting streets
7. Assessor Parcel Number(s) – provide Assessor Parcel Number(s); refer to title documents or contact City Staff for assistance
8. Total Parcel Area (acres or square feet) – provide the parcel area; refer to title documents
9. Project Description – provide a brief project description (e.g. single-family dwelling, retail business, repair shop, and etc)
10. Approximate Proposed Project Impervious Area (acres or square feet) – provide the approximate total area of all impervious surfaces (includes roofs, sidewalk, patios, driveways, and etc)

Section 2 – Identify Project Type

1. New Development – check box if proposed project is a new development (i.e. the parcel is undeveloped and there are no existing paved surfaces or structures on the site) – if project is a new development go to Section 3.
2. Redevelopment – check box if proposed project includes the redevelopment of an existing site (i.e. replacement, rehabilitation, or reconfiguring of existing structures or paved surfaces) – if project is a "redevelopment" go to Section 3
3. None of the above – check box if proposed project is not a new development or a redevelopment; skip Section 3 and go to Section 4

Section 3 – Identify Applicable Priority Development Project Categories

1. Review each category and check the appropriate boxes that apply to your project.
2. General identification of Automotive Repair Shop SIC (Standard Industrial Classifications) as follows:
   - 5013 – Motor vehicle supplies and new parts
   - 5014 – Tires and tubes
   - 5541 – Gasoline service stations
   - 7532 – Top and body repair, and paint shops
   - 7533 – Auto exhaust system repair shops
   - 7534 – Tire retreading and repair shops
   - 7536 – Automotive glass replacement shops
   - 7537 – Automotive transmission repair shops
   - 7538 – General automotive repair shops
   - 7539 – Automotive repair shops-not elsewhere classified
3. Contact Storm Water Development Review Staff at (760) 435-5164 for assistance in determining applicability of Water Quality Environmentally Sensitive Area (WQESA) category
4. If no categories apply, check "None of the above"

Section 4 – Identify Permit Application Type

1. Identify the applicable permit application type. In general, Discretionary permits applications require a public hearing, whereas Administrative permits may be approved by Staff. Suggest obtaining assistance at the City Development Services Counter Staff and from City Planning Staff. Guidance may be obtained by telephone at (760) 435-4373.

Section 5 – Applicant Certification

1. Name of Responsible Party – provide name of Owner
2 Phone Number – provide phone number of Owner
3. Email Address (Optional) – provide email address if you want to receive a digital copy of the project Storm Water Determination
4. FAX Number (Optional) – provide FAX number if you want to receive a digital copy of the project Storm Water Determination
5. Applicant Signature – provide signature of Individual completing form, i.e. Owner or Owner Representative
6. Date – provide date current date