DLZ
ENGINEERS • ARCHITECTS • SCIENTISTS
PLANNERS • SURVEYORS

March 7, 2008

Michael D. Weeks, P.E.
Project Engineer
TranSystems Corporation
5747 Perimeter Drive, Suite 240
Dublin, Ohio 43017

Re: **SCI-823-6.81, Portsmouth Bypass Project, PID 19415**
Addendum to Report: Shumway Hollow Road (TR 234) Interchange
Embankment Stability, Time-Rate of Consolidation, Soil Cut Slope Stability
DLZ Job No.: 0121-3070.03, Document No. 107

Dear Mr. Weeks:

DLZ has reviewed ODOT-Office of Geotechnical Engineering's (OGE's) Stage 1 review comments (dated January 31, 2007) for Phase 1 of the SCI-823 project. In compliance with the review comments, DLZ has modified the slope stability analyses and time-rate of consolidation calculations for the Shumway Hollow Road (TR 234) interchange embankments. This document also elaborates on our previous recommendations for soil cut slopes and includes the output of the associated stability analyses.

The following summarizes the OGE comments related to the interchange:

- OGE stated that DLZ should be consistent with the assumed shear strength values for the embankment fill material since some analyses used Φ=32 degrees while others used Φ=35 degrees, with no cohesion.
- OGE commented on the minimum required factor of safety against global stability used in the report (FS=1.25). The correct minimum required factor of safety should be 1.30 for the interchange embankments and soil cuts.
- OGE requested that DLZ use a standard degree of consolidation of ninety percent when citing consolidation times instead of eighty percent.
- OGE suggested that when estimated settlements are in excess of 24 inches, pavement preparation should not commence until at least ninety percent of primary consolidation has occurred.
- OGE stated that DLZ evaluate soil cut slopes in the interchange to ensure that the recommended use of 2H:1V slopes in the soil cuts is adequate.

Summary of Report Modifications:

- The global stability of critical embankment sections have been reevaluated using Φ=35 degrees and a standard degree of consolidation of ninety percent to estimated the consolidation times. Additionally, all global stability conditions (undrained, drained, etc.) were held to the minimum required factor of safety of 1.30. These modifications affected the embankment height during staged construction

details, the required consolidation times between stages, and the reporting of overall consolidation times.

- The stability analyses for the soil cut slopes in the interchange area have been examined to verify that the minimum required factor of safety is met. The analyses indicate that 2H:1V slopes in soil cuts are adequate. The results of the stability analyses are attached.

A. Embankment Evaluations

As per ODOT's review comments, the stability analyses have been revised to reflect consistent shear strength parameters used for the embankment fill throughout the project. The majority of the analyses contained in the interchange report used Φ=35 degrees for the embankment fill material, with some analyses using Φ=32 degrees. For consistency, the revised analyses assumed Φ=35 degrees for all of the stability analyses. In addition, the required minimum factor of safety of 1.30 was used for the global stability analyses. When citing "benchmark" consolidation periods, the standard of ninety percent consolidation (U=90%) was used instead of eighty percent, as cited in the report.

Slope stability analyses contained in the Shumway Hollow Road (TR 234) Interchange Report (hereafter referred to as the interchange report) indicated that the highest mainline embankment section (57 ft) was the most critical with respect to stability. Consequently, this embankment section was reevaluated. In the analyses, it was assumed that the embankments are characterized by 2H:1V side slopes. These analyses have been reevaluated using Φ=35; all other strength and consolidation parameters remained the same as those established in the interchange report. The details and results of these analyses are discussed in the following paragraphs.

A.1. Stability Analyses

Analyses performed for the full height embankment (57 ft) yielded a critical factor of safety of 0.73 for the undrained condition, which is well below the required minimum value of 1.30. Analyses performed for the drained and seismic conditions resulted in infinite slope type failures, with factors of safety of 1.41 and 1.31, respectively. Deeper, specified surfaces also resulted in factors of safety above the minimum required factor of safety of 1.30.

Due to the low in-situ undrained shear strength, construction of the interchange embankments using staged construction was investigated. Analyses indicate that the interchange embankments could be built in two stages. The first embankment stage may be constructed to a maximum height of 23 feet while maintaining the minimum required factor of safety of 1.30. After construction of the stage 1 embankment, a waiting period will be required prior to placing any additional fill. The waiting period is necessary to allow the foundation soil to consolidate under the influence of the stage 1 embankment load. Analyses indicate that at least ninety percent (U=90%) of the excess pore pressures should be allowed to dissipate prior to adding subsequent stages. In addition to the waiting period, the maximum pore water pressure head during the stage 1 embankment construction should not be greater than 10 feet above the existing ground surface. If the pore pressure rises above this level, the placement of fill should halt immediately to allow the level of the pore pressure to dissipate. The placement of fill may resume after

the excess pore pressure has dissipated to a level no greater than 10 feet above the existing ground surface.

After the consolidation period (U=90%), fill operations for the stage 2 embankment may commence. The stage 2 embankment may be constructed up to the proposed grade level (57 ft). During construction of the stage 2 embankment, the maximum pore water pressure head should not be greater than 10 feet above the existing ground surface. If the pore pressure rises above this level, the placement of fill should halt immediately to allow the level of the pore pressure to dissipate. The placement of fill may resume after the excess pore pressure has dissipated to a level no greater than 10 feet above the existing ground surface. A summary of the analyses, as well as the graphic results of stability analyses are attached.

A.2. Time-Rate of Consolidation

There are no changes to the total settlement/consolidation calculations presented in the interchange report.

The time-rate of consolidation calculations were modified based upon the "benchmark" time-rate of consolidation of ninety percent instead of eighty percent. Various wick drain spacing options and the associated consolidation times are also presented. The results of the calculations are presented in the following paragraphs.

As mentioned above, after constructing the stage 1 embankment, ninety percent of consolidation (U=90%) should be achieved prior to placing the subsequent stage. The estimated consolidation times are presented in the following table. It should be noted that these consolidation times are estimates only. The ODOT construction representative should determine when the specified degree of consolidation has occurred based upon settlement and piezometer measurements in the field.

Time-Rate of Consolidation Estimates

Wick Drain Spacing	Time to Ninety Percent Consolidation, t_{90}				
	[1]Mainline Embankments (U=90%)	Interchange – Ramp A (U=90%)	Interchange – Ramp B (U=90%)	Interchange – Ramp C (U=90%)	Interchange – Ramp D (U=90%)
No Wick Drains	65 years	24 years	15 months	28 months	65 years
3 ft	150 days	145 days	105 days	120 days	150 days
5 ft	400 days	380 days	200 days	250 days	400 days
7 ft	760 days	695 days	290 days	390 days	760 days

[1] Estimated waiting/consolidation period after placing stage 1, prior to placing subsequent stages.

Based upon OGE comments, in areas where the maximum anticipated settlement is in excess of 24 inches, steps for pavement preparations should not begin until at least ninety percent of the consolidation has been achieved. This recommendation is intended to prevent poor pavement performance due to excessive settlements.

A.3 Wick Drain and Instrumentation Plans

Due to changes in the time-rate of consolidation calculations and the addition of alternate wick drain spacing options, an update of the wick drain and instrumentation plans for the interchange are attached.

A.4. Embankment Drainage

It is understood that a portion of the roadway will be constructed over several existing ponds. These areas should be drained prior to construction. Any soft "muck" in the bottom should be removed to expose suitable bearing material prior to beginning the fill placement. All soil removal should be observed by the Geotechnical Engineer to verify the suitability of the bearing material. A two-foot thick layer of durable Type D riprap should be placed in the bottom of the drained pond. Any stream channels underneath the embankment should be abandoned or relocated, and filled with a 2-foot layer of durable Type D riprap. If soil fill is placed above the riprap, geotextile fabric should be placed between the soil and the rock. Ponds may require benching as set fourth in ODOT Item 203.05 or placement of a spring or seep drain prior to embankment fill placement. Ponds known to have a spring and requiring a spring drain are indicated as spring fed ponds on the plans.

B. Soil Cut Slopes

As per OGE's review comments, the stability analyses for the soil cuts in the area of the Shumway Hollow Road (TR 234) Interchange have been reexamined to verify the recommended use of 2H:1V slopes. In the interchange report, a factor of safety of 1.25 for drained condition was determined for 2H:1V slopes. This minimum factor of safety is less than the required factor of safety of 1.30. Upon further examination, it was found that the factor of safety of 1.25 was for an infinite slope type failure. Additional analyses indicate that deeper, specified surfaces yielded factors of safety greater than the minimum required value of 1.30. Consequently, the use of 2H:1V slopes are acceptable. The results of the stability analyses are attached.

DLZ
ENGINEERS • ARCHITECTS • SCIENTISTS
PLANNERS • SURVEYORS

We appreciate having the opportunity to be of service to you on this project. Please do not hesitate to call if you have any questions concerning this addendum.

Sincerely,

DLZ OHIO, INC.

Steven J. Riedy
Geotechnical Engineer

Eric Tse, P.E.
Senior Geotechnical Engineer

STATE OF OHIO
ERIC
WAI
KEUNG TSE
PE. 70726
REGISTERED
PROFESSIONAL ENGINEER

Encl: As noted

cc: file

sjr

M:\proj\0121\3070.03\Correspondence\Addendum Letters_Phase 1 Stage I\Shumway Hollow Road Interchange (TR 234) Addendum Rev.doc

Embankment Evaluations

Embankment Stability Analyses
Time-Rate of Consolidation Calculations
Wick Drain and Instrumentation Plans

SCI-823 Portsmouth Bypass
Shumway Hollow Road Interchange , Mainline Embankment Analyses
Analysis Results Summary

Project No: 0121-3070.03
Completed by: SJR
Date: 1/17/2008

Mainline Embankment Analysis - No Staged Construction

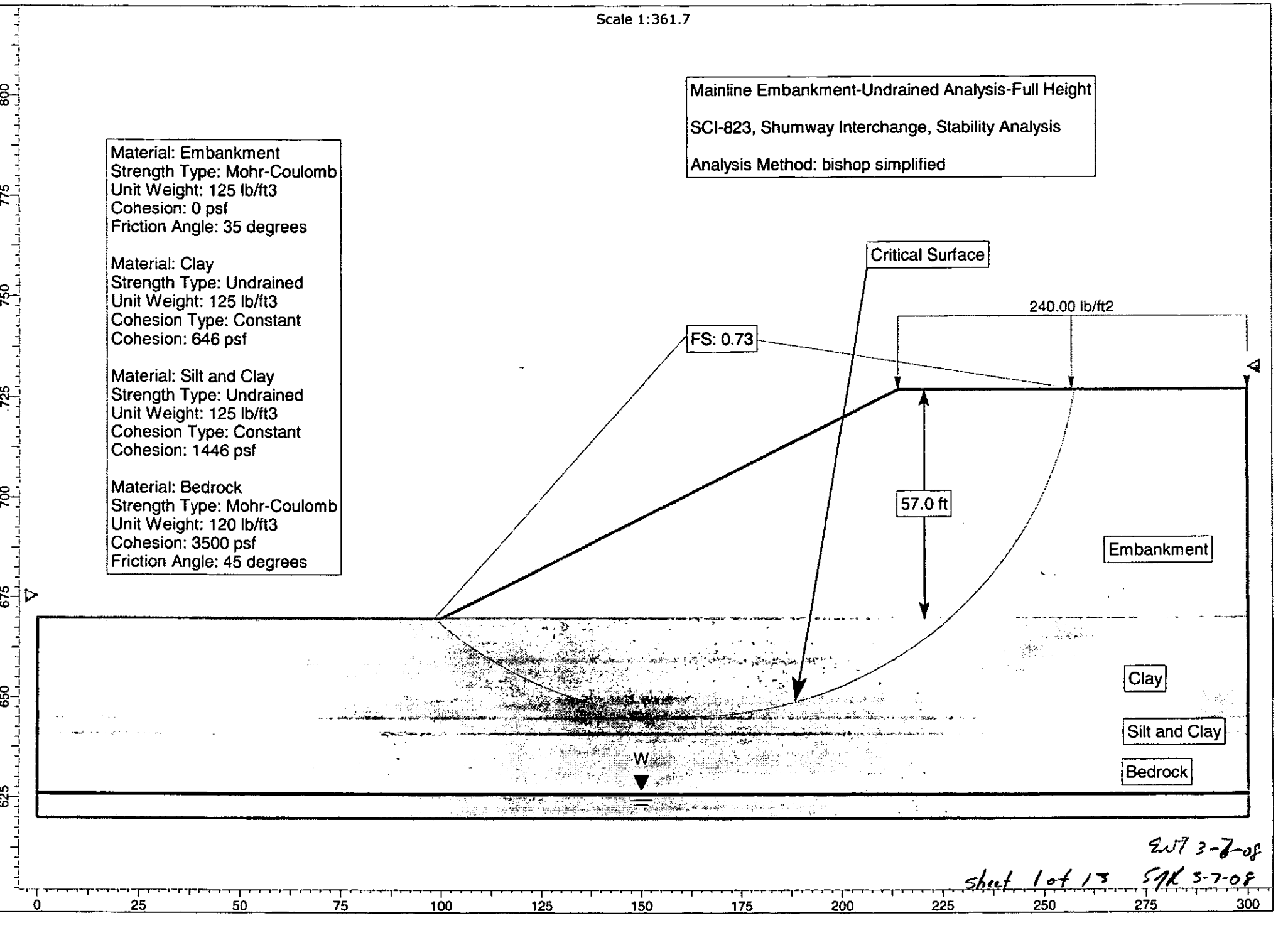
Embankment Height (ft)	Condition	Critical FS	Failure Surface
57	Undrained	0.73	Critical Surface
57	Drained	1.78	Specified Surface
57	D - Seismic	1.64	Specified Surface

