Passaic River Tidal – General Reevaluation Report

Floodwall Design Criteria

Revised April 15, 2016

FLOODWALL DESIGN CRITERIA

1. General

This design criteria addresses the design of floodwalls in typical reaches along the Passaic River extending from Kearny to Newark, NJ. The design elements defined herein represent a preliminary design (i.e., 30-percent level) using the best available information. The analysis was limited to Stability. Pile foundations provide stability against overturning, sliding and flotation resistance. Soil conditions along this reach of the Passaic River were divided into two reaches; East Kearny and West Kearny. The elevation of the bedrock was assumed based on current limited information (see the Geotechnical Report); pile lengths must be refined as more soil data becomes available.

Floodwall designs were also provided which may be used to address Hazardous, Toxic, and Radioactive Waste (HTRW) reaches in which ground disturbance may not permitted¹ (i.e., excavation, augering and drilling of piles is not permitted). In this situation, our recommendation was to construct the T-Wall on top of the existing ground surface. Pile types requiring drilling or augering were not allowed. H-Piles, Pipe Piles and concrete piles were considered; prestressed concrete piles were selected for use in these HTRW reaches. The concrete piles are more resistant to corrosion that is typically found in HTRW soils. Vinyl sheet piling may be a consideration for use as cutoff piling. Although not unconditionally accepted by the USACE, there have been several projects constructed by the Corps that have included vinyl sheeting. Interim guidance is provided in USACE document; "General Design Guide: PVC Sheet Pile", dated May 2005. Given the concern for long term durability, coated steel sheet piling has been included in our proposed designs. An L-Wall design was also developed for the HTRW reaches. In building the Floodwall on top of the ground surface, the overall height of the T-Wall was reduced to a level where L-Walls are a consideration. The L-Wall would only be applicable in the HTRW reaches. The sheet pile cutoff wall acts as both seepage cutoff and axial capacity. Where axial capacity is required, steel pilings would be required, vinyl should not be considered for this structural application. The L-Wall would not be recommended where corrosion rates are proven to be severe as the steel sheet pile would need to include significant, long-term corrosion protection and monitoring Soil testing for corrosive properties and stray currents should be performed in advance of final design. The level of corrosion protection, to include coatings and sacrificial thickness, can then be more accurately determined. In summary, Micro piles and H-Piles were considered in Typical T-wall reaches. Prestressed concrete piles were only considered for use in the HTRW reaches. L-Wall designs should be considered but only in wall heights less than 8ft where corrosion is determined to be moderate. Design calculations for this phase can be found in Appendix x.

¹ This is a potential construction condition, considered in the analysis for completeness.

For cost comparison purposes, three wall heights were considered; Top of Wall (TOW) at El 18.0, El 16.0 and El 14.0 NAVD². The Still Water Elevation (SWL) was assumed to be 2 feet below the TOW elevation. The typical ground elevation was assumed to be El 7 NAVD throughout the project.

2. Codes and Standards

The following is an abbreviated list of general U.S. Army Corps of Engineers (USACE) References and Industry codes and standards which are applicable to structural and foundation design for this preliminary design effort. Additional codes must be referenced for the final construction Plans & Specifications. Considered in this design are:

- AASHTO, American Association of State Highway and Transportation Officials, LRFD Bridge Design 7th Edition, 2014..
- ACI 318-14 American Concrete Institute, Building Code Requirements for Structural Concrete.
- ACI 350-06 American Concrete Institute, Environmental Engineering Concrete Structures
- AISC, American Institute of Steel Construction, Inc., Manual of Steel Construction, 14th Edition.
- ASCE 7-10 American Society of Civil Engineers, Minimum Design Loads for Buildings and Other Structures.
- ASTM, American Society for Testing and Materials.
- AWS D1.1-15 American Welding Society, Structural Welding Code, latest edition.
- USACE EM 1110-2-2104, Strength Design for Reinforced Concrete Hydraulic Structures.
- USACE EM 1110-2-2502, Retaining and Flood Walls.
- USACE EM 1110-2-2906, Design of Pile Foundations.
- USACE ETL 1110-2-584, Design of Hydraulic Steel Structures.
- USACE ETL 1110-2-575, Evaluation of I-Walls.

3. General Design Load Parameters

3.1.A. Load Combinations

The preliminary design includes four Basic Load Cases; these are the loadings that typically control floodwall designs. Other loadings must also be analyzed in the final design, including Seismic Load Cases for both Operating and Maximum Earthquake conditions. Additionally, sufficient hydraulic modeling should be performed as part of

² All elevations are referenced to North American Vertical Datum of 1988 (NAVD).

the future design to establish wave properties and forces. Typically, on inland waterways, when the wall is overbuilt to include uncertainty and sea-level rise the static head to top of wall is similar in force to that imparted by a wave; sufficiently close for this conceptual design. The load cases included in the design are:

1a. <u>Construction</u>. Dead load of the concrete wall components, no earthen backfill, no uplift. A 17 % overstress is permitted for this load case.

1b. <u>Construction with Wind</u>. Dead load of the concrete wall components, no earthen backfill, no uplift; a conservative wind load of 50 psf is applied to the wall stem. A 33 % overstress is permitted for this load case.

2a <u>Flood Stage at Still Water, Impervious Cutoff.</u> Dead load of concrete wall, At-Rest lateral earth pressures, and hydrostatic loading for water to the SWL; Uplift forces assume the sheet pile to be impervious. Wave force is not included.

2b. <u>Flood Stage at Still Water, Pervious Cutoff.</u> Dead load of concrete wall, At-Rest lateral earth pressures, and hydrostatic loading for water to the SWL; Uplift forces assume the sheet pile to be pervious varying linearly from flood side SWL to the ground water elevation on the Protected Side. Wave force is not included.

3a. <u>Flood Stage with Water to Top of Wall, Impervious Cutoff.</u> Dead load of concrete wall, At-Rest lateral earth pressures, and hydrostatic loading for water to the TOW; Uplift forces assume the sheet pile to be impervious. Wave force is not included. A 33% overstress is permitted.

3b. <u>Flood Stage with Water to Top of Wall, Pervious Cutoff.</u> Dead load of concrete wall, At-Rest lateral earth pressures, and hydrostatic loading for water to the TOW; Uplift forces assume the sheet pile to be pervious varying linearly from flood side TOW elevation to the ground water elevation on the Protected Side. Wave force is not included. A 33% overstress is permitted.

4a. <u>Flood Stage at Still Water, Debris Impact Load, Impervious Cutoff.</u> Loadings include: Dead load of concrete wall, At-Rest lateral earth pressures, and hydrostatic loading for water to the SWL. Uplift forces assume the sheet pile to be impervious. A debris load of 500lbs/LF is applied at the SWL. Wave force is not included. A 33% overstress is permitted.

The overstress factors listed in each load case above reflect the stress levels permitted in the HSDRRS design guidance that was developed for the New Orleans District post-Katrina and considered applicable for this flood protection project

3.1.A. Hydraulic Stages

Stage (NAVD)	Flood Side (NAVD)	Protected Side (NAVD)
TOW El 14.0		
SWL Water	EL. 12.0	EL. 6.0
TOW Water	EL. 14.0	EL. 6.0
TOW El 16.0		
SWL Water	EL. 14.0	EL. 6.0
TOW Water	EL. 16.0	EL. 6.0
TOW El 18.0		
SWL Water	EL. 16.0	EL. 6.0
TOW Water	EL. 18.0	EL. 6.0

Table 1 – Hydraulic Stages and Design Water Surface Elevations

SWL – Still Water Level

TOW – Top of Wall

3.2. Load Cases

3.2.1. Dead Loads (D)

Dead loads shall be determined in accordance with applicable engineering manuals and ASCE 7-02, and shall include the self-weight of all permanent construction components including foundations, slabs, walls, roofs, actual weights of equipment, overburden pressures, and all permanent non-removable stationary construction.

Item	Weight [Pcf]
Water (Fresh)	62.4
Semi-compacted Fill	110
Fully Compacted Granular Fill, wet	120
Fully Compacted Granular Fill, Effective	58
Fully Compacted Clay Fill, wet	110
Fully Compacted Clay Fill, Effective	48
Riprap	130
Silt	94
Reinforced Concrete (Normal weight)	150
Steel	490

Table 2 – Unit Weights

3.2.2. Live Loads (L)

Live loads for building structures shall be determined in accordance with applicable engineering manuals and ASCE 7-02.

3.2.2.1 Live Load Surcharge (LS)

A minimum live load surcharge of 200 psf will be applied during construction.

3.2.3. Soil Pressures (S)

Structures are designed for lateral and vertical soil pressures. Lateral pressures are determined using the at-rest coefficients, K₀ obtained from the Geotechnical Report:

• Lateral Soils at-rest Pressure Coefficients:

Ko = 0.8 for Clay. Ko = 0.48 for Granular Material.

3.2.4. Hydrostatic Loads (H)

Hydrostatic loads for which structures will be designed refer to the vertical and horizontal loads induced by a static water head and buoyant pressures, excluding uplift pressures. Dynamic Wave Forces have NOT been included.

3.2.5. Uplift Loads (U)

Uplift loads for which structures will be designed to two uplift conditions: Uplift Condition A, assumes the sheet pile cutoff wall is fully effective (Impervious), and Uplift Condition B, assumes the sheet pile cutoff wall is ineffective (Pervious) (pressure assumed to be vary linearly across the base).

3.2.6. Wind Loads (W)

Structures are designed for wind loads established by ASCE No. 7, "Minimum Design Loads for Buildings and Other Structures," *but in no case less than 50 psf.* The basic sustained wind speed is 110 miles per hour, and the exposure category is "C". Architectural roofs shall be designed for a 135 mile-per-hour sustained wind. An importance factor of 1.15 is included in wind calculations.

4. Concrete Design Criteria

Concrete design shall utilize EM 1110-2-2104 and the ACI 350R Concrete Sanitary Engineering Structures and will comply with the ACI 318 latest edition strength design method, unless otherwise required:

- Structural Concrete: 4,000 psi @ 28 days with a maximum water/cement ratio = 0.40
- Steel reinforcement 60,000 psi (ASTM A615)

5. Steel Design Criteria

Steel design shall utilize the ETL 1110-2-584 and the AISC Steel Construction Manual, 14th edition. Load combinations shall be in accordance with ASCE 7-02. Typical design values are as follows unless otherwise noted:

(a)	Structural steel rolled shapes	ASTM 572, Grade 50 ASTM A992, Grade 50
(b)	Plates	ASTM A992, Grade 36
(c)	Bolts and nuts	ASTM A325, min. ³ / ₄ " ASTM A490
(d)	Anchor Bolts	ASTM A449, (³ / ₄ " dia. & or greater)
(e)	Corrosion stainless steel	ASTM A304 (freshwater) ASTM A316 (saltwater)
(f)	Sheet Piles	ASTM A328, Grade 50 ASTM A572, Grade 50
(g)	Stainless Steel Embedded Anchors	ASTM A572, Orade 50 ASTM A276 or UNS S21800

Normally, components that shall be exposed to the elements are either hot-dipped galvanized or primed, painted and sealed with coats of (10 mils min.) epoxy. Vertical lift gates and steel sheet pile structures shall be painted with an epoxy painting system.

6. Pile Foundation Design Criteria

All forces applied to T-Wall structures are resisted by the pile foundation. T-wall monoliths are assumed to act independent of adjacent monoliths, no load transfer is considered between monoliths. Pile designs are based on a soil structure interactive analysis with the pile supports input in accordance with EM 1110-2-2906. Lateral resistance of the soil is based on the soil horizontal subgrade modulus. In future designs, pile capacities shall be determined utilizing springs based on P-Y and T-Z curves generated by geotechnical analysis. Factors for Group effects have been included in this analysis. Pile capacities have been determined using all-friction and a combination of

friction and end bearing. Micro Piles will be considered where bedrock is reasonably shallow (e.g., <50 feet). Micro-pile capacities include a 10ft deep rock socket. H-Pile and Concrete pile capacities mainly consider friction; very little end bearing was included. Piles embedded the standard 6"-9" were analyzed as both fixed and pinned pile heads. Recent research conducted by the New Orleans and St. Paul Districts has indicated that piles with minimal embedment act as partially fixed, more fixed than pinned. As such, recent practice is to bracket the connection design with a pinned and fixed analysis. Monoliths with all vertical piles were rigidly connected to the base and only analyzed as fixed. In order to assure a very rigid connection, these piles were embedded two pile diameters into the base.

Piles may be Micro-piles with continuous casings to bedrock, steel pipe piles, steel H piles or prestressed concrete. Pipe piles satisfy ASTM A252 with minimum yield strength of 45 ksi. H-piles satisfy Grade 50 Steel. Steel piles are designed structurally per AISC ASD, 14th Edition, as modified by EM 1110-2-2906. Concrete square piles have a design strength equal to 6,000 psi at 28 days, prestressing strands are Low-Lax, Grade 270. Prestressed concrete piles are designed to satisfy both strength and serviceability requirements. Strength design follows the basic criteria set forth by ACI, except the strength reduction factor is 0.7 for all failure modes and the load factor is 1.9 for both dead and live loads. The prestressed concrete pile is designed for an axial strength limited to 80 percent of pure axial strength and a minimum eccentricity equal to 10 percent of the pile width. Control of cracking is achieved by limiting the concrete compressive stress to 0.4f'c and the tensile stress to zero. Combined axial and bending are considered when analyzing the stresses in the piles.

Vertical piles were used only where space restraints prevented the installation of the more efficient battered pile. This condition mainly occurred were the floodwall alignment was sandwiched between the Passaic River/Hackensack River/Newark Bay and buildings located near the top of bank. Cross sections of the bank and infrastructure were not available; therefore, it was assumed that a 15ft top of bank crown at El 8 exists with a floodside bank slope down to the thalweg of the river. The vertical pile design used only a fixed pile head. To assure this fixity occurred, the piles were embedded a minimum of two pile diameters into the base. The pile foundation can be used for bearing and also to stabilize the bank slope, similar to soil nailing, if stability factors of safety are low.

Although not commonly used in the Northeast, Precast Prestressed Concrete (PPC) piles were included for use in reaches that are considered HTRW and have an increased rate of corrosion, in the event that construction on HTRW sites is pursued. The concrete pile is far more resistant to corrosion than steel. Stress levels shall be controlled to prevent cracking of the concrete when experiencing both service loads and driving stresses.

CPGA pile design software was used for this preliminary design. Settlement and ground instability were not considered to be a factor. Forces from downdrag and unbalanced loads were not included in the pile design. It was assumed that pile load tests will be conducted in advance of construction, a Factor of Safety = 2.0 was included for normal load cases and 1.5 for unusual load cases.

