1. CALL TO ORDER

2. ANNOUNCEMENTS & CORRESPONDENCE

- Applicants are requested to remove all signs after the hearing has concluded and dispose of them.

3. ZONING HEARING BOARD APPLICATIONS

- **ZHB#2020-01:** William and Colleen Ward, 3181 Mayflower Road, Plymouth Meeting, PA; Parcel #65-00-07738-00-9; Block 029A; Unit 059; A-Residential District. The Applicants are proposing to reconstruct an enclosed porch to improve structural integrity and add heat and air conditioning. The following relief is requested: Variance from Section 116-202.B. to allow less than the required 35’ aggregate side yard; 26’-9” is proposed. Original variances were granted for an unenclosed porch (with different side yard requirements). The side yard setback is regulated by this section of the Zoning Ordinance because this house was built prior to June 23, 1966 (it was originally built in 1950).

- **ZHB#2020-02:** Edward A. Gross IV and Shannon D. Gross, 4023 Fairway Road, Lafayette Hill, PA; Parcel #65-00-03487-00-3; Block 043D; Unit 026; A-Residential District. The Applicants are proposing to construct an addition with a 2-car garage and master suite above. The following relief is requested: Variance from Section 116-169.A. which allows a maximum of 18% impervious ground cover based on the Property’s location in the A-Residential District and having a steep slope ratio between 15% to 50% (this property has a steep slope ratio of 34%). An impervious ground cover of 34.6% is proposed; and a Variance from Section 116-194.A. to allow an increase in nonconforming impervious ground cover of 29.9% (to the proposed 34.6%). This section permits expansions/alterations as long as existing nonconformities are not increased.

- **ZHB#2020-03:** Duane and Bernadette McCarthy, 4024 Fairway Road, Lafayette Hill, PA; Parcel #65-00-03418-00-9; Block 043D; Unit 034; A-Residential District. The Applicants are proposing to remove an existing covered porch and crumbling foundation and replace with a new enclosed space to occupy an expanded kitchen. The following relief is requested: Variance from Section 116-202.B. to allow less than the 12’ minimum/35’ required aggregate side yard; 4’ minimum/25’ aggregate side yard is proposed. The side yard setback is regulated by this section of the Zoning Ordinance because this house was built prior to June 23, 1966 (it was originally built in 1954).

- **ZHB#2020-04:** Whitemarsh Valley Country Club, 815 Thomas Road, Lafayette Hill, PA; Parcel #65-00-1168-00-9; Block 023; Unit 002; AAA-Residential District; Recreational District Overlay. The applicant is proposing to build two replacement golf cart/pedestrian bridges in the floodplain and floodway of the Wissahickon Creek, one of which was destroyed in a storm and the other which is in deteriorated condition. The following is being requested: Variance from Section 116-165.B.(2) for structures other than the bridges (e.g., cart path, abutments, wingwalls, piers, etc.) which are not included as permitted uses as part of a recreational use in the Floodplain Conservation Overlay District; Special Exception from Section 116-166.A.(2). Bridges are permitted in a floodway by Special Exception provided that they are in compliance with provisions of the underlying districts, they cause no increase in flood heights or velocities; and are not prohibited by any other ordinance; Variance from Section 116-264.A. is sought to not reestablish forest cover and woodland habitat as none exists now and the Creek is flanked by golf course. Introducing this vegetation would restrict the play of golf; and a Variance from Section 116-265.C. is sought to permit crossings at a distance with less than 1,000 feet of buffer length. Existing bridges do not have such separation and are being replaced in the same location. Bridge separation is approximately 400 feet.