Mainline Embankment Analysis - Stage 1

[1]Embankment Height (ft)	Condition	Critical FS	Failure Surface	[2]Critical pore water pressure head (ft)
23	Undrained	1.30	Critical Surface	NA
23	Effective Stress Analysis with u_e	1.37	Specified Surface	+ 10.0

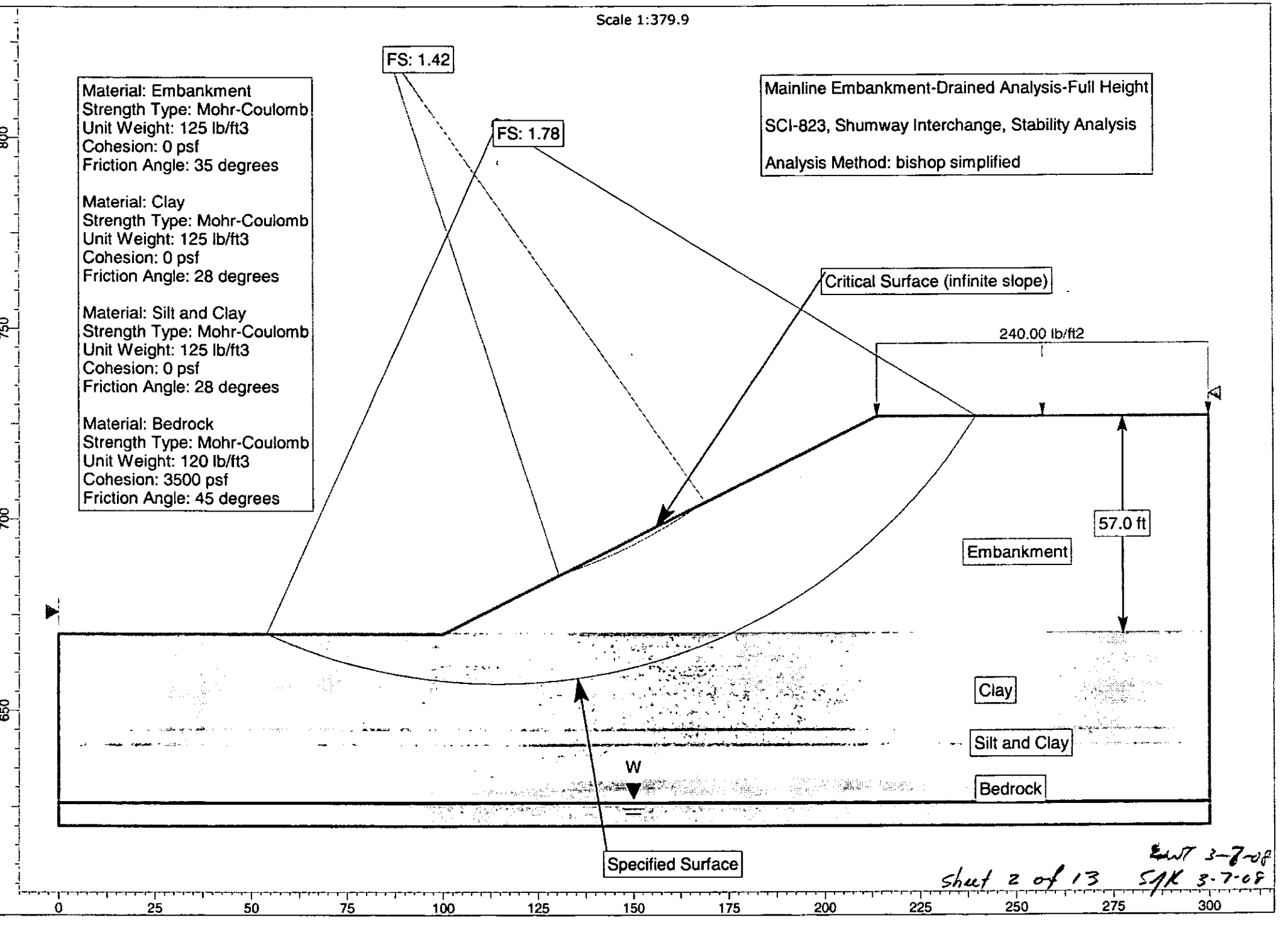
Mainline Embankment Analysis - Stage 2

[1]Embankment Height (ft)	Condition	Critical FS	Failure Surface	[2]Critical pore water pressure head (ft)
57	Undrained	1.31	Critical Surface	NA
57	Effective Stress Analysis with u_e	1.35	Specified Surface	+ 10.0