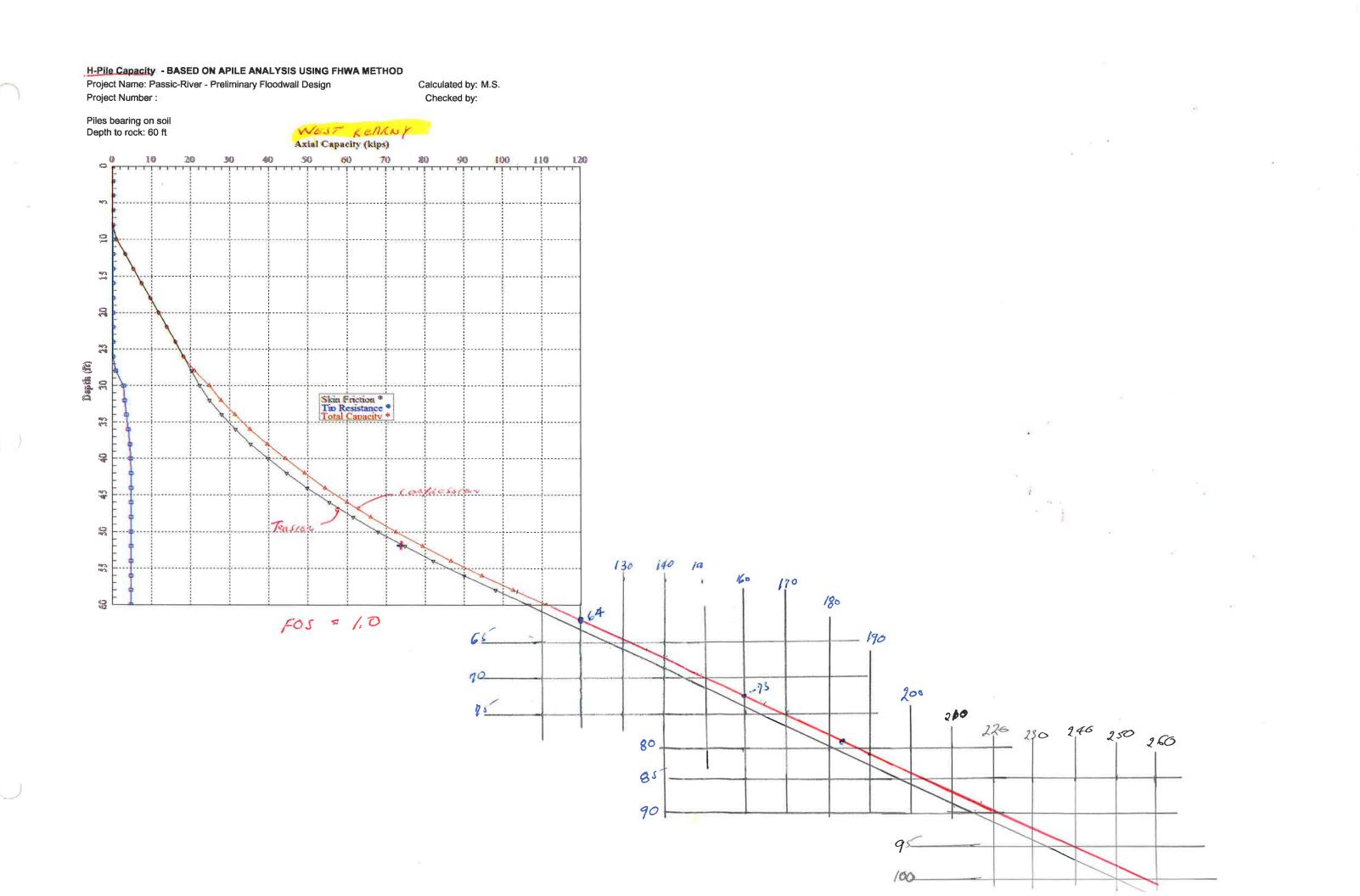
GEOTECHNICAL

MICROPILE DESIGN - BASED ON FHWA MICROPILE GUIDELINES (2005)

Project Name: Passic-River - Preliminary Floodwall Design Project Number : Calculated by: M.S. Checked by:

SUMMARY OF ESTIMATED MICROPILE CAPACITY

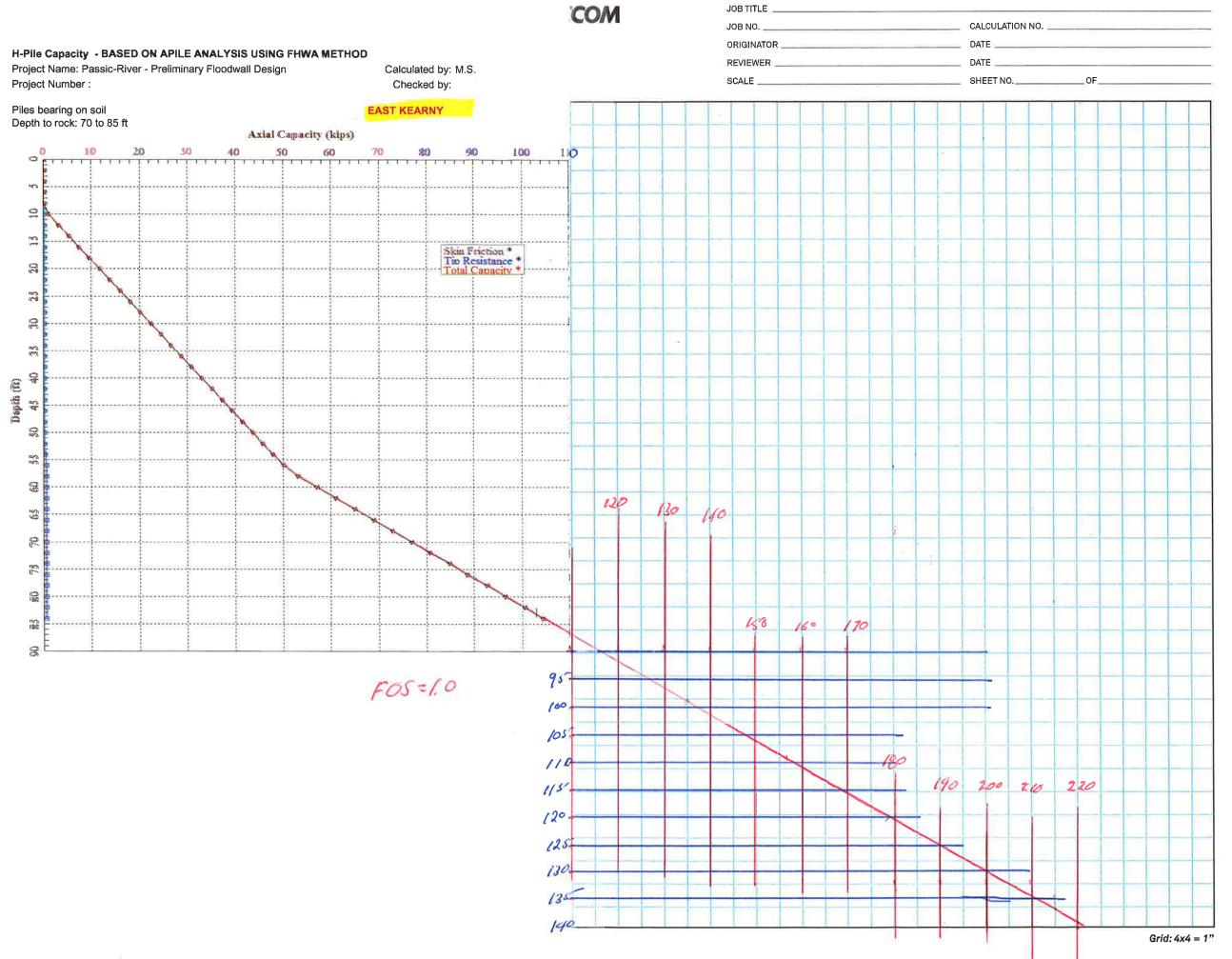
Steel Casing Outside Diameter	Steel Casing Thickness (Minimum)	Rebar Size	Rock Socket (Minimum) (ft)	Maximum A Capac (tons	ity					
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9-5/8	0.545		20	150	100					
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			10	120	75					
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			30	260	155					



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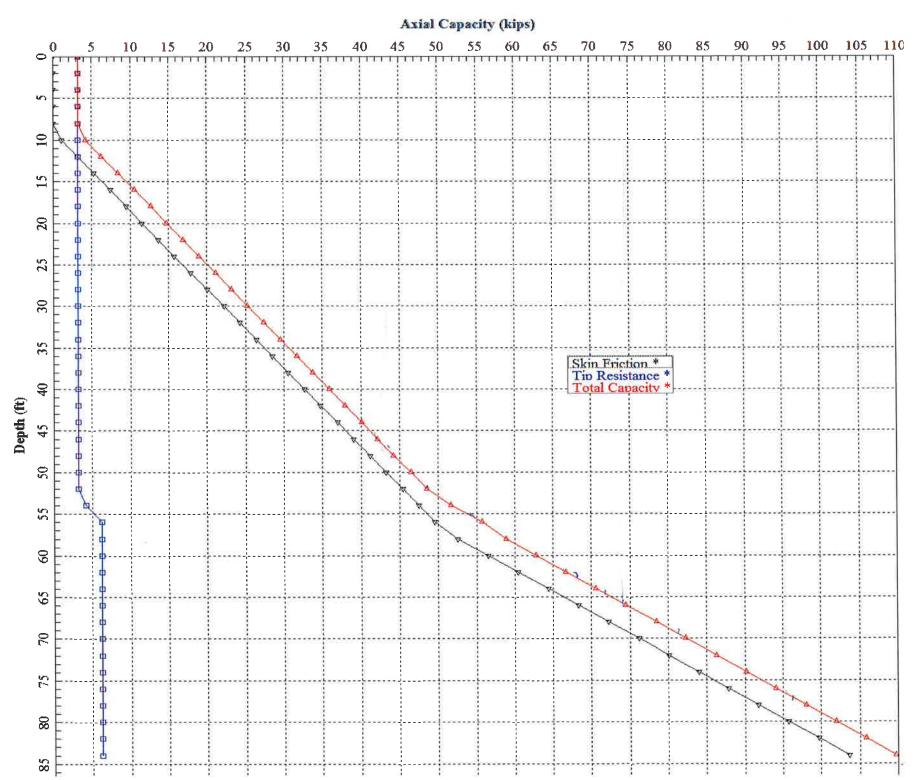


14" Concrete Prestressed Pile Capacity - BASED ON APILE ANALYSIS USING FHWA METHOD

Project Name: Passic-River - Preliminary Floodwall Design Project Number : Calculated by: M.S. Checked by:

Piles bearing on soil Depth to rock: 70 to 85 ft

EAST OF KEARNY

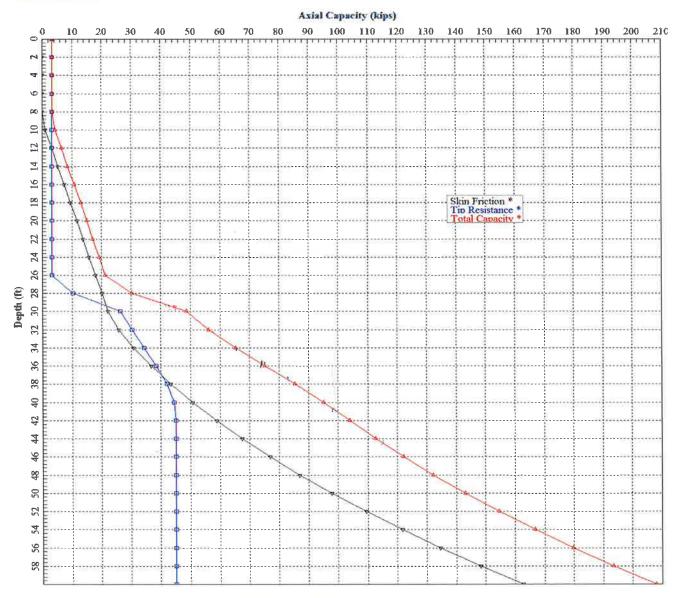


14"COUL PRESTRESS OF HERE Capacity - BASED ON APILE ANALYSIS USING FHWA METHOD

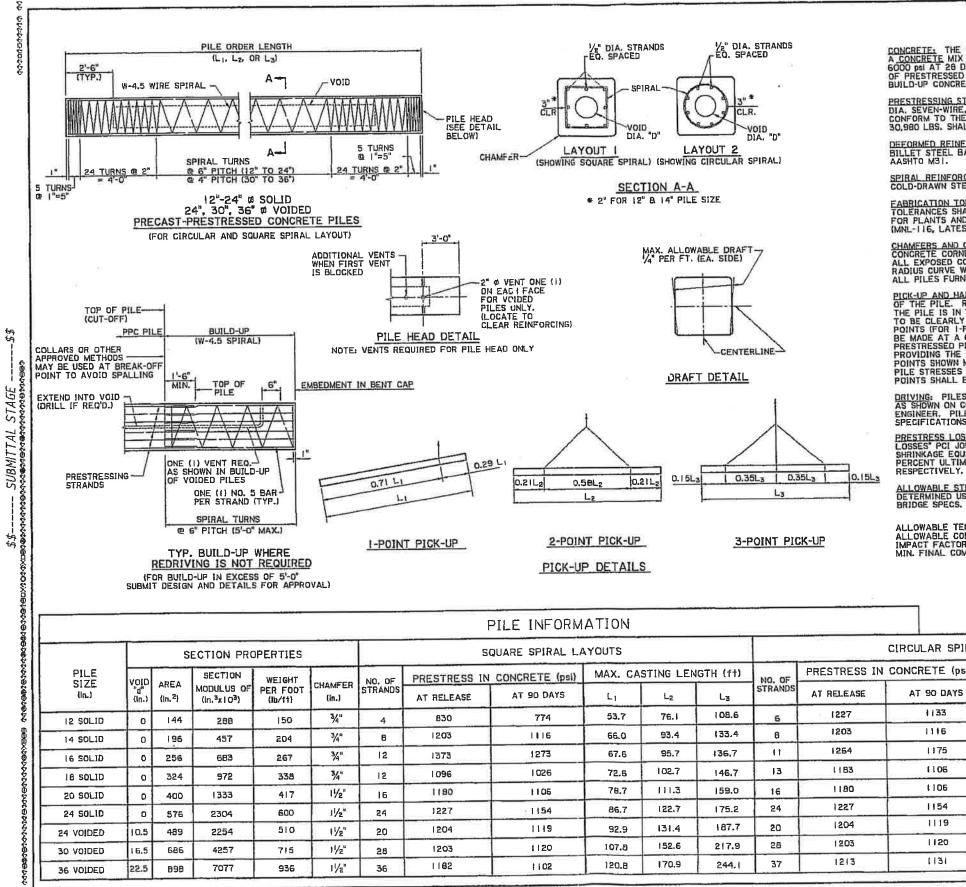
Project Name: Passic-River - Preliminary Floodwall Design Calculated by: M.S. Project Number : Checked by:

Piles bearing on soil Depth to rock: 60 ft

WEST OF KEARNY



F05 = 1.0



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CONT ILES NS. OSSES JOURL IMATI Y. STRES S. 5.9 ILSIN OR1 OMPR	INACT PLANS SHALL BE DR SHALL BE DR SHALL BE DR SHALL BE DR SHALL BE DR SHALL BE DR SHALL SO SES: THE MJ SESSI THE MJ SESSI THE MJ SESSIVE STRESS LSSIVE STRESS LSSIVE STRESS MAX. C L1 61.5 65.0 70.1	UNLESS OTHER IVEN TO TOLER IVEN TO TOLER IVEN TO TOLER IVEN TO TOLER IVEN TO TOLER COMMENDA SECONDENSITY IVEN ALLOWARD I.2 & 5.13.4.4. SS (psi): 0.451 SS (psi): 0.451 SS: 725 psi COOL ASTING LEN L2 67.0 93.4 99.2	Wise Direct RANCES SPEC TION FOR ESS (975. PERCE AYS AND 90 D 51% FOR PICK- LE STRESS (I 3) AT BOTH % PF:1 % PF:1 L3 IGTH (ft) L3 I24.2 I33.4 (41.7)	TIMATING PRESTRES NT OF ULTIMATE DAYS RESPECTIVEL 4 DAYS AND 90 DAY UP HAVE BEEN 998 AASHTO LRFD 14 DAYS AND 90 DAY	DARD SSED Y. 'S AYS.	CONCRETE PIL	16, 18, 20 AND 24 INCH SOLID	24. 30 AND 36 INCH VOIDED CLASS P(M) CONCRETE
CONT ILES NS. OSSES JOURL IMATI Y. STRES S. 5.9 ILSIN OR1 OMPR	IL LAYOUTS MAX. C L MAX. C MAX. C MAX. C MAX. C L MAX. C L MAX. C L MAX. C L 70.1 74.6	UNLESS OTHER IVEN TO TOLE! "RECOMMENDA JULYAUGUST, SC (PS) 14 D AL TO 26% AND AL TO 26% AND AXIMUM LENGTH (NG ALLOWAB 1.2 B 5.13.4.4. SS (ps)): $5\sqrt{f_c}$ SS (ps)): 0.451 SS (ps)): 0.451 SS: 725 ps) COOL ASTING LEN L2 B7.0 93.4 99.2 105.6	Wise Diffection RANCES SPEC TION FOR ES 1975. PERCE 1051% FOR PICK- 1251% FOR PICK- 1251% FOR PICK- 1251% FOR PICK- 133.4 141.7 150.8	TIMATING PRESTRES NT OF ULTIMATE DAYS RESPECTIVEL 4 DAYS AND 90 DAY UP HAVE BEEN 998 AASHTO LRFD 14 DAYS AND 90 DAY	DARD SSED Y. 'S AYS.	CONCRETE PIL	ND 24 INCH SOLID	24. 30 AND 36 INCH VOIDED CLASS P(M) CONCRETE
CONT ILES INS. OSSEC JOURN QUAL IMATI Y. STRES USING S. 5.9 USING S. 5.9 USING OR: OMPR	TRACT PLANS SHALL BE DR SHALL SE DR ST BASED ON SESS THE M/J STHE FOLLOW STHE FOLLOW SALL STRESS (P STRESSIVE STRESS LE STRESS (P SSIVE STRESS LSSIVE STRESS MAX. C L1 61.5 66.0 70.1 74.6 78.7	UNLESS OTHER IVEN TO TOLE! "RECOMMENDA JULYAUGUST, 62% FOR 14 D AL TO 26% AND AL TO 26% AND AL TO 26% AND AXIMUM LENGTH VING ALLOWAR 1.2 & 5.13.4.4. si): $5\sqrt{f_c}$ SS (psi): 0.451 SS (psi): 0.451 SS: 725 psi 6 ASTING LEN L ₂ 87.0 93.4 99.2 105.6 111.3	Wise Diffection RANCES SPEC TION FOR ESS 1975. PERCE AYS AND 90 I D 51% FOR PICK- LE STRESS (I 3) AT BOTH IS PEFIC IGTH (fft) L3 IZ4.2 I33.4 I41.7 I50.8 I59.0	TIMATING PRESTRES NT OF ULTIMATE DAYS RESPECTIVEL 4 DAYS AND 90 DAY UP HAVE BEEN 998 AASHTO LRFD 14 DAYS AND 90 DAY	DARD SSED Y. 'S AYS.	CONCRETE PIL	ND 24 INCH SOLID	24. 30 AND 36 INCH VOIDED CLASS P(M) CONCRETE
CONT ILES NS. OSSES JOURL IMATI Y. STRES COMPP OR: S. 5.9 COMPR OR: OMPR	TRACT PLANS SHALL BE DR SHALL SE DR ST BASED ON SES: THE M//SIME AND E CREEP EQU/ SES: THE M//SIME STRESSIVE STRESS	UNLESS OTHER IVEN TO TOLES IVEN TO TO TO TOLES IVEN TO TO TO TO TO IVEN TO TO TO TO IVEN TO TO TO TO IVEN TO TO TO TO IVEN TO TO IVEN TO TO IVEN	Wise Diffection RANCES SPEC TION FOR ESS (1975. PERCE AYS AND 90 D 51% FOR PICK- LE STRESS (I 3) AT BOTH IS PECI IGTH (fft) L3 IZ4.2 I33.4 I41.7 I50.8 I59.0 175.2	TIMATING PRESTRES NT OF ULTIMATE DAYS RESPECTIVEL 4 DAYS AND 90 DAY UP HAVE BEEN 998 AASHTO LRFD 14 DAYS AND 90 DAY	DARD SSED Y. 'S AYS.	CONCRETE PIL	ND 24 INCH SOLID	24. 30 AND 36 INCH VOIDED CLASS P(M) CONCRETE

FOUNDATION ANALYSIS

FOUNDATION ANALYSIS SUMMARY

The analysis was performed as needed to recommend a stable and economical pile-founded floodwall. Geotechnical data was limited to previous data. As such, for the East and West of Kearny typical floodwall reaches, foundations were developed for both a shallow bedrock and a deeper bedrock. Micro-Piles were selected were rock was shallow. A 10-foot anchor socket was used which developed sufficient tension capacity. Where bedrock was deep, deeper than 50 feet, an H-Pile was used. The deeper piles gained most of their capacity through friction, very little was attributed to end bearing. Multiple pile spacing's were considered. With limited geotechnical data, an acceptable design was considered achieved when at least 75% of the available soil capacity or 75% of the structural combined bending/axial capacity was reached. To assure redundancy, no less than two rows of four piles per row were considered for each 50foot monolith. Pile capacities included a factor of safety equal to 2.0 for normal operational load cases. Pile foundations were checked considering the pile head to base connection as both fixed and pinned. Pile foundation analysis did not include down-drag, or instability forces. Downdrag would occur if the foundation design included a fill surcharge load. Instability would occur where the piles would experience lateral forces from a wedge failure (similar to soil nailing).

Reaches, short in length and at undetermined locations, may require special HTRW consideration. It was assumed that no excavation and drilling/coring of piles was permitted in these limited reaches. Floodwalls may be constructed on top of the existing ground surface. Driven piles provide bearing, sheet piling provides cutoff. Given the potential for increased corrosion, as is found in contaminated soils, the precast prestressed concrete (PPC) pile was recommended for bearing and vinyl sheet piling for cutoff. Where the soil properties are low to moderate in corrosion severity, H-piles and steel sheet piling are acceptable. L-Walls should also be considered if one of the lower top of wall elevations (El 12 or 14 feet NAVD) is selected in the final design. In that the L-Pile cutoff piling also acts as a bearing pile, the sheet piling must be steel. Vinyl is acceptable for piling acting purely as cutoff, but not when it is also providing support and subject to both axial and flexural stresses. In the final design, it is recommended that the rate of corrosion be established testing both the soil and extent of stray currents.

Limited space for floodwall construction along riverfront reaches required special consideration. There exists a footprint of approximately 15 feet in width between the river top of bank and industrial buildings. A narrow corridor for floodwall construction. Driving battered piles, standard practice for structures resisting lateral loads in soft soils, would be problematic. Piles battered towards the protected side could conflict with the building foundations. Battered Piles driven towards the river would need to be hung over the buildings during driving and would have reduced capacity given the close proximity to the slope. The solution provided is an all vertical pile foundation. The number of piles was increased to maintain the established criteria. Additionally, pile embedment was increased into the base to assure a fixed connection was established.

Passaic River Tidal Flood Protection System

T-Wall Foundation Analysis

Note: All axial forces below are local forces in acting in the axis of the pile.

East of Kearny - Typical Monolith (Bedrock < 50')

Monolith	50 ft.	Pile	9.5" Micropile
Top of Wall	EL 118	Pile Qty	10
Top of Slab	EL 106	F/S Batter	3:1
SWL	EL 116	P/S Batter	3:1

			Axial Load,
		Axial Load,	Compression
LC	Load Case Description	Tension (kip)	(kip)
1	Construction	0.0	46.7
2	Construction + Wind on F.S.	0.0	51.9
3	Water to SWL, Impervious	32.0	105.9
4	Water to SWL, Pervious	29.3	103.1
5	Water to SWL + Debris Load, Impervious	42.6	116.4
6	Water to T.O. Wall, Impervious	57.8	132.9
7	Water to T.O. Wall, Pervious	54.6	129.8

East of Kearny - Typical Monolith (Bedrock > 50')

Monolith	50 ft.	Pile	HP14x73
Top of Wall	EL 118	Pile Qty	10
Top of Slab	EL 106	F/S Batter	3:1
SWL	EL 116	P/S Batter	3:1

			Axial Load,
		Axial Load,	Compression
LC	Load Case Description	Tension (kip)	(kip)
1	Construction	0.0	46.5
2	Construction + Wind on F.S.	0.0	50.9
3	Water to SWL, Impervious	32.6	106.5
4	Water to SWL, Pervious	30.4	104.2
5	Water to SWL + Debris Load, Impervious	42.6	116.4
6	Water to T.O. Wall, Impervious	58.3	133.4
7	Water to T.O. Wall, Pervious	55.7	130.9

West of Kearny - Typical Monolith (Bedrock < 50')

Monolith	50 ft.	Pile	9.5" Micropile
Top of Wall	EL 118	Pile Qty	10
Top of Slab	EL 106	F/S Batter	3:1
SWL	EL 116	P/S Batter	3:1

			Axial Load,
		Axial Load,	Compression
LC	Load Case Description	Tension (kip)	(kip)
1	Construction	0.0	46.7
2	Construction + Wind on F.S.	0.0	51.9
3	Water to SWL, Impervious	32.0	105.9
4	Water to SWL, Pervious	29.3	103.1
5	Water to SWL + Debris Load, Impervious	42.6	116.4
6	Water to T.O. Wall, Impervious	57.8	132.9
7	Water to T.O. Wall, Pervious	54.6	129.8

West of Kearny - Typical Monolith (Bedrock > 50')

Monolith	50 ft.	Pile	HP14x73
Top of Wall	EL 118	Pile Qty	10
Top of Slab	EL 106	F/S Batter	3:1
SWL	EL 116	P/S Batter	3:1

			Axial Load,
		Axial Load,	Compression
LC	Load Case Description	Tension (kip)	(kip)
1	Construction	0.0	46.5
2	Construction + Wind on F.S.	0.0	51.0
3	Water to SWL, Impervious	33.1	107.0
4	Water to SWL, Pervious	30.9	104.7
5	Water to SWL + Debris Load, Impervious	43.1	117.0
6	Water to T.O. Wall, Impervious	59.0	134.1
7	Water to T.O. Wall, Pervious	56.4	131.5

HTRW Sites - Typical Monolith (Bedrock > 50')

Monolith	50 ft.	Pile	12" PPC
Top of Wall	EL 118	Pile Qty	16
Top of Slab	EL 110.5	F/S Batter	3:1
SWL	EL 116	P/S Batter	3:1

			Axial Load,
		Axial Load,	Compression
LC	Load Case Description	Tension (kip)	(kip)
1	Construction	0.0	24.4
2	Construction + Wind on F.S.	0.0	25.0
3	Water to SWL, Impervious	1.4	35.9
4	Water to SWL, Pervious	0.3	34.8
5	Water to SWL + Debris Load, Impervious	6.5	41.0
6	Water to T.O. Wall, Impervious	10.6	45.9
7	Water to T.O. Wall, Pervious	5.1	40.4

Water Front (Bedrock > 50')

Monolith	50 ft.	Pile	HP14x89
Top of Wall	EL 118	Pile Qty	20
Top of Slab	EL 106	F/S Batter	Vertical
SWL	EL 116	P/S Batter	Vertical

			Axial Load,
		Axial Load,	Compression
LC	Load Case Description	Tension (kip)	(kip)
1	Construction	0.0	22.6
2	500yr SWL, Impervious	0.0	28.8
3	500yr SWL, Pervious	31.5	66.5
4	500yr SWL + 500 yr Wave, Impervious	29.4	64.5
5	500yr SWL + 100 yr Wave + Debris, Impervious	39.1	74.2
6	Water to T.O. Wall, Impervious	50.0	85.7
7	Water to T.O. Wall, Pervious	47.6	83.3

T-WALL EAST OF KEARNY

USACE Passaic River Flood Protection Feasibility Level Flood Protection

TYPICAL EAST OF KEARNY MONOLITH TOW EL. 18; TOS EL 6.0

URS Project : 60442748

Monolith Foundations



1515 Poydras Street Suite 2700 New Orleans, LA 70112 (504) 586-8111

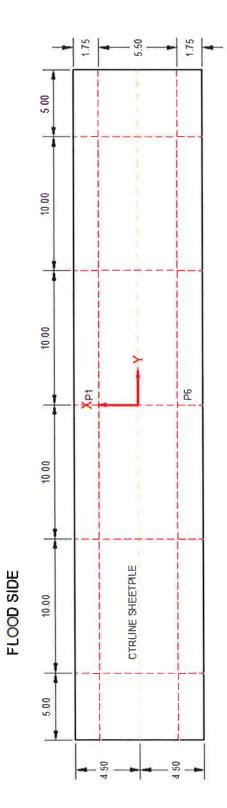
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 RBJ
 Checked by:

 Date:
 Jan-16
 Date:



			Date Jan-16		Date Jan-00	
	Project No. 60442748		Computed by RBJ		Checked by 0	
A=COM	Job USACE Passaic River Flood Protection	Feasibility Level Flood Protection	Description TYPICAL WEST OF KEARNY MONOLITH	TOW EL. 18; TOS EL 6.0	Monolith Foundation Layout & Axis	

TOW EL. 18; TOS EL 6.0



PROTECTED SIDE

A=COM				1 of 11
Job	USACE Passaic River Flood Protection	Project No.	60442748	
:	Feasibility Level Flood Protection			
Description	TYPICAL EAST OF KEAKNY MONULITH TOW EL. 18: TOS EL 6.0			141-10
	Foundation Load Cases & Combinations	Checked by	0 Date	Jan-00
			æ	References
LOAD CALCULATIONS	ATIONS			SIDE
TOW EL. 18; TOS EL 6.0	<u>OS EL 6.0</u>	TOW EL xxx	× × × × × × × × × × × × × × × × × × ×	ſ
Top of Wall EL.	18.0 NAVD88		₽Ч	Z
Normal Water El.	6.0 NAVD88	SWL 🗸	K	<i>></i>
Still Water El.	16.0 NAVD88		BAT	((
Top of Slab EL.	6.0 NAVD88		12	11 23
۲	15.0 ft.			
h1=	12.0 ft.	.ч Н		
h2=	36.0 in. (Base Slab Height)		GRADE	
h3=	12.0 in. (P.S. Soil Height)	94	EL CL	
h4=	0.0 ft.	*	*	Ď
h5=	1.00 ft. (F.S. Soil Height, T.O. Slab)	Ś		
8	9.0 ft. (Base Slab Width)	4	1	
b1=	18.0 in. (Wall Stem Width, top)	1 + m		
b2=	66.0 in. (F.S. Slab Width)	p2 / 20	/	
b3=	18.0 in. (Wall Stem Width, bottom)	2 / pe		
b4=	24.0 in. (P.S. Slab Width)	J	7	
b5=	21.0 in. (F.S. Pile Row Edge Space)	8/2	2 × BI2 >	
=96=	54.0 in. (Sheet Pile Edge Space)	8	* *	
BAT=	0.0 (Wall Batter, N/A)	4	80	
PS Grade =	7.00 NAVD88 (Average of PS soil for all)	F	T WALL CDOSS SECTION	<u>Notes:</u> 1) positive 'Y' axis is into page 2) hile hottone vouv from these show
Monolith Length	50.0 ft	-	- WALL UNUG-SECTIVIN	et prie du ters vary it dan trose stow in diagram

Bottom Of Slab = 3.0 NAVD88

	Project No.	60442748		
·			,	:
Description TYPICAL EAST OF KEARNY MONOLITH TOW EL. 18; TOS EL 6.0	Computed by	RBJ	. Date	Jan-16
Foundation Load Cases & Combinations	Checked by	0	. Date	Jan-00 References
ASSUMED UNIT WEIGHTS:				
Unit Weight of Storm Water: 62.4 bcf	Unbalanced L	Unbalanced Load for Stability Analysis:	y Analysis:	
Wet Unit Weight of Soil: Unit Weight of Riprap:	F _{ceb} (k/ft) =	00'0	(Operation Ca	0.00 (Operation Case; Force acts at bottom of slab)
	F _{cap} (k/ft) =	0.00	(Water to TO	0.00 (Water to TOW Case; Force acts at bottom of slab)
Sat Unit Weight of Soil: 47.6 pcf				
Unit Weight of Concrete	K _o , Clay fill =	0.80	0.80 (for lateral soil forces)	il forces)
150 pcf			EM 1110-2-25(EM 1110-2-2502: $P_{hz} = K_0 * (v * z_w + v' * (z - z_w))$
- PS design water elevation <bos elevation,="" hydros<="" no="" or="" ps="" th="" uplift=""><th>hydrostatic loads</th><th></th><th></th><th></th></bos>	hydrostatic loads			
FS Wind force above SWL= 50.0 psf		Wave	Wave Point Load =	0 kip/ft
Construction Surcharge Pressure = 200 psf	Dist fr	Dist from B.O. Slab to Wave Load =	Wave Load =	0 ft
LOAD CASES ANALYZED:	FS Water El.	PS Water El.	Overstress for Design	Notes
Construction	6.0	7.0	1.17	Temporary Construction Case
Construction + Wind on F.S.	6.0	7.0	1.33	Unusual Construction Case
Water to SWL, Impervious	16.0	7.0	1.00	Still Water Level Flood, Impervious uplift
Water to SWL, Pervious	16.0	7.0	1.00	Still Water Level Flood, Pervious uplift
Water to SWL + Debris Load, Impervious	16.0	7.0	1.00	Still Water Level Flood, Impervious uplift
Water to T.O. Wall, Impervious	18.0	7.0	1.33	Flood, Impervious uplift