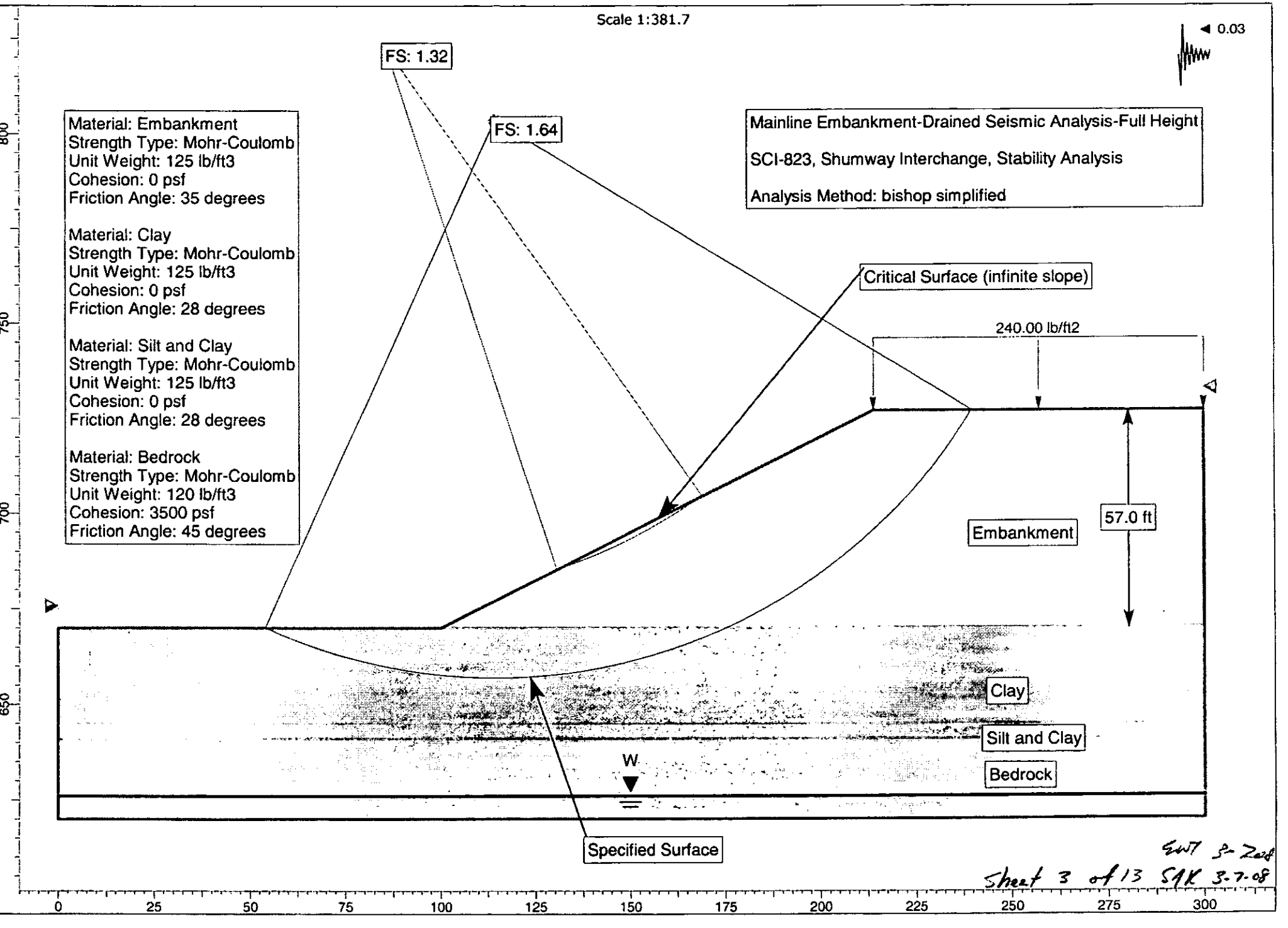


EWJ 3-7-08

Sheet 1 of 13 SJK 3-7-08

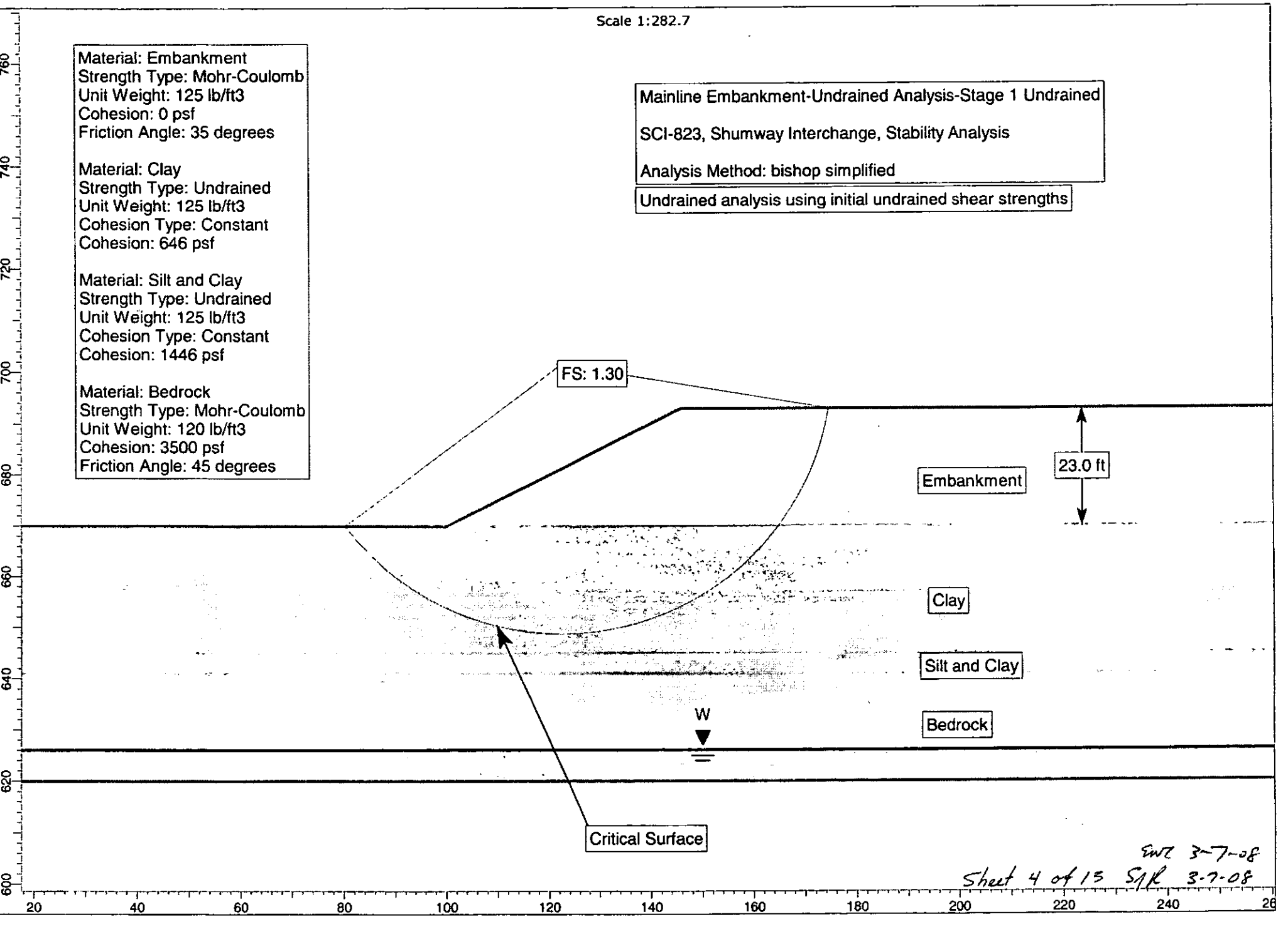


EWT 3-7-08
Sheet 2 of 13 SJK 3-7-08



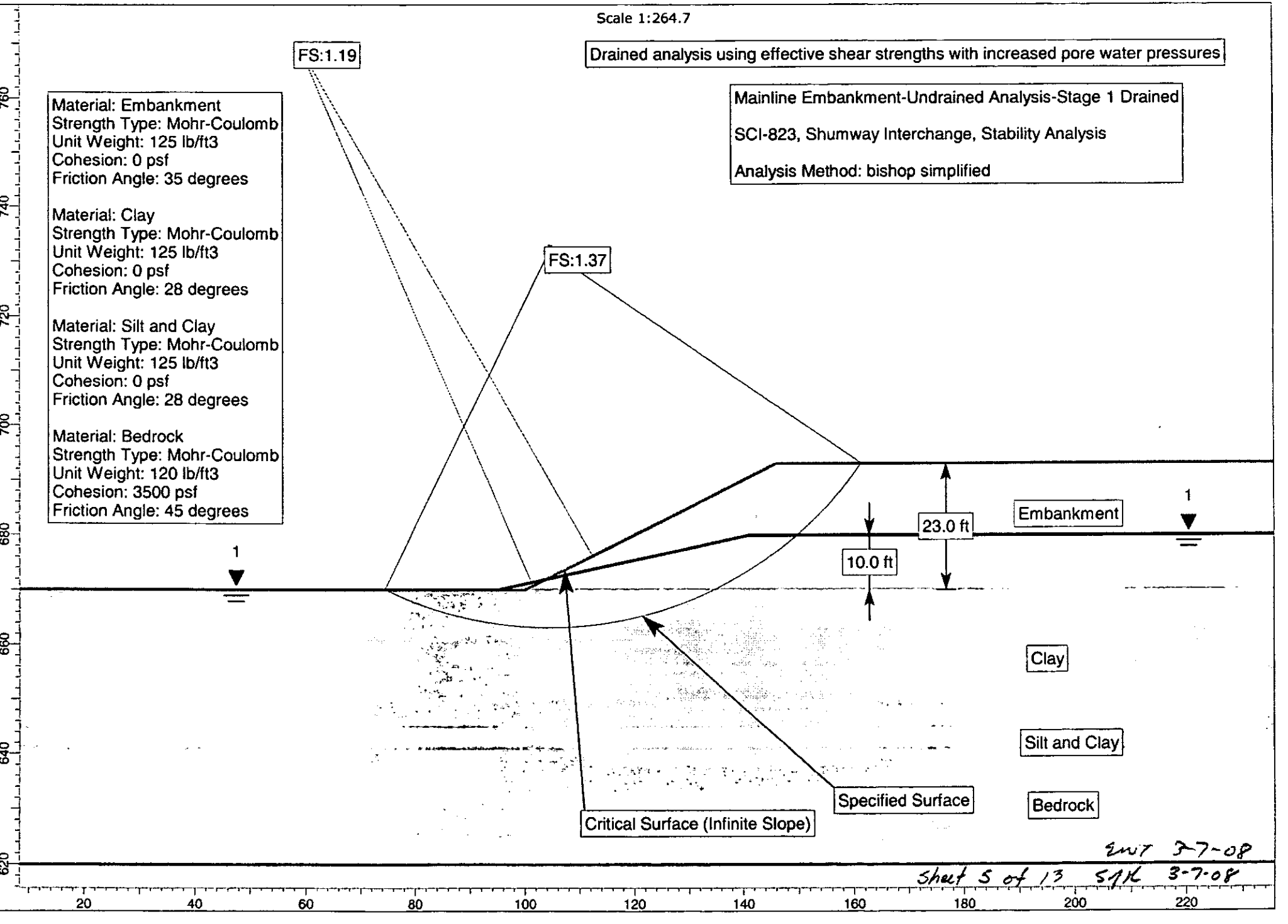
EWT 3-2008

Sheet 3 of 13 SJK 3-7-08



EWT 3-7-08

Sheet 4 of 15 SJK 3-7-08



Env 3-7-08

Sheet 5 of 13 SJK 3-7-08

DLZ

SUBJECT

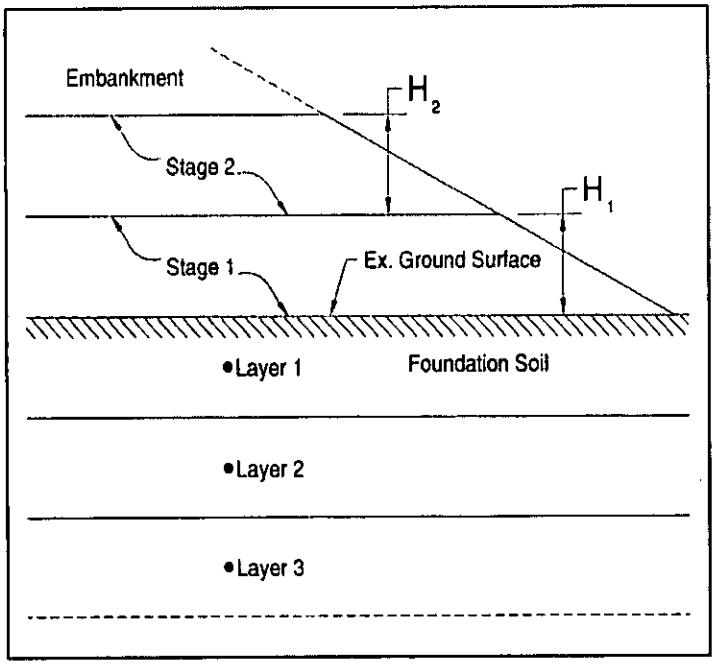
Client	Transystems Copr
Project	SCI-823 Portsmouth Bypass
Item	Undrained Strength Analysis - Staged Const.
SR 823 Mainline embankment	

JOB NUMBER	0121-3070.03		
SHEET NO.	6	OF	13
COMP. BY	SJK	DATE	3-7-08
CHECKED BY	GMT	DATE	3-7-08

Determine Increase in Undrained Shear Strength Due to Consolidation

Undrained Strength Analysis - Staged Construction

Ref: Ladd, Charles C. (1991). "Stability Evaluation During Staged Construction." *The Twenty-Second Karl Terzaghi Lecture.*, Journal of Geotechnical Engineering, ASCE, 117(4), 540-615



Increase in Undrained Shear Strength from consolidation

$$c_u = c_{ui} + \Delta\sigma' \cdot \tan(\phi_{cu})$$

Where: c_{ui} Initial undrained shear strength, UU or q_u testing

ϕ_{cu} Determined from CIU testing

$\Delta\sigma'$ Effective stress increase due to embankment loading

$$\Delta\sigma' = (H_n \cdot \gamma_{emb}) \cdot U$$

Where: U Average degree of consolidation (%)

H_n Height of Embankment, Stage n (ft)

Embankment Fill

γ_{fill} 125 pcf

Top of leveling pad el. 562.0'

Bot. of excavation el. 560.5

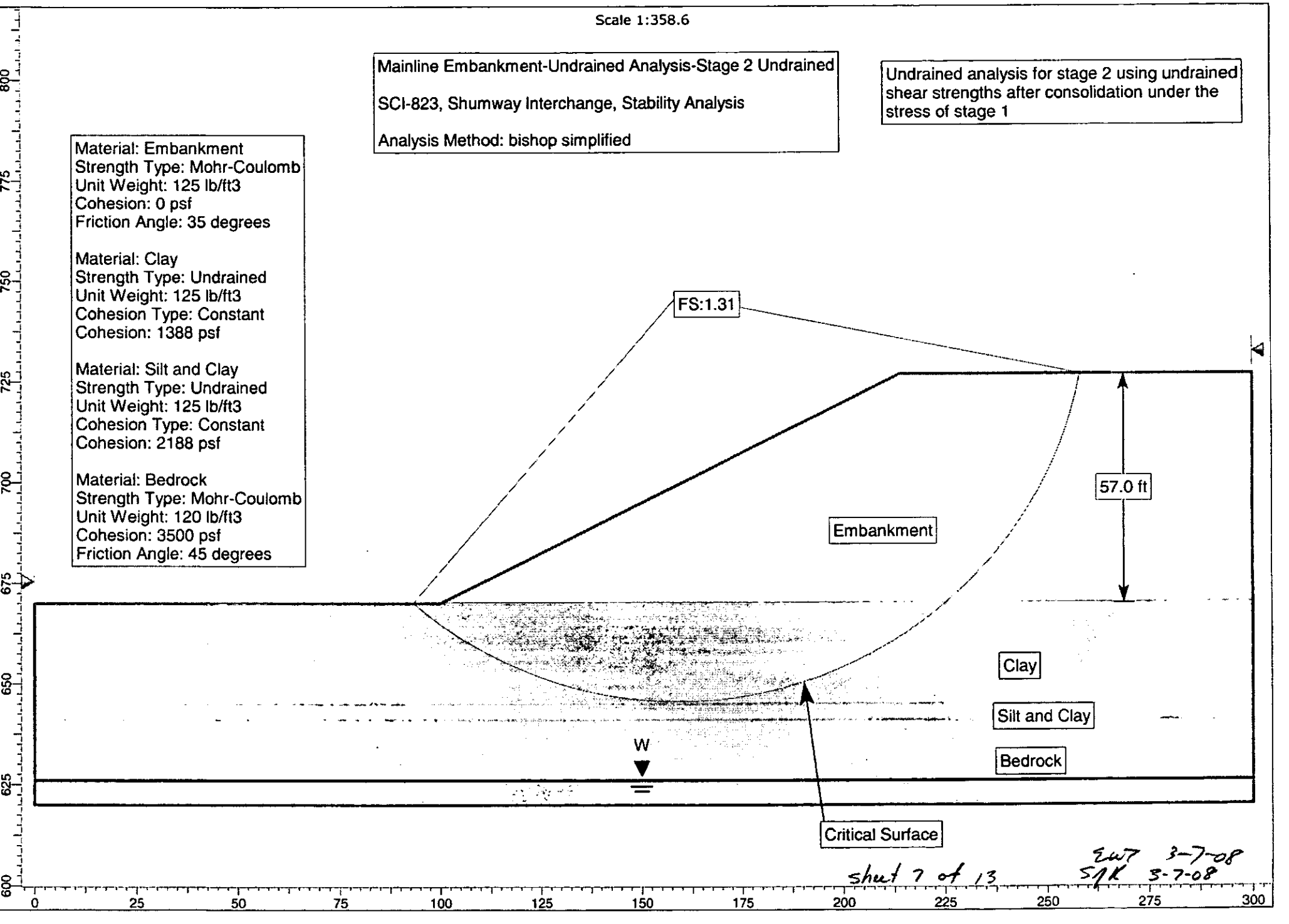
Stage 1 Embankment First Stage Embankment Height H_1= **23.0** Average Percent Consolidation U= **90%**

Depth	Soil Type	Initial Undrained Shear Strength, c_{ui} (psf)	$\Delta\sigma'$ (psf)	Φ_{cu} (deg)	Δc_u (psf)	c_u (psf), *After Consolidation*	Percent Increase
0-25	A-7-6	646	2588	16.0	742	1388	115%
25-29	A-6a	1446	2588	16.0	742	2188	51%

Stage 2 Embankment Second Stage Embankment Height H_2= **34.0** Average Percent Consolidation U= **0%**

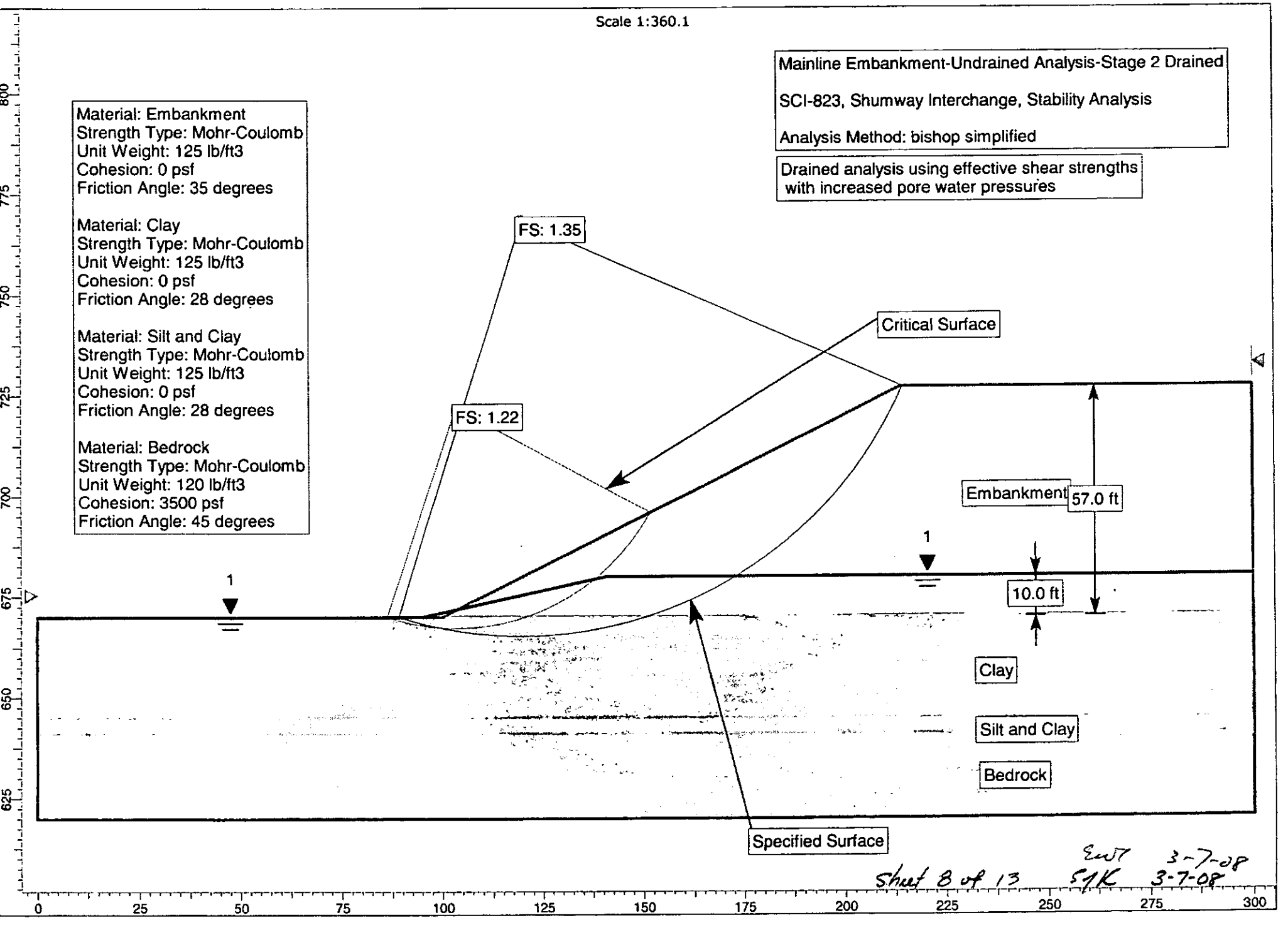
0-25	A-7-6	1388	0	16.0	0	1388	0%
25-29	A-6a	2188	0	16.0	0	2188	0%

Stage 3 Embankment Third Stage Embankment Height H_3= - Average Percent Consolidation U= -



EWT 3-7-08
SJK 3-7-08

sheet 7 of 13



EWT 3-7-08
Sheet 8 of 13 SJK 3-7-08

SCI-823 Portsmouth Bypass
Shumway Hollow Road Interchange , Mainline Embankment Analyses
Analysis Results Summary - Settlement

Project No: 0121-3070.03
Completed by: SJR
Date: 1/18/2008

Mainline Embankment Station 404+36

Maximum Settlement (in)	t_{90} (days) - Time to 90 % consolidation			
	No drains	S=3 ft	S=5 ft	S=7 ft
24.8	23772	150	400	760

Shumway Hollow Road Interchange - Ramp A Station 403+00

Maximum Settlement (in)	t_{90} (days) - Time to 90 % consolidation			
	No drains	S=3 ft	S=5 ft	S=7 ft
23.6	8657	145	380	695

Shumway Hollow Road Interchange - Ramp B Station 372+20

Maximum Settlement (in)	t_{90} (days) - Time to 90 % consolidation			
	No drains	S=3 ft	S=5 ft	S=7 ft
10.0	452	105	200	290

Shumway Hollow Road Interchange - Ramp C Station 380+00

Maximum Settlement (in)	t_{90} (days) - Time to 90 % consolidation			
	No drains	S=3 ft	S=5 ft	S=7 ft
6.0	855	120	250	390

Shumway Hollow Road Interchange - Ramp D Station 404+00

Maximum Settlement (in)	t_{90} (days) - Time to 90 % consolidation			
	No drains	S=3 ft	S=5 ft	S=7 ft
23.3	23772	150	400	760

DLZ

SUBJECT

Client	Transystems Corp
Project	SCI-823 Portsmouth Bypass
Item	Time-rate of settlement for roadway embk.
	SR 823 Mainline Sta. 404+36

JOB NUMBER 0121-3070.03
SHEET NO. 9 OF 13
COMP. BY SJL DATE 3-7-08
CHECKED BY GWT DATE 3-7-08

TIME-RATE OF CONSOLIDATION CALCULATIONS

Ref: {FHWA/RD-86/168, Prefabricated Vertical Drains}

Time-Rate of Consolidation:

Without wick drains or other treatment

$$t = \frac{T_v H_{dr}^2}{c_v}$$

Input: U = 90 %
T_v = 0.848
H_{dr} = 29 ft
c_v = 0.03 ft^2/day
Single (1) or double (2) drainage 1

t = Time to specified degree of consolidation (days)
T_v = Time Factor
H_{dr} = Thickness of fine-grained layer (ft)
c_v = Coefficient of vertical consolidation (ft^2/day)
U = Average degree of consolidation (%)

t_{90} = 23,772 days = 65.1 years

$(\delta_c)_{ult}$ = 25 in

With wick drains (PVD)

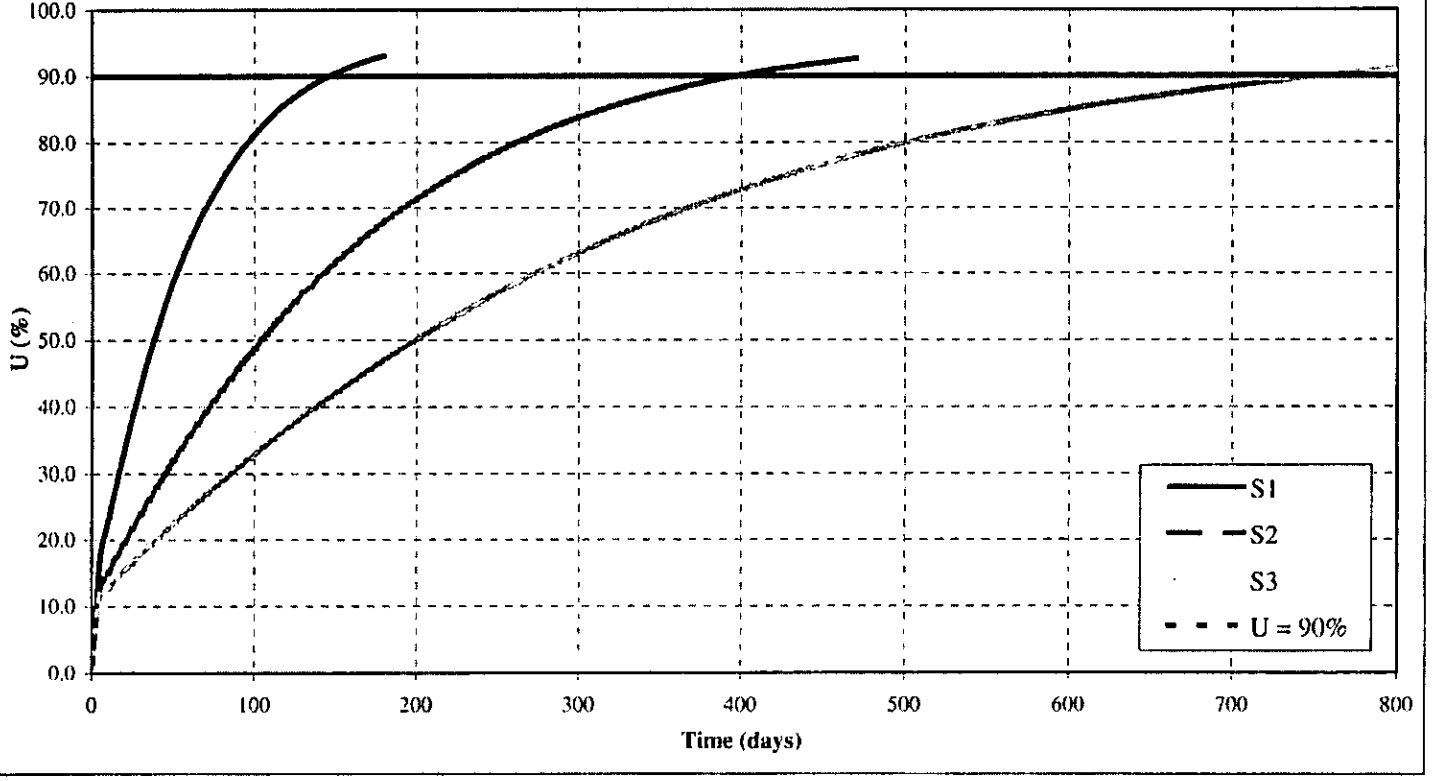
U = Average degree of consolidation (%)
S = Wick drain spacing (assume triangular pattern)
d_e = Effective drain influence zone

$$\overline{U} = 1 - (1 - \overline{U}_h)(1 - \overline{U}_v) \qquad d_e = 1.05 \cdot S$$

Spacing Options

S_1	= 3 ft	t_{90}	=	150	days
S_2	= 5 ft	t_{90}	=	400	days
S_3	= 7 ft	t_{90}	=	760	days

Percent Consolidation vs Time using Wick Drains



DLZ

SUBJECT

Client	Transystems Corp
Project	SCI-823 Portsmouth Bypass
Item	Time-rate of settlement for roadway embk.
	Shumway Hollow Int. Ramp A Sta. 403+00

JOB NUMBER	0121-3070.03		
SHEET NO.	10	OF	13
COMP. BY	SJK	DATE	3-7-08
CHECKED BY	GWT	DATE	3-7-08

TIME-RATE OF CONSOLIDATION CALCULATIONS

Ref: (FHWA/RD-86/168, Prefabricated Vertical Drains)

Time-Rate of Consolidation:

Without wick drains or other treatment

$$t = \frac{T_v H_{dr}^2}{c_v}$$

Input: U = 90 %

T_v = 0.848

H_{dr} = 35 ft

c_v = 0.03 ft^2/day

Single (1) or double (2) drainage 2

t = Time to specified degree of consolidation (days)

T_v = Time Factor

H_{dr} = Thickness of fine-grained layer (ft)

c_v = Coefficient of vertical consolidation (ft^2/day)

U = Average degree of consolidation (%)

t_{90} = 8657 days = 23.7 years

$(\delta_c)_{ult}$ = 24 in

With wick drains (PVD)

U = Average degree of consolidation (%)

S = Wick drain spacing (assume triangular pattern)