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Job	USACE Passaic River Flood Protection	Project No.
	Feasibility Level Flood Protection	
Description	TYPICAL EAST OF KEARNY MONOLITH	Computed by
	TOW EL. 18; TOS EL 6.0	
	Foundation Load Cases & Combinations	Checked by

Jan-00 References

Date

0

Jan-16

Date

RBJ

60442748

All forces on this page are per foot of monolith length

	ateral PS Soil Lateral	Force (k/ft)	0.7040	0.7040	0.7040
FS Soil	Lateral	Force (k/ft)	-0.3046	-0.3046	-0.3046
		Wt. of PS Soil (k/ft) Force (k/ft) Force (k/ft)	0.220	0.220	0.220
	Wt. of FS Soil	(k/ft)	0.2618	0.2618	0.2618
		FS Soil EL. PS Soil EL.	7.00	7.00	7.00
		FS Soil EL.	7.00	7.00	7.00
Soil Forces:		Water EL.	7.0	16.0	18.0

Water Forces:

FS Water	Lateral Force	(k/f+)	-0.499	-5.273	-7.020
Wt. of FS	Water	(k/ft)	0.3432	3.432	4.1184
		Water EL.	7.0	16.0	18.0

50 psf * monolith height / 1000 =	
Wind Force:	

k/ft
15
Ŷ

Z-coord = -2.67 Z-coord = -4.50

X-coord = -0.700

1.1 k/ft 0.4 k/ft

F.S. = 200 psf * F.S. width / 1000 = P.S. = 200 psf * P.S. width / 1000 =

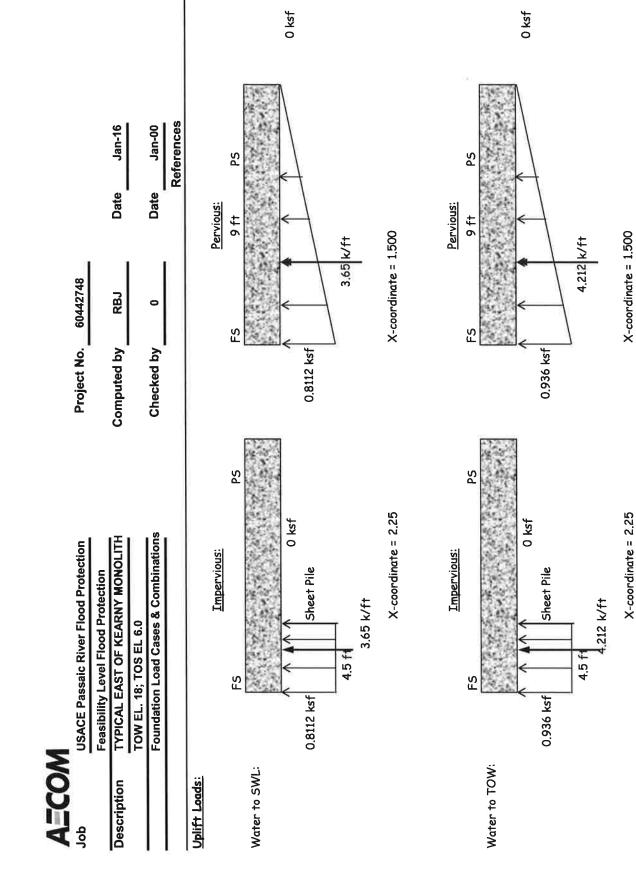
Surcharge Forces:

0.000 k/ft in (+) X Direction, acting at bottom of slab (Z-coordinate = 0) 0.000 k/ft in (+) X Direction, acting at bottom of slab (Z-coordinate = 0)

TOW: Operating:

Unbalanced Load:

East of Kearny T-Wall_TOW 18.xlsx

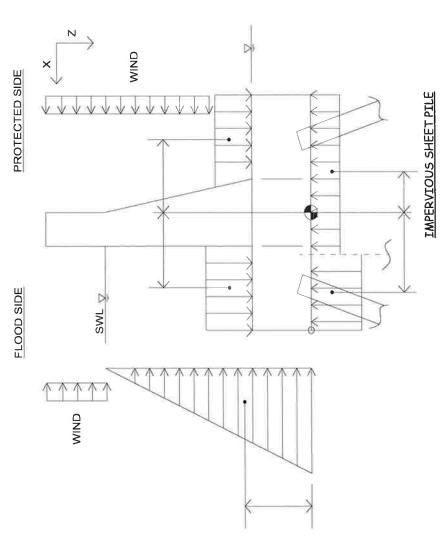


East of Kearny T-Wall_TOW 18.xlsx



Project No. 60442748		Computed by RBJ Date Jan-16		Checked by 0 Date Jan-00	References
lob USACE Passaic River Flood Protection	Feasibility Level Flood Protection	Description TYPICAL EAST OF KEARNY MONOLITH	TOW EL. 18; TOS EL 6.0	Foundation Load Cases & Combinations	

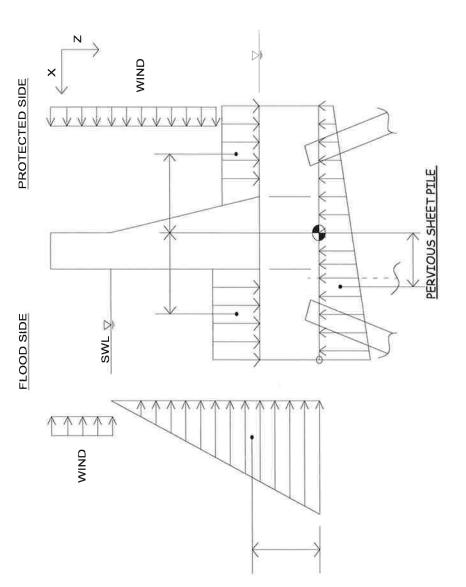
LOAD DIAGRAMS FOR IMPERVIOUS SHEET PILE CONDITIONS





		Date Jan-16		Date Jan-00	References
Project No. 60442748		Computed by RBJ		Checked by 0	
USACE Passaic River Flood Protection	Feasibility Level Flood Protection	TYPICAL EAST OF KEARNY MONOLITH	TOW EL. 18; TOS EL 6.0	Foundation Load Cases & Combinations	
Job		Description			

LOAD DIAGRAMS FOR PERVIOUS SHEET PILE CONDITIONS



A=COM Job

USACE Passaic River Flood Protection Feasibility Level Flood Protection Description

TYPICAL EAST OF KEARNY MONOLITH TOW EL. 18; TOS EL 6.0

Foundation Load Cases & Combinations

0 Checked by

Jan-00 References Date

Jan-16

Date

RBJ

Computed by

Project No. 60442748

		NOTES:	+)	wall stem weight	base slab weight	P.S. soil weight	P.S. lateral soil force	F.S. soil weight	F.S. lateral soil force	Unbalanced load, no water	Dry Soil Weight Subtotal	F.S. Equipment Surcharge	P.S. Equipment Surcharge	LC 1 CPGA Forces
	IGTH	Wz	(kip-f1/f1)								0:00			0 [.] 0
10	DF WALL LEN	My	(kip-ft/ft)	4.73	0.00	0.77	-0.94	-0.46	0.41	00.0	4.50	-1.93	1.40	3.98
LC 1: Construction, 1.17 allowable overstress	EXTERNAL FORCES & MOMENTS ABOUT ORIGIN PER FOOT OF WALL LENGTH	W×	(kip-f1/f1)								0:00			00.00
		'Z' Centroid	(t t)				-1.33		-1.33	00.0				
		'Y' Centroid	(1 1)											
		'X' Centroid	([]	-1.75	00.0	-3.50		1.75				1.75	-3.50	
		Fz	(kip/ft)	2.70	4.05	0.22		0.26			7.23	1.10	0.40	8.73
		Ę	(kip/ft)				0.70		-0.30	0.00	0.40			0.40
											Subtotal A			SUM:

		NOTES:	+)	wall stem weight	base slab weight	FS Wind Load	LC 2 CPGA Forces													
	бтн	Wz	(kip-ft/f	0		0	0.00													
erstress	JF WALL LEN	My	(kip-ft/ft)	4.73	00.0	5.63	10.35													
33 allowable ov	EN PER FOOT C	M×	(kip-ft/ft) (kip-ft/ft) (kip-ft/ft)			0	0.00													
LC 2: Construction + Wind on F.S., 1.33 allowable overstress	ABOUT ORIGIN	'Z' Centroid	(t t)			-7.50														
	EXTERNAL FORCES & MOMENTS ABOUT ORIGIN PER FOOT OF WALL LENGTH	'Y' Centroid	(ft)	0																
	EXTERNAL FO	'X' Centroid	(1 1)	-1.75	0															
							u	EXT	ЕХТЕ	EXTER	EXTER	EXTER	EXTERNA	EX	EX	Fz	(kip/ft)	2.70	4.050	
		F.	(kip/ft)			-0.75	-0.75													
							SUM:													

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Feasibility Level Flood Protection TYPICAL EAST OF KEARNY MONOLITH USACE Passaic River Flood Protection Description

Foundation Load Cases & Combinations

TOW EL. 18; TOS EL 6.0

Project No. 60442748

Computed by

Jan-16 Date RBJ

0 Checked by

Jan-00 References Date

			: 27	LC 3: Water to SWL, Impervious, 1.0 allowable overstress	mpervious, 1.0	allowable ove	rstress		
			EXTERNAL FORCE	DRCES & MOMENTS ABOUT ORIGIN PER FOOT OF WALL LENGTH	ABOUT ORIGI	N PER FOOT C	PE WALL LEN	5 ТН	
	Fx	Fz	'X' Centroid	'Y' Centroid	'Z' Centroid	M×	My	Mz	NOTES:
	(kip/ft)	(kip/ft)	(ft)	(1 1)	(t+)	(kip-ft/ft)	(kip-ft/ft) (kip-ft/ft)	(kip-ft/ft)	
		2.70	-1.75				4.73		wall stem weight
		4.05	00.0				0.00		base slab weight
		0.22	-3.50				0.77		P.S. soil weight
	0.70				-1.33		-0.94		P.S. lateral soil force
		0.26	1.75				-0.46		F.S. soil weight, saturated
	-0.30				-1.33		0.41		F.S. lateral soil force, saturated
	-5.27				-4.33		22.85		Lateral water force
		3.43	1.75				-6.01		Vertical water force
	0.00				0		0.00		Unbalanced load, water TOW
Subtotal B	-4.87	10.66				00:0	21.35	0:00	SWL Subtotal
		-3.65	2.25				8.21		Impervious FS hydrostatic uplift
		0.00					0.00		Impervious PS hydrostatic uplift
SUM:	-4.87	7.01	-			00.0	29.56	0,00	LC 3 CPGA Forces

			LC 4: Water to SWL, Pervious, 1 allowable overstress	, Pervious, 1 a	llowable overst	rress		
		EXTERNAL FO	EXTERNAL FORCES & MOMENTS ABOUT ORIGIN PER FOOT OF WALL LENGTH	ABOUT ORIGI	N PER FOOT O	F WALL LEN	ЭТН	
Å	Fz	'X' Centroid	'Y' Centroid 'Z' Centroid	'Z' Centroid	Mx	My	Mz	NOTES
(kip/ft)	(kip/ft)	(ft)	(ft)	(ft)	(kip-ft/ft) (kip-ft/ft) (kip-ft/ft)	(kip-ft/ft)	(kip-ft/ft)	
-4.87	10.66				0:00	21.35	0.00	SWL Subtotal
	-3.65	1.500				5.48		Pervious hydrostatic uplift
-4.87	7.01				0.00	26.82	0,00	LC 4 CPGA Forces

18.xlsx
IL_T0W
T-Wall
Kearny
East of

			NOTES:		wall stem weight	base slab weight	P.S. soil weight	P.S. lateral soit force	F.S. soil weight, saturated	F.S. lateral soil force, saturated	Lateral water force	Vertical water force	Unbalanced load, water TOW	TOW Subtotal	Impervious FS hydrostatic uplift	Impervious PS hydrostatic uplift	LC 6 CPGA Forces
22.2			Wz	(kip-f1/f1)										00:0			0.00
20.00	overstress	T. OF WALL	My	(kip-ft/ft)	4.73	0.00	0.77	-0.94	-0.46	0.41	35.10	-7.21	0.00	32.40	9.48	0.00	41.87
20.0	.33 allowable	DRIGIN PER F	Mx	(kip-ft/ft)										00:0			0.00
	Impervious, 1	INTS ABOUT ('Z' Centroid	(tt)				-1.33		-1.33	-5.00		0				
	LC 6: Water to T.O. Wall, Impervious, 1.33 allowable overstress	AL FORCES & MOMENTS ABOUT ORIGIN PER FT. OF WALL	'Y' Centroid	(1 1)													
	LC 6: V	EXTERNAL	'X' Centroid	(tt)	-1.75	00.0	-3.50		1.75			1.75			2.25		
10.1			Fz	(kip/ft)	2.70	4.05	0.22		0.26			4.12		11.35	-4.21	00.0	7.14
10.0-			Fx	(kip/ft)				0.70		-0.30	-7.02		0.00	-6.62			-6.62
WOR			s NO.											Subtotal B			SUM:

S			NOTES:		SWL Subtotal	Impervious FS hydrostatic uplift	Impervious PS hydrostatic uplift	Debris Load	LC 5 CPGA Forces
Kererences	S		Mz	(kip-ft/ft)	0:00				0.00
	ible overstres	F. OF WALL	My	(kip-ft/ft) (kip-ft/ft)	21.35	8.21	0.00	6.50	36.06
	ous, 1.0 allowa	ORIGIN PER FI	W×	(kip-ft/ft)	0:00				0.00
	Load, Impervi	ENTS ABOUT ('Z' Centroid	(t t)				-13.00	
	rr to SWL + Debris Load, Impervious, 1.0 allowable overstress	AL FORCES & MOMENTS ABOUT ORIGIN PER FT. OF WALL	'Y' Centroid	(1 1)					
	LC 5: Water	EXTERNAL	'X' Centroid	(+)		2.25			
			Fz	(kip/ft)	10.66	-3.65	0.00		7.01
			F	(kip/ft)	-4.87			-0.50	-5.37
					Subtotal B				SUM:

Jan-16

Date

RBJ

Computed by

TYPICAL EAST OF KEARNY MONOLITH TOW EL. 18; TOS EL 6.0

Description

USACE Passaic River Flood Protection Feasibility Level Flood Protection

Foundation Load Cases & Combinations

Project No. 60442748

Jan-00

Date

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		Date Jan-16		Date Jan-00	References
Project No. 60442748		Computed by RBJ		Checked by 0	
USACE Passaic River Flood Protection	Feasibility Level Flood Protection	TYPICAL EAST OF KEARNY MONOLITH	TOW EL. 18; TOS EL 6.0	Foundation Load Cases & Combinations	
Job		Description			