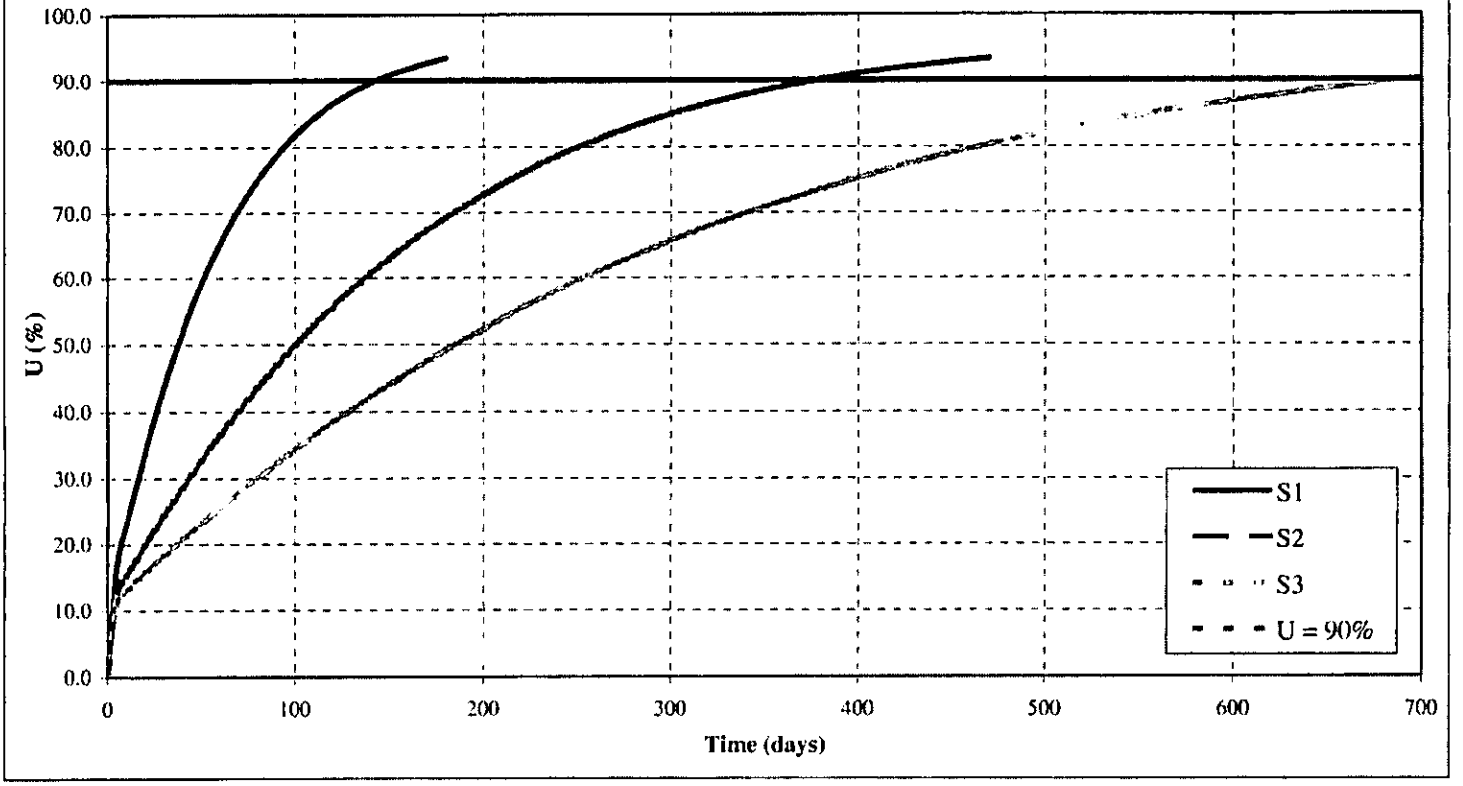
d_e = Effective drain influence zone

$$\overline{U} = 1 - (1 - \overline{U}_h)(1 - \overline{U}_v) \qquad d_e = 1.05 \cdot S$$

Spacing Options

S_1 =	3	ft	t_{90} =	145	days
S_2 =	5	ft	t_{90} =	380	days
S_3 =	7	ft	t_{90} =	695	days

Percent Consolidation vs Time using Wick Drains



DLZ

SUBJECT

Client	Transystems Corp
Project	SCI-823 Portsmouth Bypass
Item	Time-rate of settlement for roadway embk.
	Shumway Hollow Int. Ramp B Sta. 372+20

JOB NUMBER 0121-3070.03
SHEET NO. 11 OF 15
COMP. BY SAC DATE 3-7-08
CHECKED BY GWT DATE 3-7-08

TIME-RATE OF CONSOLIDATION CALCULATIONS

Ref: {FHWA/RD-86/168, Prefabricated Vertical Drains}

Time-Rate of Consolidation:

Without wick drains or other treatment

$$t = \frac{T_v H_{dr}^2}{c_v}$$

Input: U = 90 %
T_v = 0.848
H_{dr} = 8 ft
c_v = 0.03 ft^2/day
Single (1) or double (2) drainage 2

t = Time to specified degree of consolidation (days)
T_v = Time Factor
H_{dr} = Thickness of fine-grained layer (ft)
c_v = Coefficient of vertical consolidation (ft^2/day)
U = Average degree of consolidation (%)

t_{90} = 452 days = 1.2 years

$(\delta_c)_{ult}$ = 10 in

With wick drains (PVD)

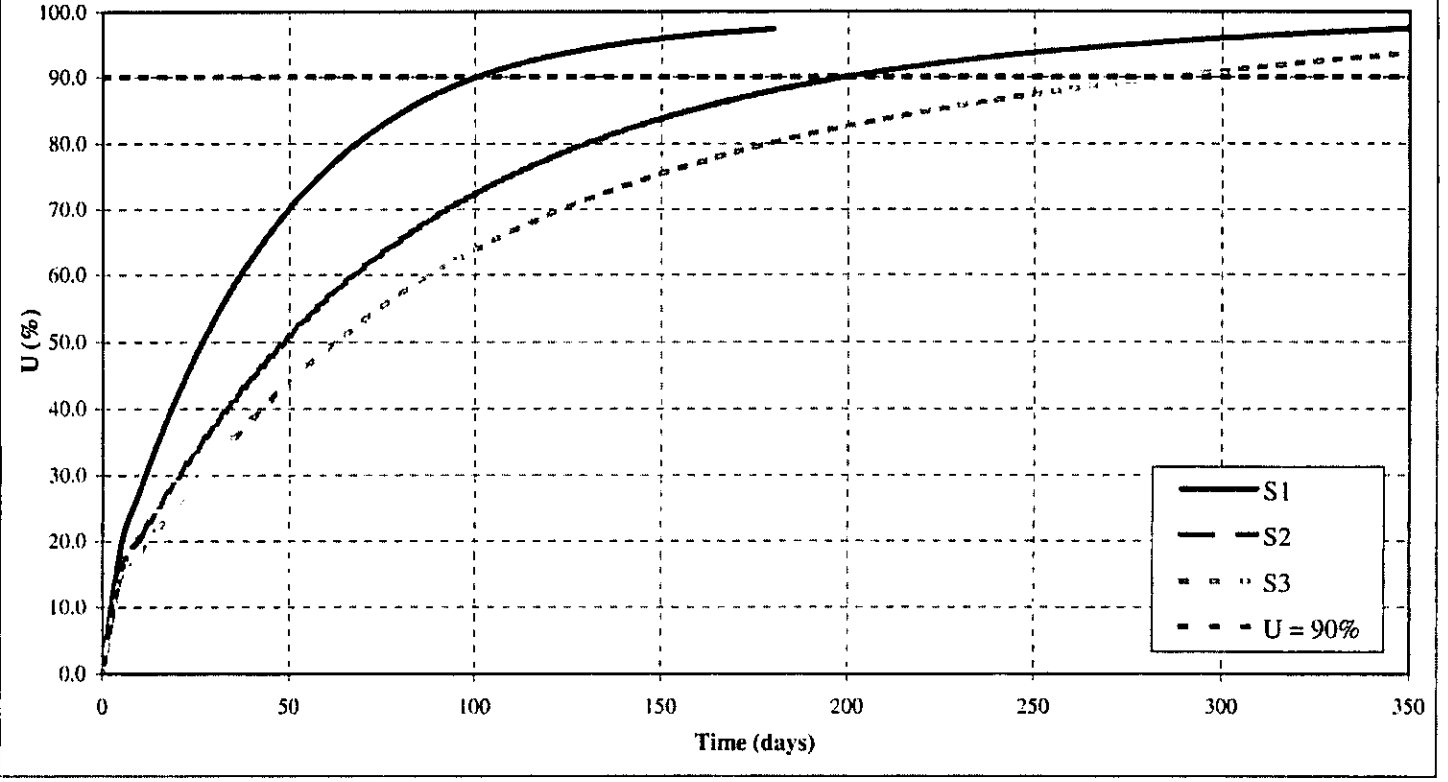
U = Average degree of consolidation (%)
S = Wick drain spacing (assume triangular pattern)
d_e = Effective drain influence zone

$$\overline{U} = 1 - (1 - \overline{U}_h)(1 - \overline{U}_v) \qquad d_e = 1.05 \cdot S$$

Spacing Options

S_1	= 3 ft	t_{90}	=	105	days
S_2	= 5 ft	t_{90}	=	200	days
S_3	= 7 ft	t_{90}	=	290	days

Percent Consolidation vs Time using Wick Drains



DLZ

SUBJECT

Client	Transystems Corp
Project	SCI-823 Portsmouth Bypass
Item	Time-rate of settlement for roadway embk.
	Shumway Hollow Int. Ramp C Sta. 380+00

JOB NUMBER 0121-3070.03
SHEET NO. 12 OF 13
COMP. BY SJK DATE 3-7-08
CHECKED BY GWT DATE 3-7-08

TIME-RATE OF CONSOLIDATION CALCULATIONS

Ref: {FHWA/RD-86/168, Prefabricated Vertical Drains}

Time-Rate of Consolidation:

Without wick drains or other treatment

$$t = \frac{T_v H_{dr}^2}{c_v}$$

Input: U = 90 %
T_v = 0.848
H_{dr} = 11 ft
c_v = 0.03 ft^2/day
Single (1) or double (2) drainage [2]

t = Time to specified degree of consolidation (days)
T_v = Time Factor
H_{dr} = Thickness of fine-grained layer (ft)
c_v = Coefficient of vertical consolidation (ft^2/day)
U = Average degree of consolidation (%)

t_{90} = 855 days = 2.3 years

$(\delta_c)_{ult}$ = 6 in

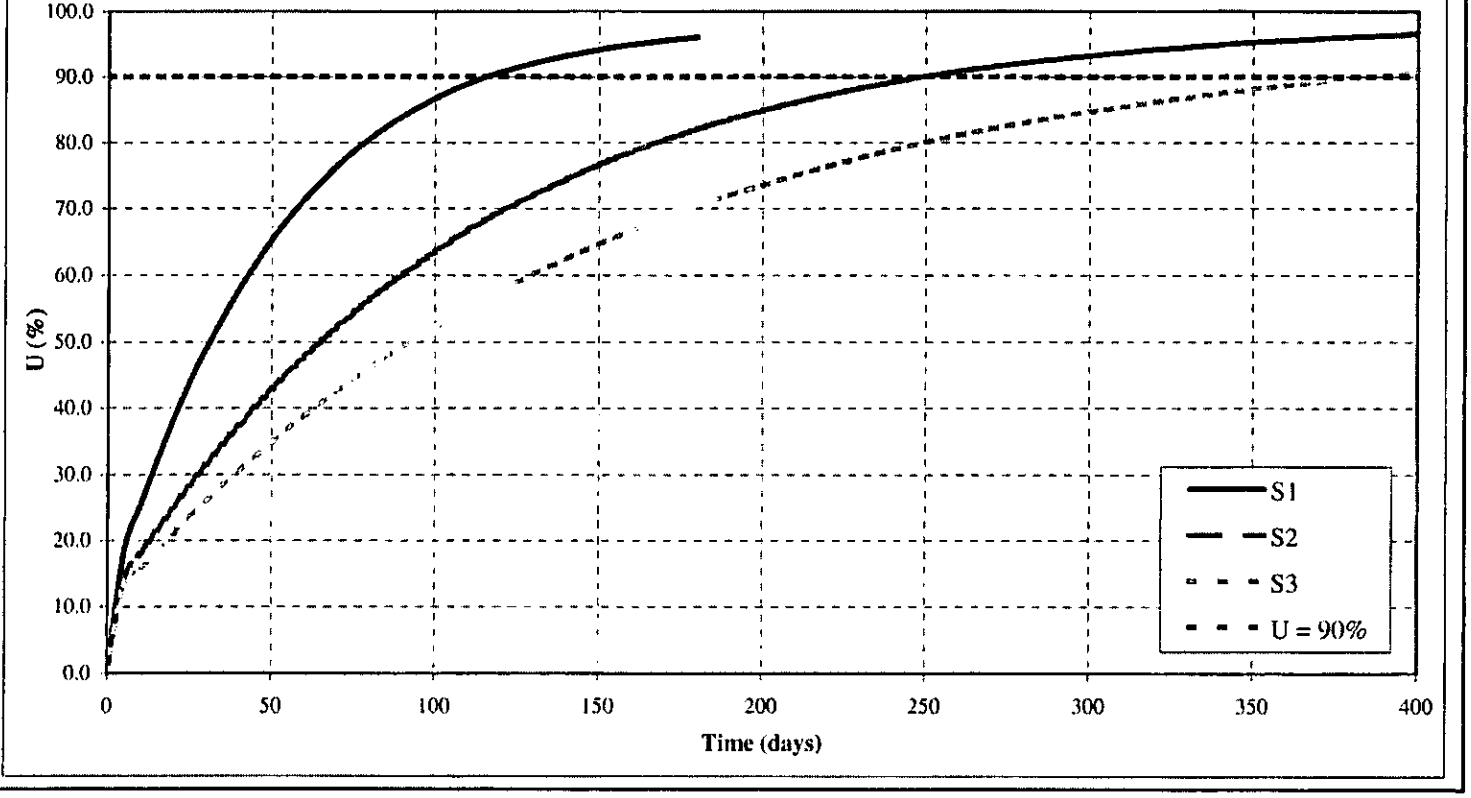
With wick drains (PVD) *Calculations on the following pages*

U = Average degree of consolidation (%)
S = Wick drain spacing (assume triangular pattern)
d_e = Effective drain influence zone

$$\overline{U} = 1 - (1 - \overline{U}_h)(1 - \overline{U}_v) \qquad d_e = 1.05 \cdot S$$

Spacing Options				
S_1 = 3 ft	t_{90} = 120 days
S_2 = 5 ft	t_{90} = 250 days
S_3 = 7 ft	t_{90} = 390 days

Percent Consolidation vs Time using Wick Drains



DLZ

SUBJECT

Client	Transystems Corp
Project	SCI-823 Portsmouth Bypass
Item	Time-rate of settlement for roadway embk.
	Shumway Hollow Int. Ramp D Sta. 404+00

JOB NUMBER 0121.3070.03
SHEET NO. 13 OF 13
COMP. BY SAR DATE 3-7-08
CHECKED BY GMT DATE 3-7-08

TIME-RATE OF CONSOLIDATION CALCULATIONS

Ref: {FHWA/RD-86/168, Prefabricated Vertical Drains}

Time-Rate of Consolidation:

Without wick drains or other treatment

$$t = \frac{T_v H_{dr}^2}{c_v}$$

Input: U = 90 %
T_v = 0.848
H_{dr} = 29 ft
c_v = 0.03 ft^2/day
Single (1) or double (2) drainage 1

t = Time to specified degree of consolidation (days)
T_v = Time Factor
H_{dr} = Thickness of fine-grained layer (ft)
c_v = Coefficient of vertical consolidation (ft^2/day)
U = Average degree of consolidation (%)

t_{90} = 23772 days = 65.1 years

$(\delta_c)_{ult}$ = 23 in

With wick drains (PVD) *Calculations on the following pages*

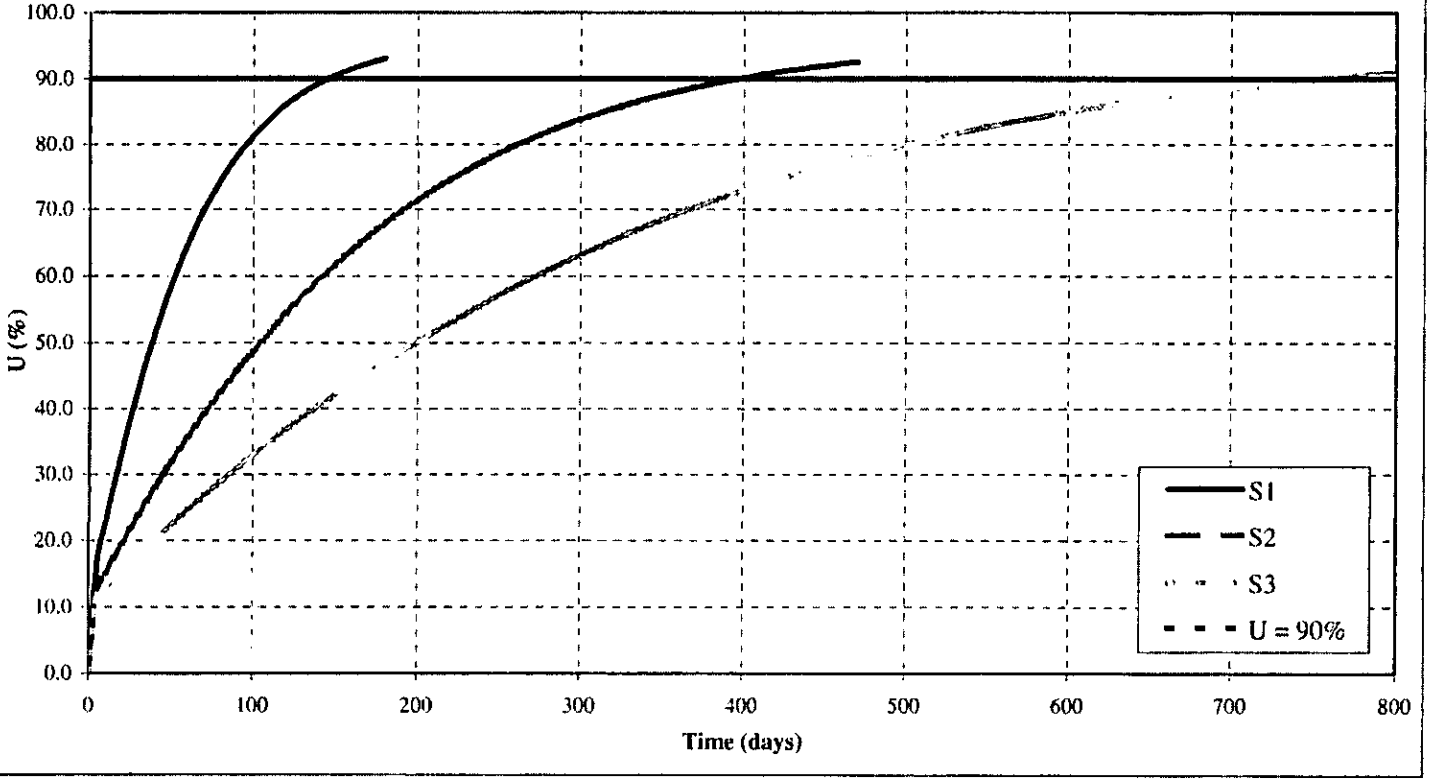
U = Average degree of consolidation (%)
S = Wick drain spacing (assume triangular pattern)
d_e = Effective drain influence zone

$$\overline{U} = 1 - (1 - \overline{U}_h)(1 - \overline{U}_v) \qquad d_e = 1.05 \cdot S$$

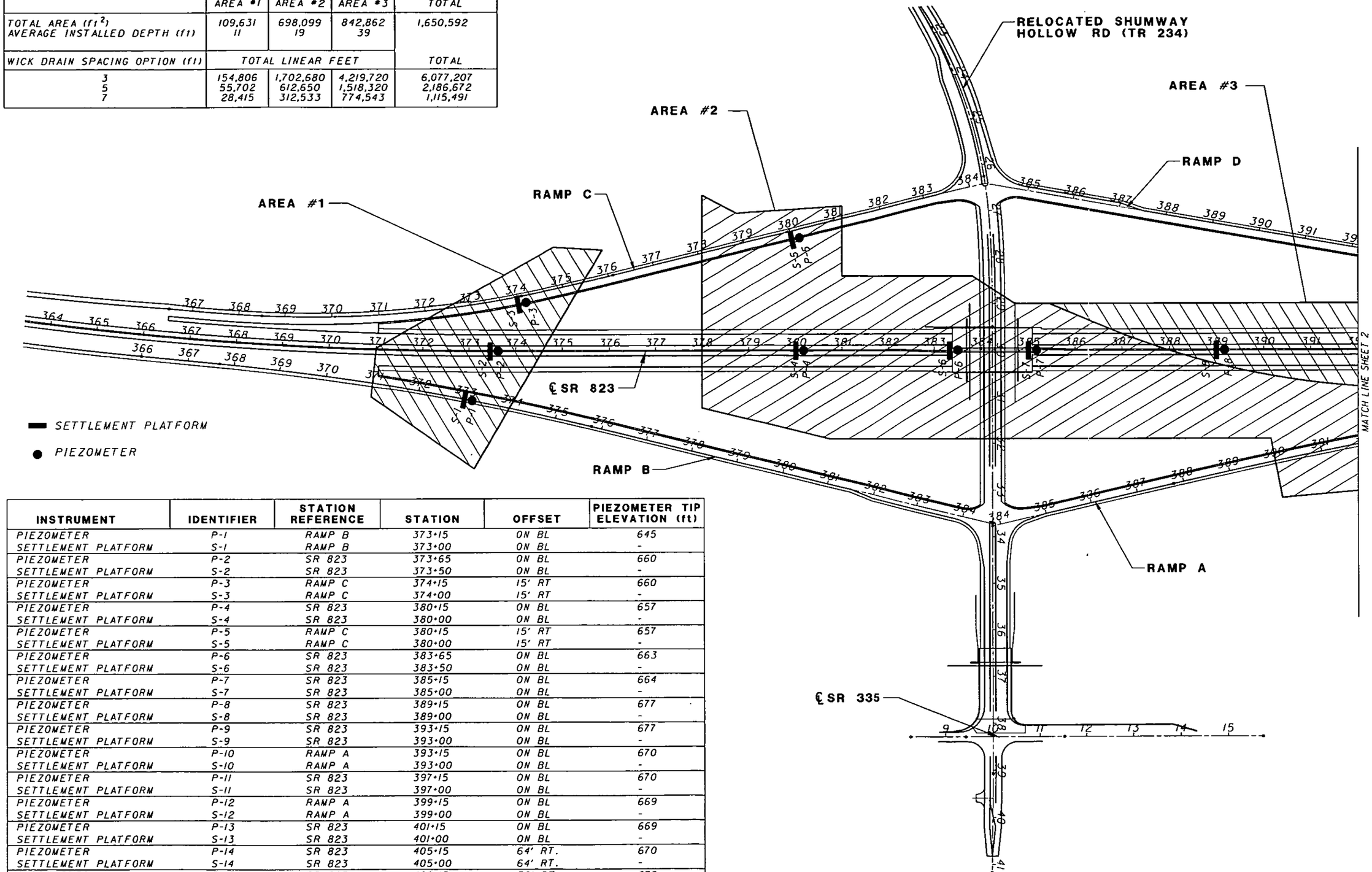
Spacing Options

S_1 =	3	ft	t_{90} =	150	days
S_2 =	5	ft	t_{90} =	400	days
S_3 =	7	ft	t_{90} =	760	days

Percent Consolidation vs Time using Wick Drains



	TREATMENT AREA			
	AREA #1	AREA #2	AREA #3	TOTAL
TOTAL AREA (ft^2) AVERAGE INSTALLED DEPTH (ft)	109,631 11	698,099 19	842,862 39	1,650,592
WICK DRAIN SPACING OPTION (ft)	TOTAL LINEAR FEET			TOTAL
3	154,806	1,702,680	4,219,720	6,077,207
5	55,702	612,650	1,518,320	2,186,672
7	28,415	312,533	774,543	1,115,491



INSTRUMENT	IDENTIFIER	STATION REFERENCE	STATION	OFFSET	PIEZOMETER TIP ELEVATION (ft)
PIEZOMETER	P-1	RAMP B	373+15	ON BL	645
SETTLEMENT PLATFORM	S-1	RAMP B	373+00	ON BL	-
PIEZOMETER	P-2	SR 823	373+65	ON BL	660
SETTLEMENT PLATFORM	S-2	SR 823	373+50	ON BL	-
PIEZOMETER	P-3	RAMP C	374+15	15' RT	660
SETTLEMENT PLATFORM	S-3	RAMP C	374+00	15' RT	-
PIEZOMETER	P-4	SR 823	380+15	ON BL	657
SETTLEMENT PLATFORM	S-4	SR 823	380+00	ON BL	-
PIEZOMETER	P-5	RAMP C	380+15	15' RT	657
SETTLEMENT PLATFORM	S-5	RAMP C	380+00	15' RT	-
PIEZOMETER	P-6	SR 823	383+65	ON BL	663
SETTLEMENT PLATFORM	S-6	SR 823	383+50	ON BL	-
PIEZOMETER	P-7	SR 823	385+15	ON BL	664
SETTLEMENT PLATFORM	S-7	SR 823	385+00	ON BL	-
PIEZOMETER	P-8	SR 823	389+15	ON BL	677
SETTLEMENT PLATFORM	S-8	SR 823	389+00	ON BL	-
PIEZOMETER	P-9	SR 823	393+15	ON BL	677
SETTLEMENT PLATFORM	S-9	SR 823	393+00	ON BL	-
PIEZOMETER	P-10	RAMP A	393+15	ON BL	670
SETTLEMENT PLATFORM	S-10	RAMP A	393+00	ON BL	-
PIEZOMETER	P-11	SR 823	397+15	ON BL	670
SETTLEMENT PLATFORM	S-11	SR 823	397+00	ON BL	-
PIEZOMETER	P-12	RAMP A	399+15	ON BL	669
SETTLEMENT PLATFORM	S-12	RAMP A	399+00	ON BL	-
PIEZOMETER	P-13	SR 823	401+15	ON BL	669
SETTLEMENT PLATFORM	S-13	SR 823	401+00	ON BL	-
PIEZOMETER	P-14	SR 823	405+15	64' RT.	670
SETTLEMENT PLATFORM	S-14	SR 823	405+00	64' RT.	-
PIEZOMETER	P-15	SR 823	409+15	56' RT.	670
SETTLEMENT PLATFORM	S-15	SR 823	409+00	56' RT.	-
PIEZOMETER	P-16	SR 823	413+15	48' RT.	680
SETTLEMENT PLATFORM	S-16	SR 823	413+00	48' RT.	-