		NOTES:		TOW Subtotal	Pervious hydrostatic uplift	LC 7 CPGA Forces
		Wz	(kip-ft/ft)	0.00		0.00
verstress	T. OF WALL	My	(kip-ft/ft)	32.40	6.32	38.72
33 allowable o	DRIGIN PER F	M×	(kip-ft/ft) (kip-ft/ft) (kip-ft/ft)	0.00		0.00
l, Pervious, 1.	ENTS ABOUT ('Z' Centroid	(ft)			
LC 7: Water to T.O. Wall, Pervious, 1.33 allowable overstress	VAL FORCES & MOMENTS ABOUT ORIGIN PER FT. OF WALL	'Y' Centroid 'Z' Centroid	(ft)			
LC 7:	EXTERNAL	'X' Centroid	(1 1)		1.500	
		Fz	(kip/ft)	11.35	-4.21	7.14
		Fx	(kip/ft)	-6.62		-6.62
		s NO.		Subtotal B		SUM:

A ECOAA

			Date Jan-16		Date Jan-00	References
	Project No. 60442748		Computed by RBJ		Checked by 0	
	USACE Passaic River Flood Protection	Feasibility Level Flood Protection	TYPICAL EAST OF KEARNY MONOLITH	TOW EL. 18; TOS EL 6.0	Foundation Load Cases & Combinations	
ALCOV	Job		Description			

Summary of Forces and Moments (For Full Length of Monolith):

LOAD CASE NUMBER	Fx	Fγ	Fz	W×	My	Wz
	kips	kips	kips	(kip-ft)	(kip-ft)	(kip-ft)
1	20.0	0.0	436.6	0.0	199.0	0.0
2	-37.5	0.0	337.5	0.0	517.5	0.0
m	-243.7	0.0	350.7	0.0	1478.0	0.0
4	-243.7	0.0	350.7	0:0	1341.1	0.0
£	-268.7	0.0	350.7	0.0	1803.0	0.0
6	-331.0	0.0	356.9	0:0	2093.7	0.0
7	-331.0	0.0	356.9	0.0	1935.8	0.0

AECOM

		Passaic River Flood Protection	Project No. 60442748	
Descrip		TYPICAL EAST OF KEARNY MONOLITH	Computed by RBJ	Checked by 0
		TOW EL. 18; TOS EL 6.0		
	Soil & F	Pile Information Required for CPGA	Date Jan-16	Date Jan-00
				References

Pile Layout, SW-11:

Row	1		Row	2	
pile no.	×	У	pile no,	×	У
1	2.25	-20.00	6	-2.25	-20.00
2	2,25	-10.00	7	-2,25	-10.00
3	2.25	0.00	8	-2.25	0.00
4	2.25	10.00	9	-2.25	10.00
5	2.25	20.00	10	-2.25	20,00

Tip Elevation: (For CPGA, need Tip Elevation as a function of CPGA Axis at B,O. Slab, +Z points downward)

B.O.S. Elevation = _____4 NAVD88 Bedrock EL = ____45 NAVD89 "TłP" in CPGA = ___61 ft

<u>Pile Properties & Attributes:</u> (See hand calculations for micropiles)

$E_s = \frac{3,605,000}{1000} psi$ A = 181 in² $I_x = I_y = \frac{1534}{1534} in^4$

- A.E.	101	200
x = I _y =	1534	in ⁴
A 14		2222010-004

C₃₃ = 1.2 (factor for method of axial load transfer from pile to soil; = 1 for full tip bearing, = 2 for full skin friction)

0.03

* Socketed 12' min into bedrock

Allowable Compression (AC) =	160	kips
Allowable Tension (AT) =	100	kips
PO =	1597	kips
PT =	1010	kips
PB =	550	kips
MB =	2825	kip-in
MO =	2200	kip-in

Es Value for CPGA Run:

Monolith width = 50 ft N_h = 30 pci =

GROUP	FACTORS
Pile Spacing in Direction of Loading	From EM1110-2- 2906
	D
3 B	0.33
4B	0.38
5B	0,45
6B	0.56
7B	0.71
88	1

Group reduction is based on distance between piles in direction of loading. This includes distance due to battering and is taken over the distance 10*d_{pile} (point of fixety).

Assume a batter of 3 B = d _{plle} = <mark>9.63</mark> in =	0.803 ft
Distance between piles at B.O. Slab = Average distance between piles over 10*dpile =	4.50 ft 9.85 ft
Average distance between piles in terms of pile width B =	12,274 B
Group Reduction "D" value for this distance =	1
Therefore, Es including group reduction =	0.0300 kci

AECOM

Job USACE Passaic Riv		Passaic River Flood Protection	Project No. 6			
	Feasibility Level Flood Protection					
Descrip	otion	TYPICAL EAST OF KEARNY MONOLITH	Computed by	RBJ	Date	Jan-16
		TOW EL. 18; TOS EL 6.0	-			
		CPGA Input & Output Files	Checked by	0	Date	Jan-00
-					· · · · · · · · · · · · · · · · · · ·	

TOM EL18, H-pile 10' O.C.

Input file:

100 EAST OF KEARNY, TOW EL18, FIX, 1:3 BATTER, HP14x73, 10'OC 200 PROP 29000 261 729 26.1 1.7 0 ALL 300 SOIL ES 0.03 TIP 60 0 ALL 400 FIX ALL 500 ALLOW H 200 53 535 498 895 2675 ALL 600 FOVSTR 1.17 1.17 1 700 FOVSTR 1.33 1.33 2 6 7 1000 BATTER 3 ALL 1100 ANGLE 180 6 TO 10 1200 PILE 1 2.5 -20 0 1300 PILE 6 -2.5 -20 0 1400 ROW Y 5 1 4 AT 10 1500 ROW Y 5 6 4 AT 10 4500 LOAD 1 20 0 436.6 0 199 0 4600 LOAD 2 -37.5 0 337.5 0 517.5 0 4700 LOAD 3 -243.7 0 350.7 0 1478 0 4800 LOAD 4 -243.7 0 350.7 0 1341 0 4900 LOAD 5 -268.7 0 350.7 0 1803 0 5000 LOAD 6 -331 0 356.9 0 2094 0 5100 LOAD 7 -331 0 356.9 0 1936 0 6000 FOUT 1 2 3 4 5 6 7 EL18HP10.doc 6100 PFO ALL 6200 PLB ALL

 \mathbf{x}

T-WALL WEST OF KEARNY

USACE Passaic River Flood Protection Feasibility Level Flood Protection

TYPICAL WEST OF KEARNY MONOLITH TOW EL. 18; TOS EL 6.0

URS Project : 60442748

Monolith Foundations



Suite 2700 New Orleans, LA 70112 (504) 586-8111

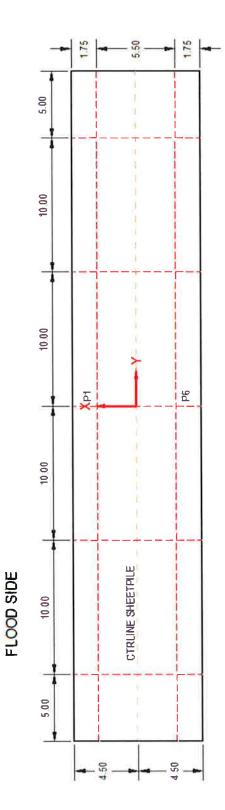
 Computed by:
 RBJ
 Checked by:

 Date:
 Jan-16
 Date:



	Project No. 60442748		Computed by RBJ Date Jan-16		Checked by 0 Date Jan-00	
A=COM	Job USACE Passaic River Flood Protection	Feasibility Level Flood Protection	Description TYPICAL WEST OF KEARNY MONOLITH	TOW EL. 18; TOS EL 6.0	Monolith Foundation Layout & Axis	

TOW EL. 18; TOS EL 6.0



PROTECTED SIDE

A=COM					1 of 11
doL	USACE Passaic River Flood Protection	Project No.	60442748		
Decrintion	Feasibility Level Flood Protection	Committed by	RR.I D	Date	
	TOW EL. 18; TOS EL 6.0		1		
	Foundation Load Cases & Combinations	Checked by	0 D	Date Jan-00	
a constant a				References	
LOAD CALCULATIONS	ATIONS			PROTECTED SIDE	
TOW EL. 18; TOS EL 6.0	OS EL 6.0	TOW ELXX		×	
Top of Wall EL.	18.0 NAVD88		Ħ	Z	
Normal Water El.	6.0 NAVD88			÷	
Still Water El.	16.0 NAVD88	8	BAT		((
Top of Slab EL.	6.0 NAVD88		12		
Ŧ	15.0 ft.				, -0.
h1=	12.0 ft.	щ	_		
+2=	36.0 in. (Base Slab Height)		5	GRADE	
h3=	12.0 in. (P.S. Soil Height)	SH	X EL	×	
h4=	0.0 ft.	*	-	⊅	1
h5≓	1.00 ft. (F.S. Soil Height, T.O. Slab)	5			
B=	9.0 ft. (Base Slab Width)	ч	1		
b1=	18.0 in. (Wall Stem Width, top)	A 40 1	•		
b2=	66.0 in. (F.S. Slab Width)	p2/ / X			
b3=	18.0 in. (Wall Stem Width, bottom)	99			
b4=	24.0 in. (P.S. Slab Width)	J		1	
b5=	21.0 in. (F.S. Pile Row Edge Space)	K B/2	(× BI2		
b6=	54.0 in. (Sheet Pile Edge Space)	P2	×		
BAT=	0.0 (Wall Batter, N/A)	4	Ю	5	
PS Grade =	7.00 NAVD88 (Average of PS soil for all)	H	T-WALL PDOSS-SECTTON	Notes:	<u>Notes:</u> 1) positive 'Y' axis is into page 2) hile hatters vorv from those show
Monolith Length	50.0 ft	-			in diagram
Bottom Of Slob =	3 0 NAVNRR				

West of Kearny T-Wall_TOW 18.xlsx

A=COM		Droiord No.	07267703		2 of 1
gor	USACE Passaic Kiver Flood Protection Feasibility Level Flood Protection		00447140		
Description	IOLITH	Computed by	RBJ	Date	Jan-16
	TOW EL. 18; TOS EL 6.0	Charkad hv	c	Date	
		• •	,		References
ASSUMED UN	ASSUMED UNIT WEIGHTS:				
Unit Weight of Storm Water:	storm Water:	- <u> </u>	llabolooond l and fan Stabilithe Anaherie:	Analysia.	
0 6. Wether Wish		E (F/t+) =		y muryaia. (Onerntion Co	000 (Meration Case: Force acts at hottom of slah)
Wet Unit Weight of Soli.	100 pcf 0 pcf	F _{cap} (k/ft) =	00.0	(Water to TO	0.00 (Water to TOW Case; Force acts at bottom of slab)
Sat Unit Weight of Soil:					
37.(37.6 pcf				
Unit Weight of Concrete	Concrete	Ko, Clay fill =	0.80	0.80 (for lateral soil forces)	il forces)
15(150 pcf			EM 1110-2-25	EM 1110-2-2502: P _{hz} = K _o * (y * z _w + y' * (z - z _w))
- PS design wate	- PS design water elevation <bos elevation,="" hydrostatic="" loads<="" no="" or="" ps="" td="" uplift=""><td>S</td><td></td><td></td><td></td></bos>	S			
FS	FS Wind force above SWL= 50.0 psf		Wave	Wave Point Load =	0 kip/ft
Construct	Construction Surcharge Pressure = 250 psf	Dist fro	Dist from B.O. Slab to Wave Load =	Wave Load =	0 ft
	LOAD CASES ANALYZED:	FS Water El.	PS Water El.	Overstress for Design	Notes
1	Construction	3.0	3.0	1.17	Temporary Construction Case
2	Construction + Wind on F.S.	3.0	3.0	1.33	Unusual Construction Case
m	Water to SWL, Impervious	16.0	6.0	1.00	Still Water Level Flood, Impervious uplift
4	Water to SWL, Pervious	16.0	6.0	1.00	Still Water Level Flood, Pervious uplift
5	Water to SWL + Debris Load, Impervious	16.0	6.0	1.00	Still Water Level Flood, Impervious uplift
9	Water to T.O. Wall, Impervious	18.0	6.0	1.33	TOW Flood, Impervious uplift
2	Water to T.O. Wall, Pervious	18.0	6.0	1.33	TOW Flood, Pervious uplift

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USACE Passaic River Flood Protection	Feasibility Level Flood Protection	FYPICAL WEST OF KEARNY MONOLITH	TOW EL. 18; TOS EL 6.0	Foundation Load Cases & Combinations
Job	-	Description		

Jan-16

Date

RBJ

Computed by

Project No. 60442748

Jan-00 References

Date

0

Checked by

All forces on this page are per foot of monolith length

					FS Soil	
1			Wt. of FS Soil		Lateral	PS Soil Lateral
S	Soil EL.	FS Soil EL. PS Soil EL.	(k/f†)	Wt. of PS Soil (k/ft) Force (k/ft) Force (k/ft)	Force (k/ft)	Force (k/ft)
	7.00	7.00	0.2068	0.200	-0.2406	0.6400
	7.00	7.00	0.2068	0.200	-0.2406	0.6400
	7.00	7.00	0.2068	0.200	-0.2406	0.6400

Water Forces:

	Wt. of FS	FS Water
	Water	Lateral Force
Water EL.	(k/ft)	(k/f+)
7.0	0.3432	-0.499
16.0	3.432	-5.273
18.0	4.1184	-7.020

50 psf * monolith height / 1000 = Wind Force:

-0.75 k/ft

Lateral (k-ft) 0.116 0.844 Vertical (k-ft) 0.270 Soil Concrete <u>MDE Earthquake Force:</u>

Z-coord = -2.67

Z-coord = -4.50

1.375 k/ft

F.S. = 250 psf * F.S. width / 1000 =

Surcharge Forces:

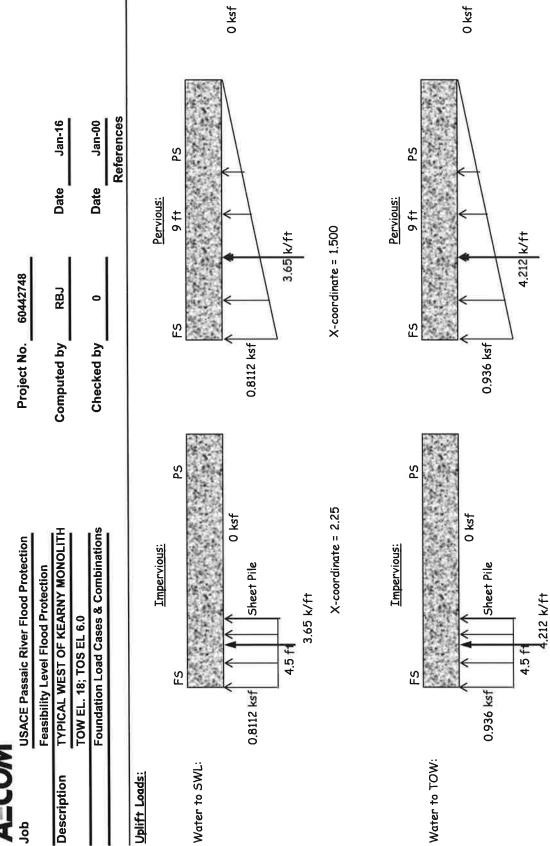
X-coord = -0.700

3 of 11

West of Kearny T-Wall_TOW 18.xlsx

0.5 k/ft	0.000 k/ft in (+) X Direction, acting at bottom of slab (Z-coordinate = 0) 0.000 k/ft in (+) X Direction, acting at bottom of slab (Z-coordinate = 0)
P.S. = 250 psf * P.S. width / 1000 =	0.000 k/f† in (+) X 0.000 k/f† in (+) X
P.S. = 250 p	Operating: TOW:
	Unbalanced Load:





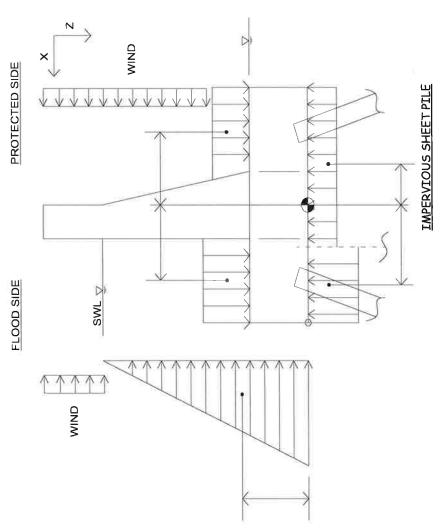
4 of 11

X-coordinate = 1.500

X-coordinate = 2.25



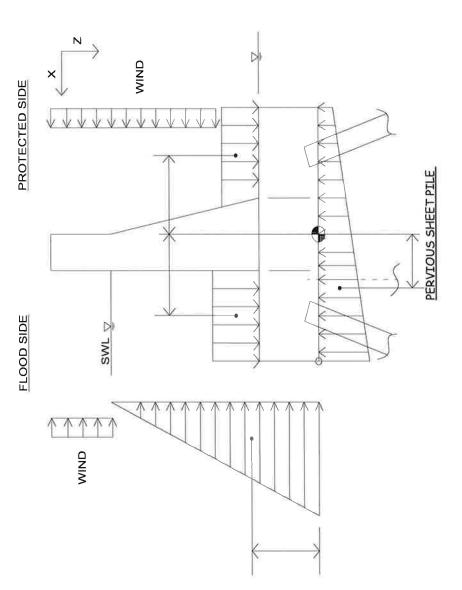
dob	USACE Passaic River Flood Protection	Project No. 60442748	60442748			
	Feasibility Level Flood Protection					
Description	TYPICAL WEST OF KEARNY MONOLITH	Computed by	RBJ	Date	Date Jan-16	
	TOW EL. 18; TOS EL 6.0					
	Foundation Load Cases & Combinations	Checked by	0	Date	Date Jan-00	
				Re	References	
LOAD DIAGRAM	LOAD DIAGRAMS FOR IMPERVIOUS SHEET PILE CONDITIONS					





	Project No. 60442748		H Computed by RBJ Date Jan-16		s Checked by 0 Date Jan-00	Deferences
	USACE Passaic River Flood Protection	Feasibility Level Flood Protection	TYPICAL WEST OF KEARNY MONOLITH	TOW EL. 18; TOS EL 6.0	Foundation Load Cases & Combinations	
うりて	Job		Description			

LOAD DIAGRAMS FOR PERVIOUS SHEET PILE CONDITIONS



A=COM Job

USACE Passaic River Flood Protection Feasibility Level Flood Protection TYPICAL WEST OF KEARNY MONOLITH TOW EL. 18; TOS EL 6.0 Foundation Load Cases & Combinations

Description

0 Checked by

Jan-00 References Date

Jan-16

Date

RBJ

Computed by

Project No. 60442748

X centroidY centroidNMMNOTES: $(f+)$ $(f+)$ $(f+)$ $(f+)$ $(f+)$ (h) (h) $h)$ Mo $(1,7)$ $(f+)$ $(f+)$ $(f+)$ $(f+)$ (h) $h)$ $h)$ $h)$ h $(1,75)$ $(-1,75)$ $(-1,33)$ $(-0,6)$ $(-0,85)$ $(-0,85)$ $P.S.$ soli weight $(1,75)$ $(-1,33)$ $(-0,85)$ $(-0,85)$ $(-0,85)$ $P.S.$ soli weight $(1,75)$ $(-1,33)$ $(-0,85)$ $(-0,36)$ $P.S.$ soli weight $(1,75)$ $(-1,33)$ $(-0,36)$ $(-0,36)$ $P.S.$ soli weight $(1,75)$ $(-1,33)$ $(-0,36)$ $(-0,36)$ $P.S.$ soli weight $(1,75)$ $(-1,33)$ $(-2,36)$ $(-2,36)$ $(-2,36)$ $(1,75)$ $(-1,33)$ $(-0,00)$ $(-2,41)$ $(-2,64)$ $(1,75)$ $(-2,64)$ $(-2,41)$ $(-2,64)$ $(-2,64)$ $(1,75)$ $(-2,41)$ $(-2,41)$ $(-2,64)$ $(-2,64)$ $(-3,50)$ $(-2,41)$ $(-2,64)$ $(-2,64)$ $(-2,64)$
(f1) (kip-f1/f1) (kip-f1/f1) (kip-f1/f1) (f1) (kip-f1/f1) (kip-f1/f1) (kip-f1/f1) (f1) (kip-f1/f1) (kip-f1/f1) (kip-f1/f1) (f1) (f1) (f1) (f1)
4.73 4.73 0.00 0.00 0.70 0.70 0.70 -0.85 -0.85 -0.36 0.70 -0.36 0.70 -0.36 0.70 4.53 0.00 4.53 0.00 4.53 0.00 3.87
0.00 0.00 0.70 0.70 0.85 0.85 0.85 -0.85 0.36 -0.36 0.37 0.32 0.32 0.32 0.32 0.32 0.32 0.00 0.00 4.53 0.00 4.53 0.00 1.75 0.00 3.87
0.70 0.70 -0.85 -0.85 0.20 -0.36 0.20 0.32 0.22 0.00 0.00 4.53 0.00 4.53 0.70 -2.41 1.75 0.00 3.87 0.00
-0.85 -0.85 -0.36 -0.36 -0.35 0.32 0.32 0.32 0.32 0.32 0.32 0.32 0.32 0.00 1.75 0.00 1.75 0.00
-0.36 -0.36 0.32 0.32 0.00 4.53 0.00 4.53 0.00 4.53 1.75 0.00 2.87 0.00
0.32 0.32 0.00 0.00 0.00 4.53 0.00 4.53 1.75 0.00 3.87
0.00 4.53 0.00 0.00 4.53 0.00 1.75 1.75 1.75 0.00 3.87 0.00
4.53 0.00 -2.41 1.75 3.87 0.00
-2.41 -2.41
1.75 0.00
3.87

		NOTES:		wall stem weight	base slab weight	FS Wind Load	LC 2 CPGA Forces				
	бТН	Mz	(kip-ft/ft)	0		0	0.00				
erstress	F WALL LEN	My	(kip-ft/ft)	4.73	0.00	5.63	10.35				
LC 2: Construction + Wind on F.S., 1.33 allowable overstress EXTERNAL FORCES & MOMENTS ABOUT ORIGIN PER FOOT OF WALL LENGTH	W×	(kip-ft/ft) (kip-ft/ft) (kip-ft/ft)			0	0.00					
	EXTERNAL FORCES & MOMENTS ABOUT ORIGIN F	'Z' Centroid	(t+)			-7.50					
		EXTERNAL FORCES & MOMENTS	EXTERNAL FORCES & MOMENTS	EXTERNAL FORCES & MOMENTS	L FORCES & MOMENTS	'Y' Centroid	(1 1)	ο			
					'X' Centroid	(1 1)	-1.75	0			
		Fz	(kip/ft)	2.70	4.050		6.75				
		Fx	(kip/ft)			-0.75	-0.75				
							SUM:				

USACE Passaic River Flood Protection Feasibility Level Flood Protection TYPICAL WEST OF KEARNY MONOLITH TOW EL. 18; TOS EL 6.0 Foundation Load Cases & Combinations Description

RBJ Computed by

Project No. 60442748

Jan-16

Date

0 Checked by

Jan-00 Date

References

		NOTES:		wall stem weight	base slab weight	P.S. soil weight	P.S. lateral soil force	F.S. soil weight, saturated	F.S. lateral soil force, saturated	Lateral water force	Vertical water force	Unbalanced load, water TOW	SWL Subtotal	Impervious FS hydrostatic uplift	Impervious PS hydrostatic uplift	LC 3 CPGA Forces
	бтн	zW	(kip-ft/ft)										00:0			00.00
erstress	DF WALL LEN	My	(kip-ft/ft)	4.73	0.00	0.70	-0.85	-0.36	0.32	22.85	-6.01	0.00	21.37	8.21	0.00	29.59
) allowable ove	N PER FOOT C	W×	(kip-ft/ft)										0:00			0.00
mpervious, 1.(ABOUT ORIGI	'Z' Centroid	(tt)				-1.33		-1.33	-4.33		0				
3: Water to SWL, Impervious, 1.0 allowable overstress	EXTERNAL FORCES & MOMENTS ABOUT ORIGIN PER FOOT OF WALL LENGTH	'Y' Centroid	(tt)													
FC 3:	EXTERNAL FO	'X' Centroid	(1 1)	-1.75	0.00	-3.50		1.75			1.75			2.25		
		Fz	(kip/ft)	2.70	4.05	0.20		0.21			3.43		10.59	-3.65	00.0	6.94
		Fx	(kip/ft)				0.64		-0.24	-5.27		0.00	-4.87			-4.87
													Subtotal B			SUM:

				LC 4: Water to SWL, Pervious, 1 allowable overstress	Pervious, 1 a	llowable oversi	tress		
			EXTERNAL F	EXTERNAL FORCES & MOMENTS ABOUT ORIGIN PER FOOT OF WALL LENGTH	ABOUT ORIGI	N PER FOOT C	DF WALL LEN	ЭТН	
	Fx	Fz	'X' Centroid	'Y' Centroid 'Z' Centroid	'Z' Centroid	W×	My	Wz	NOTES:
	(kip/ft)	(kip/ft)	(+1)	(††)	(ft)	(kip-ft/ft) (kip-ft/ft) (kip-ft/ft)	(kip-f1/f1)	(kip-ft/ft)	
Subtotal B	-4.87	10.59				0:00	21.37	0.00	SWL Subtotal
		-3.65	1.500				5.48		Pervious hydrostatic uplift
SUM:	-4.87	6.94				0.00	26.85	00.00	LC 4 CPGA Forces

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West

T										ted			>		lift	ift	
			NOTES:		wall stem weight	base slab weight	P.S. soil weight	P.S. lateral soil force	F.S. soil weight, saturated	F.S. lateral soil force, saturated	Lateral water force	Vertical water force	Unbalanced load, water TOW	TOW Subtotal	Impervious FS hydrostatic uplift	Impervious PS hydrostatic uplift	LC 6 CPGA Forces
3			Mz	(kip-f1/f1)										0:00			00.0
60.02	overstress	T. OF WALL	My	(kip-ft/ft)	4.73	0.00	0.70	-0.85	-0.36	0.32	35.10	-7.21	0.00	32.42	9.48	0.00	41.90
8.5	.33 allowable	DRIGIN PER F	M×	(kip-ft/ft)					-					0.00			00.0
	Impervious, 1	NTS ABOUT ('Z' Centroid	(ft)				-1.33		-1.33	-5.00		0				
	<u>Vater to T.O. Wall, Impervious, 1.33 allowable overstress</u>	AL FORCES & MOMENTS ABOUT ORIGIN PER FT. OF WALL	'Y' Centroid	(+1)													
	LC 6: Wate	EXTERNAL	'X' Centroid	([]	-1.75	00.0	-3.50		1.75			1.75			2.25		
0.74			Fz	(kip/ft)	2.70	4.05	0.20		0.21			4.12		11.28	-4.21	0.00	7.06
-7.5/			Fx	(kip/ft)				0.64		-0.24	-7.02		0.00	-6.62			-6.62
:WNS			S NO.											Subtotal B			SUM:

								Velei elles	
			LC 5: Water 1	er to SWL + Debris Load, Impervious, 1.0 allowable overstress	: Load, Impervi	ious, 1.0 allowe	able overstres	SS	
			EXTERN	EXTERNAL FORCES & MOMENTS ABOUT ORIGIN PER FT. OF WALL	IENTS ABOUT	ORIGIN PER F	T. OF WALL		
	F	Fz	'X' Centroid	'Y' Centroid	'Z' Centroid	W×	My	zW	NOTES:
	(kip/ft)	(kip/ft)	(+)	(++)	(t+)	(kip-ft/ft)	(kip-ft/ft) (kip-ft/ft)	(kip-ft/ft)	
Subtotal B	-4.87	10.59				0:00	21.37	0:00	SWL Subtotal
		-3.65	2.25				8.21		Impervious FS hydrostatic uplift
		0.00					00:0		Impervious PS hydrostatic uplift
	-0.50				-13.00		6.50		Debris Load
SUM:	-5.37	6.94				0.00	36.09	0.00	LC 5 CPGA Forces

USACE Passaic River Flood Protection Feasibility Level Flood Protection TYPICAL WEST OF KEARNY MONOLITH TOW EL. 18; TOS EL 6.0 Foundation Load Cases & Combinations A=COM Description doL

Project No. 60442748

Computed by

Jan-16 Date RBJ

Jan-00 Date

0

Checked by

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doL	USACE Passaic River Flood Protection	-
	Feasibility Level Flood Protection	
Description	TYPICAL WEST OF KEARNY MONOLITH	ပိ
	TOW EL. 18; TOS EL 6.0	
	Foundation Load Cases & Combinations	0

Project No. 60442748 RBJ computed by

Date Jan-16 Checked by

0

References Date Jan-00

		NOTES:		TOW Subtotal	Pervious hydrostatic uplift	LC 7 CPGA Forces
		Mz	(kip-ft/ft)	00.0		0.00
/erstress	. OF WALL	My	(kip-ft/ft)	32.42	6.32	38.74
33 allowable o	DRIGIN PER FI	W×	(kip-ft/ft) (kip-ft/ft) (kip-ft/ft)	0.00		0.0
l, Pervious, 1.	ENTS ABOUT ('Z' Centroid	(ft)			
LC 7: Water to T.O. Wall, Pervious, 1.33 allowable overstress	AL FORCES & MOMENTS ABOUT ORIGIN PER FT. OF WALL	'Y' Centroid	(1 1)			
IC 7:	EXTERNAL	'X' Centroid	(tt)		1.500	
		Fz	(kip/ft)	11.28	-4.21	7.06
		Å	(kip/ft)	-6.62		-6.62
		S NO.		Subtotal B		SUM:

AFCOM

		Date Jan-16		Date Jan-00	References
Project No. 60442748		Computed by RBJ		Checked by 0	
USACE Passaic River Flood Protection	Feasibility Level Flood Protection	TYPICAL WEST OF KEARNY MONOLITH	TOW EL. 18; TOS EL 6.0	Foundation Load Cases & Combinations	
Job		Description			

Summary of Forces and Moments (For Full Length of Monolith):

LOAD CASE NUMBER	Fx	Fy	Fz	W×	My	Wz	
	kips	kips	kips	(kip-ft)	(kip-ft)	(kip-ft)	
1	20.0	0.0	451.6	0.0	193.7	0.0	Temporary Construction Case
2	-37.5	0.0	337.5	0.0	517.5	0.0	Unusual Construction Case
m	-243.7	0.0	346.9	0.0	1479.3	0.0	Still Water Level Flood, Impervious uplift
4	-243.7	0.0	346.9	0.0	1342.4	0.0	Still Water Level Flood, Pervious uplift
a	-268.7	0.0	346.9	0.0	1804.3	0.0	Still Water Level Flood, Impervious uplift
9	-331.0	0.0	353.2	0.0	2095.0	0.0	TOW Flood, Impervious uplift
7	-331.0	0.0	353.2	0.0	1937.1	0.0	TOW Flood, Pervious uplift

AECOM

-	Passaic River Flood Protection	Project No. 60442748	
Description	TYPICAL WEST OF KEARNY MONOLITH	Computed by RBJ	Checked by 0
	TOW EL. 18; TOS EL 6.0		
Soil &	Pile Information Required for CPGA	Date Jan-16	Date Jan-00
a		11	References

Pile Layout, SW-11:

Row	1		Row	2	
pile no.	×	y	pile no.	×	y y
1	2.25	-20.00	6	-2.25	-20.00
2	2,25	-10.00	7	-2.25	-10.00
3	2.25	0.00	8	-2.25	0.00
4	2.25	10.00	9	-2,25	10.00
5	2.25	20.00	10	-2.25	20.00

Tip Elevation: (For CPGA, need Tip Elevation as a function of CPGA Axis at B.O. Slab, +Z points downward)

4 NAVD88 B.O.S. Elevation = -45 NAVD89 Bedrock EL = "TIP" in CPGA = 61 ft

* Socketed 12' min into bedrock

Pile Properties & Attributes: (See hand calculations for micropiles)



1.2 (factor for method of axial load transfer from pile to soil; = 1 for full tip bearing, = 2 for full skin friction)

Allowable Compression (AC) =	160	kips
Allowable Tension (AT) =	100	kips
PO =	1597	kips
PT =	1010	kips
PB =	550	kips
MB =	2825	kip-in
MO =	2200	kip-in

Es Value for CPGA Run:



GROUP	FACTORS
Pile Spacing in Direction of Loading	From EM1110-2- 2906
	D
38	0.33
48 58 68	0.38
	0.45
	0.56
78	0.71
88	1

Group reduction is based on distance between piles in direction of loading. This includes distance due to battering and is taken over the distance 10*d_{pile} (point of fixety).