HORIZONTAL SCALE IN FEET
0 50 100 200

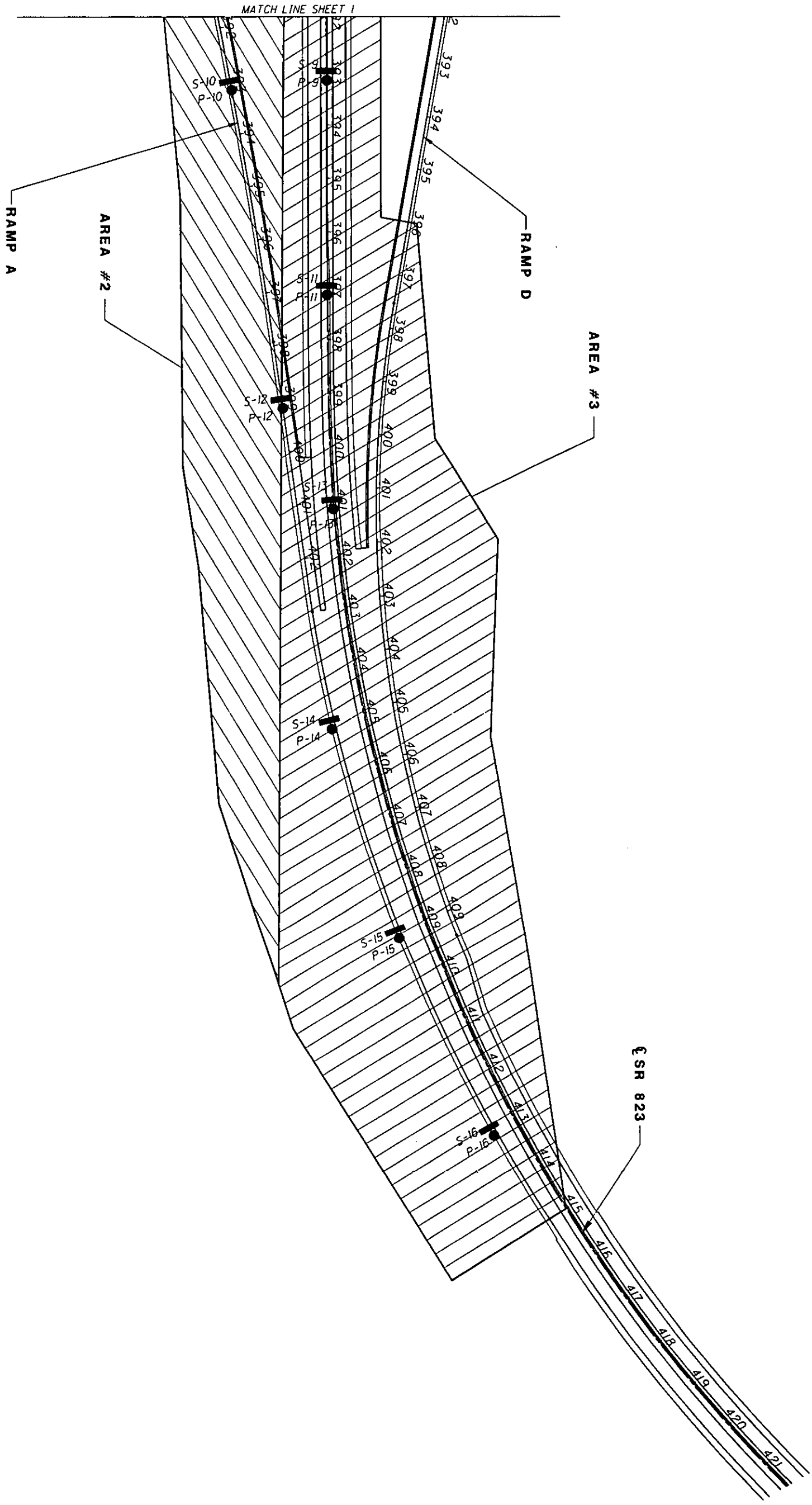
WICK DRAIN AND INSTRUMENTATION PLAN
SHUMWAY HOLLOW RD (TR 234) INTERCHANGE

PID NO. 19415

SCI-823-6.81

1

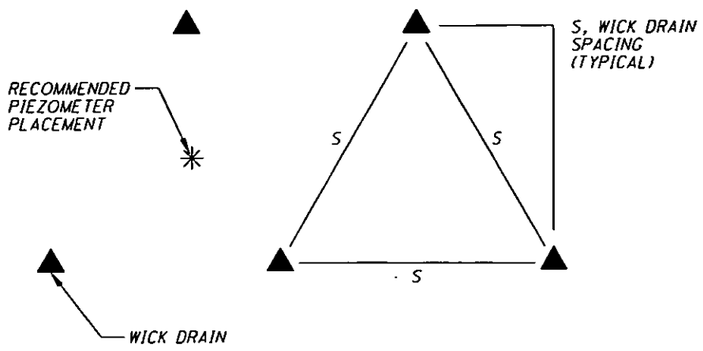
1/6/2008
11:02:52 PM
I:\PROJ\0121\3070.03\FINAL DESIGN PLANS - PHASE I\WICK DRAINS\SHUMWAY\FINAL\REVISED-FINAL\SHUMWAY_INSTRPLAN02.DGN



2	SCI-823-6.81	PID NO. 19415	WICK DRAIN AND INSTRUMENTATION PLAN SHUMWAY HOLLOW RD (TR 234) INTERCHANGE	0 100 50 200 HORIZONTAL SCALE IN FEET

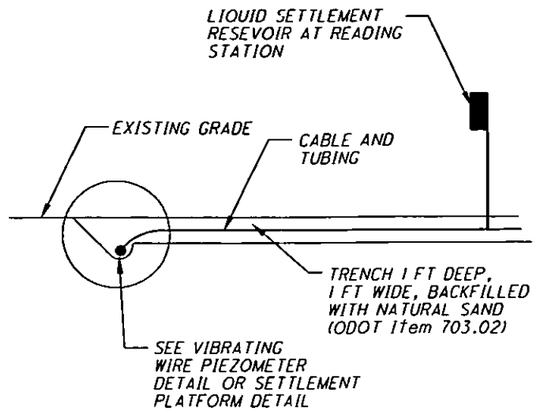
DETAIL "A"

WICK DRAIN TYPICAL LAYOUT-PLAN VIEW
(NOT TO SCALE)



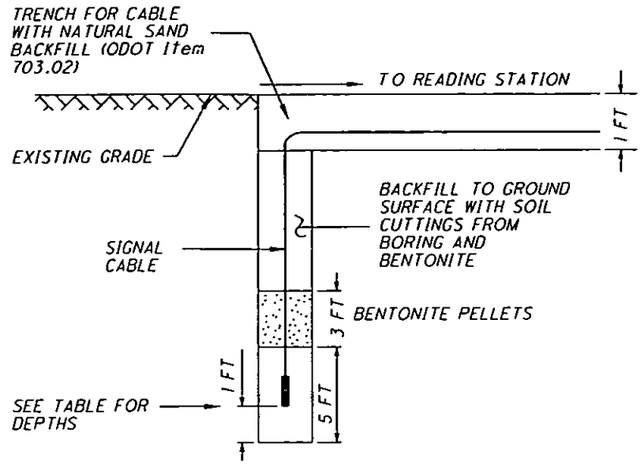
DETAIL "B"

INSTRUMENTATION DETAILS
(NOT TO SCALE)



VIBRATING WIRE PIEZOMETER DETAIL

(NOT TO SCALE)



SETTLEMENT PLATFORM DETAIL

(NOT TO SCALE)

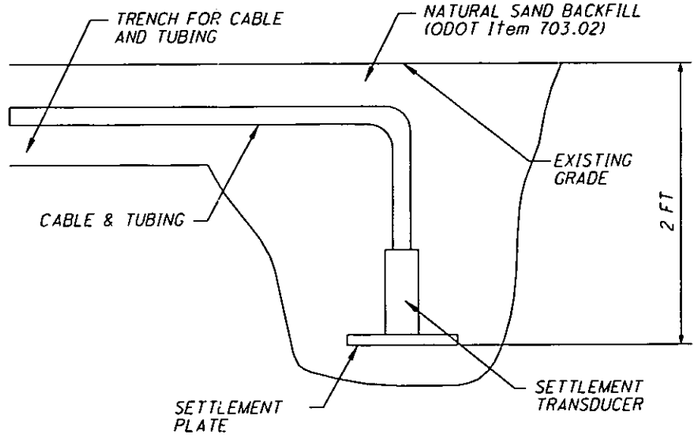


TABLE 1 -STAGED CONSTRUCTION DETAILS

EMBANKMENT SECTIONS, APPROXIMATE STATIONS	TOTAL EMBANKMENT HEIGHT (ft)		REQUIRED DEGREE OF CONSOLIDATION PRIOR TO PLACING SUBSEQUENT STAGES	MAXIMUM EXCESS PORE PRESSURE HEAD+	REQUIRED WAITING PERIOD**			
					WICK DRAIN SPACING			
					NO WICK DRAINS	3 ft	5 ft	7 ft
Mainline and Ramp Embankments over 23 feet high	Stage 1	23	90%	+10 ft (above)	65 years	150 days	400 days	760 days
	Stage 2++	57	NA	+10 ft (above)	NA	NA	NA	NA

* Provided waiting periods are estimates only. Piezometer and settlement readings should verify that consolidation requirements are met.
** Provided waiting periods are estimates only. Piezometer readings should verify that pore pressure requirements are met.
+ Excess pore pressures should not be allowed to rise above specified level at any time. Level measured relative to existing ground surface.
++ Embankment may be constructed up to the proposed grade. Approximate maximum height is 57 feet.

TABLE 2 -TIME-RATE OF CONSOLIDATION DETAILS

EMBANKMENT SECTIONS, APPROXIMATE STATIONS	TIME TO NINETY PERCENT CONSOLIDATION (U=90%)+			
	WICK DRAIN SPACING			
	NO WICK DRAINS	3 FT	5 FT	7 FT
SR 823 Mainline	65 years	150 days	400 days	760 days
Ramp A	24 years	145 days	380 days	695 days
Ramp B	1.3 years	105 days	200 days	290 days
Ramp C	2.3 years	120 days	250 days	390 days
Ramp D	65 years	150 days	400 days	760 days

\+ In areas where the maximum settlement is anticipated to exceed 24 inches, it is recommended that ninety percent consolidation be achieved prior to preparing the pavement.

CALCULATED SJR
CHECKED DAA

INSTRUMENTATION AND SPECIAL CONSTRUCTION NOTES AND DETAILS

SCI-823-6.81

NOTES:

1. PLACE 3 FEET OF ODOT ITEM 703.02 BEFORE THE INSTALLATION OF THE WICK DRAINS. WICK DRAINS TO BE INSTALLED PRIOR TO EMBANKMENT CONSTRUCTION.

2. THE SAND SHALL CONSIST OF CLEAN, FREE-DRAINING, COARSE NATURAL SAND, OR SAND AND PEA GRAVEL, SHALL BE GRADED UNIFORMLY FROM COARSE TO FINE, AND SHALL BE OF SUCH SIZE THAT, WHEN TESTING ON U.S. STANDARD SIEVES IN ACCORDANCE WITH AASHTO T27 AND WASHING THE SAMPLE IN ACCORDANCE WITH AASHTO T11, SHALL CONFORM TO THE GRADING REQUIREMENTS OF ODOT CMS 703.02.

3. THE SAND SHALL NOT CONTAIN ANY ORGANIC OR OTHER DELETERIOUS MATERIALS AND SHALL NOT BE FROZEN WHEN PLACED.

4. IF DENSE SAND, GRAVEL OR HARD SOIL LAYERS ARE ENCOUNTERED BELOW THE GROUND SURFACE AND CANNOT BE PENETRATED WITH REASONABLE EFFORT, THE CONTRACTOR SHALL BE REQUIRED TO PRE-DRILL THE WICK DRAIN LOCATIONS.

5. WICK DRAINS SHALL BE INSTALLED FROM THE WORKING SURFACE TO THE DEPTH SHOWN IN THE PLANS, OR TO COMPLETELY PENETRATE THE COMPRESSIBLE FOUNDATION SOILS AT SUCH A DEPTH EITHER SHALLOWER OR DEEPER THAN PLAN DEPTH WHERE THE SOIL RESISTS A REASONABLE EFFORT AT FURTHER PENETRATION.