Assume a batter of 3	
B = d _{pile} = <mark>9.63</mark> in =	0.803 ft
Distance between piles at B.O. Slab =	4.50 ft
Average distance between piles over 10*dpile =	9.85 ft
Average distance between piles in terms of pile width B =	12.274 B
Group Reduction "D" value for this distance =	1
Therefore, Es including group reduction =	<u>0.0300 kci</u>

AECOM

USACE	Passaic River Flood Protection	Project No. 60442748						
Feasibi	ility Level Flood Protection							
tion	TYPICAL WEST OF KEARNY MONOLITH	Computed by	RBJ	Date	Jan-16			
	TOW EL. 18; TOS EL 6.0	_						
	CPGA Input & Output Files	Checked by	0	Date	Jan-00			
1	Feasib	TOW EL. 18; TOS EL 6.0	Typical West of Kearny Monolith Computed by TOW EL. 18; TOS EL 6.0 Total State	Feasibility Level Flood Protection TYPICAL WEST OF KEARNY MONOLITH Computed by RBJ TOW EL. 18; TOS EL 6.0	Feasibility Level Flood Protection tion TYPICAL WEST OF KEARNY MONOLITH Computed by RBJ Date TOW EL. 18; TOS EL 6.0 TOW EL 6.0 TOW EL. 18; TOS EL 6.0 TOW EL 6.0 TO			

×

TOM EL18, Micropile 5' O.C.

Input file:

100 WEST OF KEARNY, TOW EL18, FIX, 1:3 BATTER, MICROPILE, 5'OC 200 PROP 3605 1534 1534 181 1.2 0 ALL 300 SOIL ES 0.03 TIP 60 0 ALL 400 FIX ALL 500 TENSION 0.8 ALL 600 DLS R 160 100 1597 1010 550 2825 2200 H 15.18 ALL 700 FOVSTR 1.17 1.17 1 800 FOVSTR 1.33 1.33 2 6 7 1000 BATTER 3 ALL 1100 ANGLE 180 11 TO 20 1200 PILE 1 2.5 -22.5 0 1300 PILE 11 -2.5 -22.5 0 1400 ROW Y 10 1 9 AT 5 1500 ROW Y 10 11 9 AT 5 4500 LOAD 1 20 0 436.6 0 199 0 4600 LOAD 2 -37.5 0 337.5 0 517.5 0 4700 LOAD 3 -243.7 0 350.7 0 1478 0 4800 LOAD 4 -243.7 0 350.7 0 1341 0 4900 LOAD 5 -268.7 0 350.7 0 1803 0 5000 LOAD 6 -331 0 356.9 0 2094 0 5100 LOAD 7 -331 0 356.9 0 1936 0 6000 FOUT 1 2 3 4 5 6 7 EL18MP05.doc 6100 PFO ALL 6200 PLB ALL

RIVER FRONTING WALLS ALL-VERTICAL PILES

USACE Passaic River Flood Protection Feasibility Level Flood Protection

TYPICAL FRONTING MONOLITH TOW EL. 18; TOS EL 6.0

URS Project : 60442748

Monolith Foundations



1515 Poydras Street Suite 2700 New Orleans, LA 70112 (504) 586-8111

 Computed by:
 RBJ
 Checked by:

 Date:
 Jan-16
 Date:

AECOM	-				1 of 11
Job	USACE Passaic River Flood Protection	Project No.	60442748		
	Feasibility Level Flood Protection		ā		34
Description	TYPICAL FRONTING MONOLITH		KBJ		
1	Foundation Load Cases & Combinations	Checked by	0	Date	Jan-00
		1		Refe	References
LOAD CALCULATIONS	ATIONS	FLOOD SIDE		PROTECTED SIDE	Ш
TOW EL. 18; TOS EL 6.0	<u>.05 EL 6.0</u>	TOW EL xxx	x pl /	×	
Top of Wall EL.	18.0 NAVD88		₩	,	Z
Normal Water El.		SWL 🛛		\rightarrow	
Still Water El.	16.0 NAVD88		BAT		((
Top of Slab EL.	6.0 NAVD88		12		
뿟	15.0 ft.	_	_		
h1=	12.0 ft.	.u H			
h2=	36.0 in. (Base Slab Height)			GRADE	
h3=	12.0 in. (P.S. Soil Height)	SH	5	a VXX	
h4=	0.0 ft.	*			Δ
h5=	1.00 ft. (F.S. Soil Height, T.O. Slab)	2			
₿	9.0 ft. (Base Slab Width)	4		٢	
b1=	18.0 in. (Wall Stem Width, top)	/ 1/ on m	•		
b2=	66.0 in. (F.S. Slab Width)	p2 / 29	· - 1	/	
b3=	18.0 in. (Wall Stem Width, bottom)	2 / / pg	\	/	
b4=	24.0 in. (P.S. Slab Width)	J		2	
b5=	21.0 in. (F.S. Pile Row Edge Space)	K B/2	× ⁄	B/2	
b6=	54.0 in. (Sheet Pile Edge Space)	P2	* ⁸³ *	R R	
BAT=	0.0 (Wall Batter, N/A)	2	Ð	7	
PS Grade =	7.00 NAVD88 (Average of PS soil for all)	Ļ	T-WALL CROSS-SECTION		<u>Notes:</u> 1) positive 'Y' axis is into page 2) bile batters varv from those show
Monolith Length	50.0 ft	I			in diagram
Bottom Of Slab =	3.0 NAVD88				

Fronting T-Wall_TOW 18.xlsx

AECOM					2 01 1
	USACE Passaic River Flood Protection	Project No.	60442748		
	Feasibility Level Flood Protection				
Description T	TYPICAL FRONTING MONOLITH	Computed by	RBJ	Date	Jan-16
	TOW EL. 18; TOS EL 6.0				
	Foundation Load Cases & Combinations	Checked by	0	Date	Jan-00
					References
ASSUMED UNIT WEIGHTS:	T WEIGHTS:				
Unit Weight of Storm Water:	srm Water:				
62.4 pcf	ocf	Unbalanced Lo	Unbalanced Load for Stability Analysis:	y Analysis:	
Wet Unit Weight of Soil:	of Soil: Unit Weight of Riprap:	F _{cap} (k/ft) =	00.0	(Operation Cas	0.00 (Operation Case; Force acts at bottom of slab)
100 pcf		F _{cap} (k/ft) =	00.0	(Water to TO	0.00 (Water to TOW Case; Force acts at bottom of slab)
Sat Unit Weight of Soil:	f Soil:				
1 Ini+ Wainht of Concrete		Ko Clav fill =	0.80	0.80 (for lateral soil forces)	l forces)
150 pcf	ocf			EM 1110-2-250	EM 1110-2-2502: $P_{hz} = K_0 * (y * z_w + y' * (z - z_w))$
- PS design water e	- PS design water elevation <bos elevation,="" hy<="" no="" or="" ps="" td="" uplift=""><td>hydrostatic loads</td><td></td><td></td><td></td></bos>	hydrostatic loads			
FS W	FS Wind force above SWL= 50.0 psf		Wave	Wave Point Load =	0 kip/ft
Construction	Construction Surcharge Pressure = 250 psf	Dist fr	Dist from B.O. Slab to Wave Load =	Wave Load =	0 ft
	LOAD CASES ANALYZED:	FS Water EI.	PS Water El.	Overstress for Design	Notes
1	Construction	3.0	3.0	1.17	Temporary Construction Case
2	Construction + Wind on F.S.	3.0	3.0	1.33	Unusual Construction Case
e e	Water to SWL, Impervious	16.0	6.0	1.00	Still Water Level Flood, Impervious uplift
4	Water to SWL, Pervious	16.0	6.0	1.00	Still Water Level Flood, Pervious uplift
5	Water to SWL + Debris Load, Impervious	16.0	6.0	1.00	Still Water Level Flood, Impervious uplift
9	Water to T.O. Wall, Impervious	18.0	6.0	1.33	TOW Flood, Impervious uplift
~ ~	Water to T.O. Wall, Pervious	18.0	6.0	1.33	TOW Flood, Pervious uplift

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60442748		RBJ		0	
Project No. 60442748		Computed by RBJ		Checked by	
g		1	1	ons	
JSACE Passaic River Flood Protection	Feasibility Level Flood Protection	YPICAL FRONTING MONOLITH	S EL 6.0	Foundation Load Cases & Combinations	
USACE Passaic	Feasibility Level	TYPICAL FRONT	TOW EL. 18; TOS EL 6.0	Foundation Load	
Job		Description			

Jan-00 References

Date

Jan-16

Date

All forces on this page are per foot of monolith length

h		_	-		_
	PS Soil Lateral	Force (k/ft)	0.6400	0.6400	0.6400
FS Soil	Lateral	Force (k/ft)	-0.2406	-0.2406	-0.2406
		Wt. of PS Soil (k/ft) Force (k/ft) Force (k/ft)	0.200	0.200	0.200
	Wt. of FS Soil	(k/f†)	0.2068	0.2068	0.2068
		FS Soil EL. PS Soil EL.	7.00	7.00	7.00
		FS Soil EL.	7.00	7.00	7.00
Soil Forces:		Nater EL.	7.0	16.0	18.0

Water Forces:

	Wt. of FS	FS Water
	Water	Lateral Force
Water EL.	(k/ft)	(k/ft)
7.0	0.3432	-0.499
16.0	3.432	-5.273
18.0	4.1184	-7.020

50 psf * monolith height / 1000 = Wind Force:

-0.75 k/ft

<u> MDE Earthquake Force:</u>		Vertical (k-ft)	Lateral (k-ft)	
	Soil		0.116	Z-coord = -2.6
	Concrete	0.270	0.844	Z-coord = -4.5(

F.S. = 250 psf * F.S. width / 1000 = P.S. = 250 psf * P.S. width / 1000 = Surcharge Forces:

1.375 k/ft

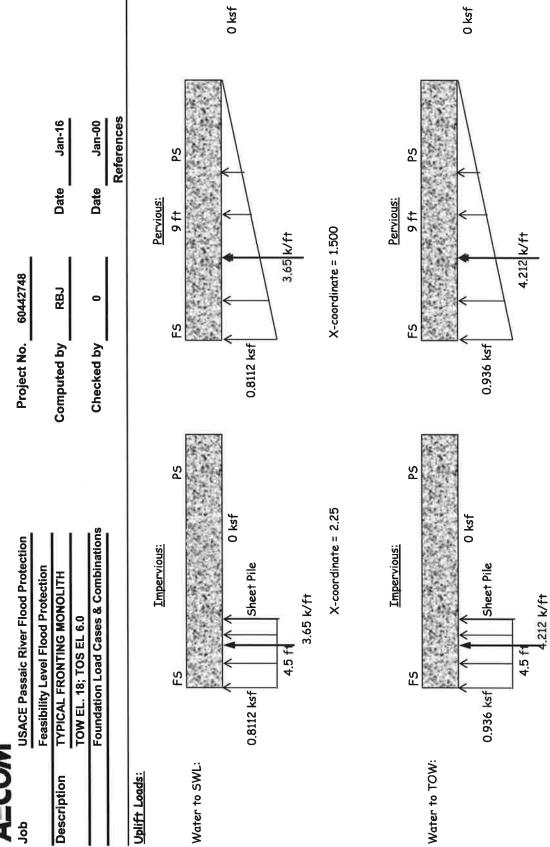
X-coord = -0.700 20

67

Fronting T-Wall_TOW 18.xlsx

0.000 k/ft in (+) X Direction, acting at bottom of slab (Z-coordinate = 0) 0.000 k/ft in (+) X Direction, acting at bottom of slab (Z-coordinate = 0) 0.5 k/ft TOW: Operating: Unbalanced Load:





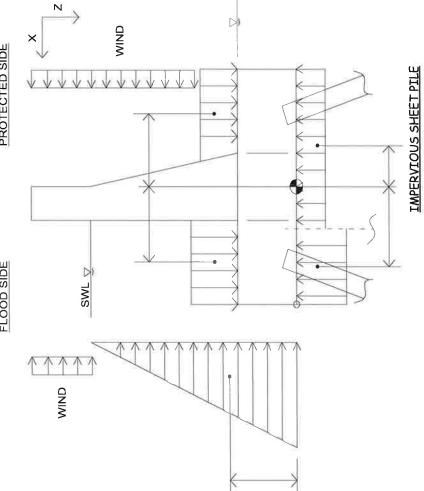
Fronting T-Wall_TOW 18.xlsx

X-coordinate = 1.500

X-coordinate = 2.25



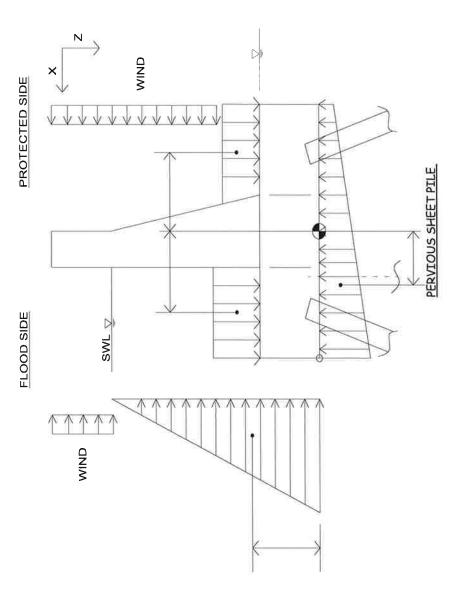
		Date Jan-16		Date Jan-00	References		
Project No. 60442748		by RBJ		by 0			PROTECTED SIDE
Project		Computed by		Checked by		SNC	FLOOD SIDE
USACE Passaic River Flood Protection	Feasibility Level Flood Protection	TYPICAL FRONTING MONOLITH	TOW EL. 18; TOS EL 6.0	Foundation Load Cases & Combinations		MS FOR IMPERVIOUS SHEET FILE CONDITIONS	ELO
Job		Description				LOAD DIAGRAMS FOR IN	





Project No. 60442748		Computed by RBJ Date Jan-16		Checked by 0 Date Jan-00	Rafarancas
USACE Passaic River Flood Protection	Feasibility Level Flood Protection	TYPICAL FRONTING MONOLITH	TOW EL. 18; TOS EL 6.0	Foundation Load Cases & Combinations	
dot	16	Description			

LOAD DIAGRAMS FOR PERVIOUS SHEET PILE CONDITIONS



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USACE Passaic River Flood Protection Feasibility Level Flood Protection TYPICAL FRONTING MONOLITH TOW EL. 18; TOS EL 6.0 Description