6. SETTLEMENT PLATES SHALL BE GEOKON MODEL 4600 OR EQUIVALENT.

7. VIBRATING WIRE PIEZOMETERS SHALL BE SLOPE INDICATOR MODEL 52611099 OR EQUIVALENT.

8. SR 823 MAINLINE AND INTERCHANGE RAMP EMBANKMENTS OVER 23 FEET IN HEIGHT MUST BE BUILT USING STAGED CONSTRUCTION. THE FOUNDAITON PORE WATER PRESSURES AND SETTLEMENTS SHALL BE MONITORED. THE STAGED HEIGHTS, AND PORE PRESSURE DETAILS ARE PRESENTED IN TABLE 1. A WAITING PERIOD WILL BE REQUIRED BETWEEN STAGES TO ALLOW PORE PRESSURES TO DISSIPATE PRIOR TO PLACING SUBSEQUENT STAGES. THE MAXIMUM REQUIRED PORE PRESSURE AS WELL AS THE REQUIRED WAITING PERIOD FOR SELECTED WICK DRAIN SPACING OPTIONS IS OUTLINED IN TABLE 1. THE ESTIMATED CONSOLIDATION TIMES (U=90%) FOR OTHER INTERCHANGE FEATURES ARE PRESENTED IN TABLE 2. ESTIMATES FOR WICK DRAIN QUANTITIES ARE PRESENTED IN TABULAR FORM ON SHEET 1.

9. THE ACTUAL WICK DRAIN TREATMENT AREA AND DEPTH MIGHT DIFFER FROM THE PROPOSED LIMITS DUE TO SOIL VARIATIONS AT THE SITE AND THEREFORE SHOULD BE CONFIRMED IN THE FIELD BY THE ODOT CONSTRUCTION REPRESENTATIVE.

10. IT IS RECOMMENDED THAT WICK DRAINS BE INSTALLED PRIOR TO THE INSTALLATION OF SETTLEMENT PLATFORMS OR PIEZOMETERS. PIEZOMETERS SHOULD BE PLACED EQUAL DISTANCES FROM ADJACENT WICK DRAINS TO PREVENT PORE PRESSURE DISSIPATION NEAR THE DRAINS FROM SKEWING MEASUREMENTS, SEE DETAIL "A". THE ODOT CONSTRUCTION REPRESENTATIVE MAY MODIFY THE INSTRUMENTATION PLAN BASED UPON FIELD CONDITIONS.

CALCULATED SJR
CHECKED DAA

INSTRUMENTATION AND SPECIAL CONSTRUCTION NOTES AND DETAILS

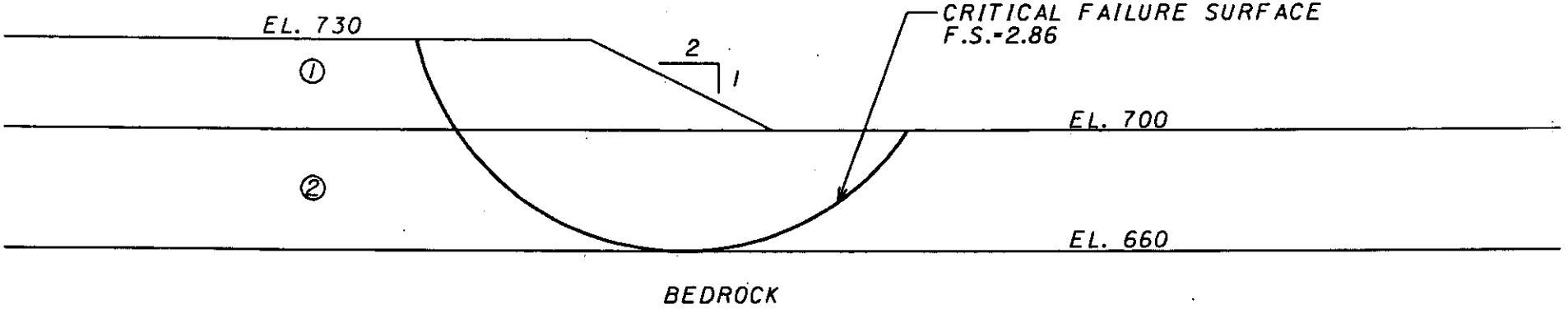
SCI-823-6.81

4

Soil Cut Slope Stability Analyses

MATERIAL PROPERTIES					
LAYER	UNIT WEIGHT (pcf)	c (psf)	c' (psf)	ϕ (deg)	ϕ' (deg)
① UPPER STIFF CLAY	130	2000	0	0	32
② FOUNDATION CLAY	130	2000	0	0	32

PROFILE BASED ON B-1324 AND B-1325

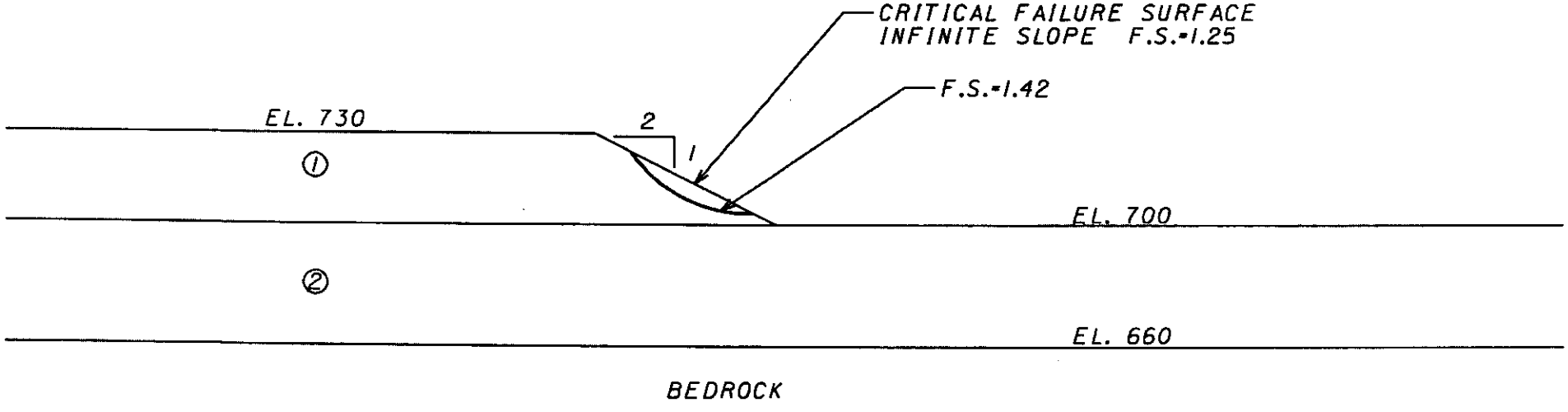


SOIL CUT STABILITY ANALYSIS
SHUMWAY HOLLOW RAMP D
STATION 390+00

UNDRAINED CONDITION
30-FOOT HIGH CUT

MATERIAL PROPERTIES					
LAYER	UNIT WEIGHT (pcf)	c (psf)	c' (psf)	ϕ (deg)	ϕ' (deg)
① UPPER STIFF CLAY	130	2000	0	0	32
② FOUNDATION CLAY	130	2000	0	0	32

PROFILE BASED ON B-1324 AND B-1325

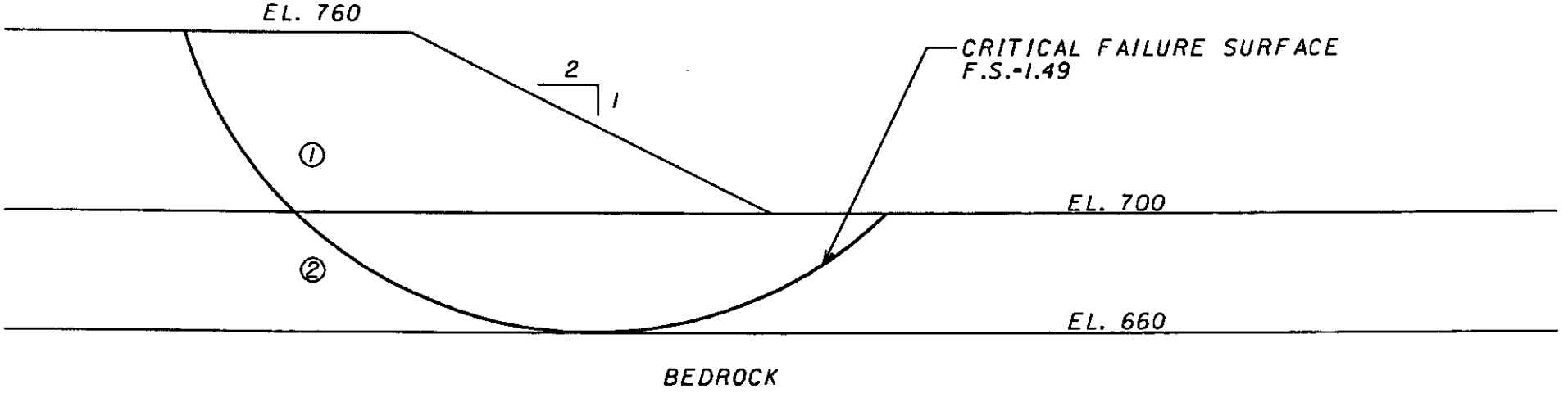


SOIL CUT STABILITY ANALYSIS
SHUMWAY HOLLOW RAMP D
STATION 390+00

DRAINED CONDITION
30-FOOT HIGH CUT

MATERIAL PROPERTIES					
LAYER	UNIT WEIGHT (pcf)	c (psf)	c' (psf)	ϕ (deg)	ϕ' (deg)
① UPPER STIFF CLAY	130	2000	0	0	32
② FOUNDATION CLAY	130	2000	0	0	32

PROFILE BASED ON B-1324 AND B-1325

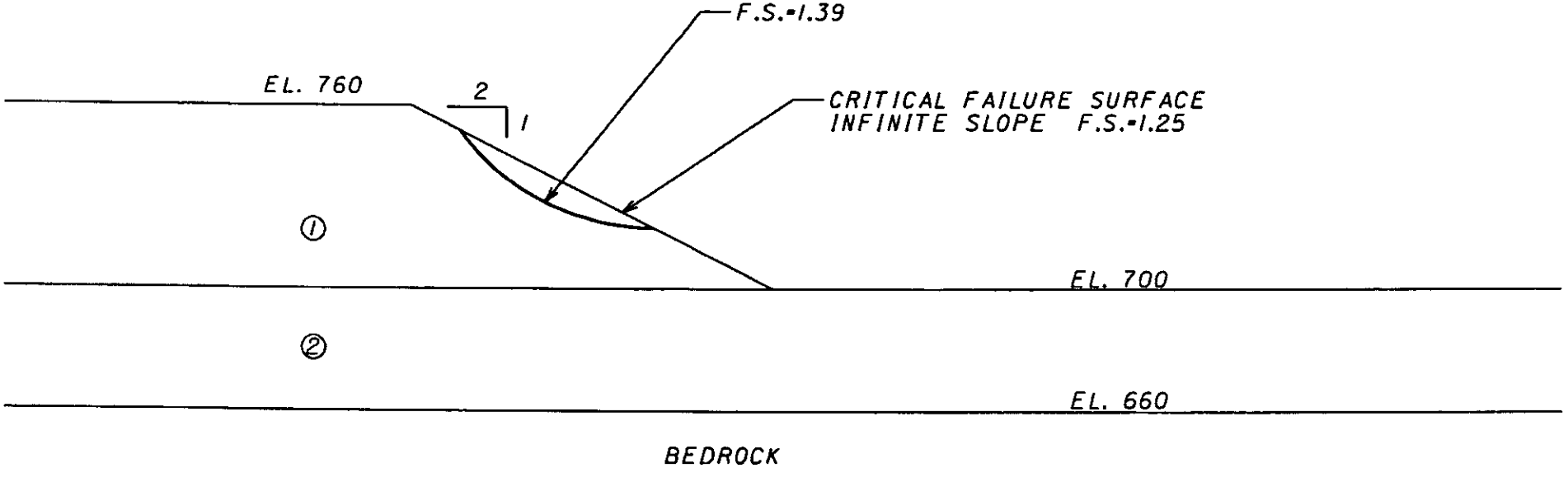


SOIL CUT STABILITY ANALYSIS
SHUMWAY HOLLOW RAMP D
STATION 390+00

UNDRAINED CONDITION
60-FOOT HIGH CUT

MATERIAL PROPERTIES					
LAYER	UNIT WEIGHT (pcf)	c (psf)	c' (psf)	ϕ (deg)	ϕ' (deg)
① UPPER STIFF CLAY	130	2000	0	0	32
② FOUNDATION CLAY	130	2000	0	0	32

PROFILE BASED ON B-1324 AND B-1325



SOIL CUT STABILITY ANALYSIS
SHUMWAY HOLLOW RAMP D
STATION 390+00

DRAINED CONDITION
60-FOOT HIGH CUT