Foundation Load Cases & Combinations

RBJ Computed by

Project No. 60442748

Jan-16

Date 0 Checked by

Jan-00 ļ Date

References

EXTERNAL FORCES & MOMENTS ABOUT ORLETINGTHEXTERNAL FORCES & MOMENTS ABOUT ORLETINGTHFxFzX' CentroidWMMNOTES:(kip/ft)(kip/ft)(ft)(ft)(ft)(kip-ft/ft)(kip-ft/ft)(kip-ft/ft)(kip/ft)2.70 -1.75 0.00Y' CentroidX'4.73MMOTES:(kip/ft)(kip/ft)(kip-ft/ft)(kip-ft/ft)(kip-ft/ft)(kip-ft/ft)(kip-ft/ft)(kip/ft)0.00 -1.75 0.000.000.00DDase slab weight(n)0.20 -3.50 0.000.130.000.70DDase slab weight(n)0.200.20 -3.50 0.000.13DDDDD(n)0.200.200.200.200.20DDDDDD(n)0.211.750.200.230.000.23DDD					LC 1: Construction, 1.17 allowable overstress	on, 1.17 allowa	ble overstress			
Fx Fz Y. Centroid Y' Centroid Y' Centroid W My Mz (kip/ti) (kip/ti) (fi) (fi) (fi) (fi) ($kip-ft/ft$)				EXTERNAL FO	RCES & MOMENTS .	ABOUT ORIGI	N PER FOOT C	OF WALL LEN	GTH	
(kip/ft)(kip/ft)(ft)(ft)(kip-ft/ft)(kip-ft/ft)(kip-ft/ft)(kip-ft/ft) 2.70 -1.75 -1.75 0.00 4.73 4.73 7.74 7.74 $7.$		F	Fz	'X' Centroid	'Y' Centroid	'Z' Centroid	M×	My	Mz	NOTES:
1 2.70 -1.75 4.73 4.73 1 4.05 0.00 -1.75 0.00 0.00 1 1 4.05 0.00 -3.50 0.00 0.00 1 0 1 0.20 -3.50 0.00 1.33 0.07 0.07 1 1 0.21 1.75 0.13 0.13 0.05 1 1 1 0.24 1.75 1.75 0.00 1.33 0.32 1 1 1 0.02 1.75 0.00 1.33 0.00 4.53 0.00 1 1 0.00 1.33 0.00 4.53 0.00 1 1 1 0.138 1.75 1.15 0.00 4.53 0.00 1 <td></td> <td>(kip/ft)</td> <td>(kip/ft)</td> <td>(tt)</td> <td>(tt)</td> <td>(tt)</td> <td>(kip-ft/ft)</td> <td>(kip-ft/ft)</td> <td>(kip-f1/f1)</td> <td></td>		(kip/ft)	(kip/ft)	(tt)	(tt)	(tt)	(kip-ft/ft)	(kip-ft/ft)	(kip-f1/f1)	
1 4.05 0.00 0.00 0 0.20 3.50 0.70 0.70 1 0 0.64			2.70	-1.75				4.73		wall stem weight
1 0.20 -3.50 -3.50 -1.33 0.70 0.70 1 1 0.64 1 1 1.33 1.33 1.085 1 1 1 0.64 1.75 1.75 1.133 1.085 1.085 1 1 1 -0.24 1.75 1.75 1.133 0.32 1 1 1 1 -0.24 1.75 1.133 1.133 0.32 1 1 1 1 0.00 1.16 1.133 0.00 1.33 0.32 1 1 1 0.40 7.16 1.133 0.00 4.53 0.00 1 1 1 0.40 1.38 1.75 1.76 1.75 1.00 1			4.05	00.0				0.00		base slab weight
0.64 -1.35 -1.33 -0.85			0.20	-3.50				0.70		P.S. soil weight
1 0.21 1.75 <td></td> <td>0.64</td> <td></td> <td></td> <td></td> <td>-1.33</td> <td></td> <td>-0.85</td> <td></td> <td>P.S. lateral soil force</td>		0.64				-1.33		-0.85		P.S. lateral soil force
-0.24 -0.24 -1.33 -1.33 0.32 -1.33 0.00 0.00 0.00 0.00 0.00 0.00 1 0.40 7.16 0.00 0.00 4.53 0.00 1 0.40 1.38 1.75 0.00 4.53 0.00 1 1 1.38 1.75 0.00 1.51 1.75 1 1 0 0.50 -3.50 0.50 3.87 0.00 1 1 0.40 9.03 0.00 3.87 0.00 1 1 1			0.21	1.75				-0.36		F.S. soil weight
0.00 1.16 0.00 0.00 4.53 0.00 1 0.40 7.16 1.75 1.75 1.75 1.75 0.00 4.53 0.00 1 1 1.38 1.75		-0.24				-1.33		0.32		F.S. lateral soil force
0.40 7.16		0.00				0.00		0.00		Unbalanced load, no water
1 1.38 1.75 -2.41 -3.41 0 0.50 -3.50 -3.50 1.75 1.75 0.40 9.03 0.00 3.87 0.00	ibtotal A	0.40	7.16				00:0	4.53	0:00	Dry Soil Weight Subtotal
0.50 -3.50 -3.50 1.75 0.40 9.03 0.00 3.87 0.00			1.38	1.75				-2.41		F.S. Equipment Surcharge
0.40 9.03 0.00 3.87 0.00			0.50	-3.50				1.75		P.S. Equipment Surcharge
	SUM:	0.40	9.03				0.00	3.87	0.00	LC 1 CPGA Forces

		NOTES:		wall stem weight	base slab weight	FS Wind Load	LC 2 CPGA Forces
	бТН	Mz	(kip-f1/f1)	0		0	0.00
erstress	JF WALL LEN	My	(kip-ft/ft) (kip-ft/ft) (kip-ft/ft)	4.73	0.00	5.63	10.35
33 allowable ov	IN PER FOOT C	M×	(kip-ft/ft)			0	0.00
d on F.S., 1.3	ABOUT ORIGI	'Z' Centroid	(ft)			-7.50	
LC 2: Construction + Wind on F.S., 1.33 allowable overstress	DRCES & MOMENTS ABOUT ORIGIN PER FOOT OF WALL LENGTH	'Y' Centroid	(tt)	0			
FC 2:	EXTERNAL FOR	'X' Centroid	(1 1)	-1.75	0		
		Fz	(kip/ft)	2.70	4.050		6.75
		Fx	(kip/ft)			-0.75	-0.75
							SUM:

 Job
 USACE Passaic River Flood Protection

 Feasibility Level Flood Protection

 Description

 TYPICAL FRONTING MONOLITH

 TOW EL. 18; TOS EL 6.0

Foundation Load Cases & Combinations

Project No. 60442748

Computed by RBJ

RBJ Date Jan-16

Checked by 0

Date Jan-00 References

			LC.	LC 3: Water to SWL, Impervious, 1.0 allowable overstress	mpervious, 1.0) allowable ove	rstress		
			EXTERNAL FORCE	DRCES & MOMENTS ABOUT ORIGIN PER FOOT OF WALL LENGTH	ABOUT ORIGI	N PER FOOT C	DF WALL LEN	GTH	
	ž	Fz	'X' Centroid	'Y' Centroid	'Z' Centroid	W×	My	Wz	NOTES:
	(kip/ft)	(kip/ft)	(t+)	(+1)	(ft)	(kip-ft/ft)	(kip-ft/ft)	(kip-f1/f1)	
		2.70	-1.75				4.73		wall stem weight
		4.05	0.00				00.0		base slab weight
		0.20	-3.50				0.70		P.S. soil weight
	0.64				-1.33		-0.85		P.S. lateral soil force
		0.21	1.75				-0.36		F.S. soil weight, saturated
	-0.24				-1.33		0.32		F.S. lateral soil force, saturated
	-5.27				-4.33		22.85		Lateral water force
		3.43	1.75				-6.01		Vertical water force
	0.00				0		00.00		Unbalanced load, water TOW
Subtotal B	-4.87	10.59				0.00	21.37	0:00	SWL Subtotal
		-3.65	2.25				8.21		Impervious FS hydrostatic uplift
		0.00					0.00		Impervious PS hydrostatic uplift
SUM:	-4.87	6.94				0.00	29.59	0.00	LC 3 CPGA Forces

		NOTES:		SWL Subtotal	Pervious hydrostatic uplift	LC 4 CPGA Forces												
	бТН	Mz	(kip-f1/f1)	0.00		26.85 0.00												
ress	F WALL LEN	My	(kip-ft/ft)	21.37	5.48	26.85												
illowable overst	ABOUT ORIGIN PER FOOT OF	S ABOUT ORIGIN PER FOOT OF W	S ABOUT ORIGIN PER FOOT OF W	ABOUT ORIGIN PER FOOT OF	ABOUT ORIGIN PER FOOT OF	S ABOUT ORIGIN PER FOOT O	S ABOUT ORIGIN PER FOOT O	ABOUT ORIGIN PER FOOT (ABOUT ORIGIN PER FOOT OF	S ABOUT ORIGIN PER FOOT OF	'S ABOUT ORIGIN PER FOOT OF V	S ABOUT ORIGIN PER FOOT OF W	EXTERNAL FORCES & MOMENTS ABOUT ORIGIN PER FOOT OF WALL LENGTH	W×	(kip-f1/f1) (kip-f1/f1) (kip-f1/f1)	0.00		0.00
LC 4: Water to SWL, Pervious, 1 allowable overstress														'Z' Centroid	(ft)			
	DRCES & MOMENTS /	'Y' Centroid 'Z' Centroid	(+1)															
	EXTERNAL FO	'X' Centroid	(1 1)		1.500													
		Fz	(kip/ft)	10.59	-3.65	6.94												
		Ŀ,	(kip/ft)	-4.87		-4.87												
				Subtotal B		SUM:												

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			PC 6: N	LC 6: Water to T.O. Wall, Impervious, 1.33 allowable overstress	Impervious, 1	l.33 allowable	overstress		
			EXTERNAL	AL FORCES & MOMENTS ABOUT ORIGIN PER FT. OF WALL	ENTS ABOUT (DRIGIN PER F	T. OF WALL		
s NO.	Fx	Fz	'X' Centroid	'Y' Centroid	'Z' Centroid	M×	My	Wz	NOTES:
	(kip/ft)	(kip/ft)	(1 1)	(ft)	(t+)	(kip-ft/ft)	(kip-ft/ft)	(kip-ft/ft)	
		2.70	-1.75				4.73		wall stem weight
		4.05	0.00				0.00		base slab weight
		0.20	-3.50				0.70		P.S. soil weight
	0.64				-1.33		-0.85		P.S. lateral soil force
		0.21	1.75				-0.36		F.S. soil weight, saturated
	-0.24				-1.33		0.32		F.S. lateral soil force, saturated
	-7.02				-5.00		35.10		Lateral water force
		4.12	1.75				-7.21		Vertical water force
	0.00				0		0.00		Unbalanced load, water TOW
Subtotal B	-6.62	11.28				0.00	32.42	0:00	TOW Subtotal
		-4.21	2.25				9.48		Impervious FS hydrostatic uplift
		00.0					0.00		Impervious PS hydrostatic uplift
SUM:	-6.62	7.06				0.00	41.90	0.00	LC 6 CPGA Forces

			NOTES:		SWL Subtotal	Impervious FS hydrostatic uplift	Impervious PS hydrostatic uplift	Debris Load	LC 5 CPGA Forces	
References	S		Mz	(kip-ft/ft)	0.00				0.0	
	ible overstre:	L. OF WALL	My	(kip-ft/ft) (kip-ft/ft) (kip-ft/ft)	21.37	8.21	0.00	6.50	36.09	
	ous, 1.0 allowe	DRIGIN PER F	M×	(kip-ft/ft)	0.00				0.00	
	Load, Impervi	NTS ABOUT ('Z' Centroid	(ft)				-13.00		
	er to SWL + Debris Load, Impervious, 1.0 allowable overstress	EXTERNAL FORCES & MOMENTS ABOUT ORIGIN PER FT. OF WALL	'Y' Centroid	(ft)						
	LC 5: Water	EXTERN	'X' Centroid	(ft)		2.25				
			Fz	(kip/ft)	10.59	-3.65	0.00		6.94	
			Fx	(kip/ft)	-4.87			-0.50	-5.37	
					Subtotal B				SUM:	

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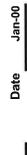
USACE Passaic River Flood Protection Feasibility Level Flood Protection











Foundation Load Cases & Combinations

TYPICAL FRONTING MONOLITH TOW EL. 18; TOS EL 6.0

Description

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		Date Jan-16		Date Jan-00	References
Project No. 60442748		Computed by RBJ		Checked by 0	
USACE Passaic River Flood Protection	Feasibility Level Flood Protection	TYPICAL FRONTING MONOLITH	TOW EL. 18; TOS EL 6.0	Foundation Load Cases & Combinations	
Job		Description			

			IC 2:	LC 7: Water to T.O. Wall, Pervious, 1.33 allowable overstress	, Pervious, 1.	33 allowable o	/erstress		
			EXTERNAL	VAL FORCES & MOMENTS ABOUT ORIGIN PER FT. OF WALL	NTS ABOUT (DRIGIN PER FI	C. OF WALL		
S NO.	Fx	Fz	'X' Centroid	'Y' Centroid	'Z' Centroid	WX	My	Wz	NOTES:
	(kip/ft)	(kip/ft)	(++)	(1 1)	(tt)	(kip-f1/f1) (kip-f1/f1) (kip-f1/f1)	(kip-ft/ft)	(kip-ft/ft)	
Subtotal B	-6.62	11.28				00.0	32.42	00:0	TOW Subtotal
		-4.21	1.500				6.32		Pervious hydrostatic uplift
SUM:	-6.62	7.06				0.00	38.74	0.00	LC 7 CPGA Forces

AFCOM

		Date Jan-16		Date Jan-00	References
Project No. 60442748		Computed by RBJ		Checked by 0	
USACE Passaic River Flood Protection	Feasibility Level Flood Protection	TYPICAL FRONTING MONOLITH	TOW EL. 18; TOS EL 6.0	Foundation Load Cases & Combinations	
Job		Description			

Summary of Forces and Moments (For Full Length of Monolith):

LOAD CASE NUMBER	Fx	Fγ	Fz	WX	My	Wz	
	kips	kips	kips	(kip-ft)	(kip-ft)	(kip-ft)	
1	20.0	0.0	451.6	0.0	193.7	0.0	Temporary Construction Case
2	-37.5	0.0	337.5	0.0	517.5	0:0	Unusual Construction Case
m	-243.7	0.0	346.9	0.0	1479.3	0.0	Still Water Level Flood, Impervious uplift
4	-243.7	0.0	346.9	0.0	1342.4	0.0	Still Water Level Flood, Pervious uplift
a	-268.7	0.0	346.9	0.0	1804.3	0.0	Still Water Level Flood, Impervious uplift
Ŷ	-331.0	0.0	353.2	0.0	2095.0	0.0	TOW Flood, Impervious uplift
7	-331.0	0.0	353.2	0.0	1937.1	0.0	TOW Flood, Pervious uplift



USACE Passaic River Flood Protection

Feasib	ility Level Flood Protection				
Description	TYPICAL WEST OF KEARNY MONOLITH	Computed by	RBJ	Date	Jan-16
	TOW EL. 18; TOS EL 6.0			3) <u> </u>	
	CPGA Input & Output Files	Checked by	0	Date	Jan-00
		Checked by	0		Date

Project No. 60442748

TOM EL18, HP14x89 5' O.C. CERTICAL PILES

Input file:

100 FROPNTING WALL, 50' MONOLITH TOW EL18-110 H-PILE, 5'OC, VERTICAL FS & PS 200 PROP 29000 326 905 26.1 1 0 ALL 300 SOIL ES 0.11 TIP 60 0 ALL 400 FIX ALL 500 TENSION 0.8 ALL 600 ALLOW H 200 60 653 607 1108 3275 ALL 700 FOVSTR 1.17 1.17 1 800 FOVSTR 1.33 1.33 2 6 7 1200 PILE 1 3 -22.5 0 1300 PILE 11 -3 -22.5 0 1400 ROW Y 10 1 9 AT 5 1500 ROW Y 10 11 9 AT 5 4500 LOAD 1 20 0 436.6 0 199 0 4600 LOAD 2 -37.5 0 337.5 0 517.5 0 4700 LOAD 3 -243.7 0 350.7 0 1478 4800 LOAD 4 -243.7 0 350.7 0 1341 0 4900 LOAD 5 -268.7 0 350.7 0 1803 0 5000 LOAD 6 -331 0 356.9 0 2094 0 5100 LOAD 7 -331 0 356.9 0 1936 0 6000 FOUT 1 2 3 4 5 6 7 FWHP.doc 6100 PFO ALL 6200 PLB ALL 6200 PLB ALL