4. ADJOURNMENT
ZHB APPEAL #2020-01
SUMMARY

APPLICANTS: William and Colleen Ward

PROPERTY LOCATION: Parcel #65-00-07738-00-9
Block 029A, Unit 059
3181 Mayflower Road
Plymouth Meeting, PA 19462

ZONING DISTRICT: A-Residential District

SUMMARY OF RELIEF REQUEST:

The Applicants are proposing to reconstruct an enclosed porch to improve structural integrity and add heat and air conditioning. The following relief is requested:

1. **Variance from Section 116-202.B.** to allow less than the required 35’ aggregate side yard; 26’-9” is proposed. Original variances were granted for an unenclosed porch (with different side yard requirements). The side yard setback is regulated by this section of the Zoning Ordinance because this house was built prior to June 23, 1966 (it was originally built in 1950).

PRIOR DECISIONS:
ZHB#1956-27 Variance / Side Yard / Garage
ZHB#1953-33 Variance / Side Yard / Patio & Porch

Respectfully Submitted,

Charles L. Guttenplan, AICP
Director of Planning and Zoning/Zoning Officer
APPEAL TO ZONING HEARING BOARD
WHITEMARSH TOWNSHIP
COMMONWEALTH OF PENNSYLVANIA

APPEAL NO: 2820-01

Applicant/Appellant: Colleen and William Ward
Address: 3131 Mayflower Road

Owner: William Ward
Address: Same

Location of the Property Involved:
Block #: 629-A Unit #: 059 Parcel #: 650007738009

NATURE OF APPLICATION (Describe proposed use and/or construction: type of appeal requested and specific section(s) of Whitemarsh Township Zoning Code which is (are) relied upon):
Variance from section 116-202b for less than 35' aggregate

GROUND FOR APPEAL (State reasons for appeal and nature of hardship, if claimed):
**Attach additional sheets if necessary
Improved structural integrity with heat and air conditioning

Legal Counsel (if represented):
Address: 
Phone #: E-Mail: 

My (Our) signature(s) authorize(s) permission to pose my (our) property and permission to the Zoning Hearing Board and their representative to enter thereon for inspection purposes.

I (We) certify the information provided on this application and supporting documentation and plans are true and correct to the best of my (our) knowledge, information, and belief. You are required to submit proof that you are one of the following:

[☑] Owner(s) of Legal Title
[☑] Owner(s) of Equitable Title
[ ] Tenant(s) with permission of Owner(s) of Title
(Enclose letter attesting to same)

Signature of Applicant/Appellant:)

Signature of Applicant/Appellant:
Existing 2x6 Rafter Hip Roof

(2) 2x8 Beam with 2' Ply

(2) 2x4 Studs

30wx5lxH window
30wx5lxH window
30wx5lxH window
30wx5lxH window
30wx5lxH window

93" x 17'2"

6" existing concrete Pad

5"

2x4 Purlin
Whitemarsh Township Zoning Board
RE: Variance for 3181 Mayflower Road
January 21, 2020

To Whom it may concern,

I have shared a driveway with the Ward family for the past 22 years. It is my understanding that they wish to redo the existing porch and encorporate it as a formal structure to be part of their home.

I have no concerns as the new structure will occupy the same footprint as the existing structure.

Sincerely,

Florence J. Peterson
3179 Mayflower Road
Plymouth Meeting PA 19462
May 4, 1956

Mr. Lawrence K. Thomas
3181 Mayflower Road
Plymouth Meeting, Pa.

Dear Mr. Thomas:

Your petition before the Whitemarsh Zoning Board of Adjustment is hereby granted.

Before construction can begin, it will be necessary for you to secure a building permit from this office.

Very truly yours,

MICHAEL J. LAPUTKA
Secretary
Zoning Board of Adjustment
Whitemarsh Township

M.JL/ag
NOTICE OF PUBLIC HEARING


A hearing will be held on the application of LAURENCE K. THOMAS

JOSHUA ROAD AND FIRST AVENUE
at the Township Building, Ridge Pike and Crescent Avenue; on
WEDNESDAY, MAY 2, 1956 at 8:00 p.m.

The property involved is 3161 MAYFLOWER ROAD, PLYMOUTH MEETING

The applicant requests PERMISSION TO ERECT A GARAGE WITH LESSER SIDE YARD THAN MINDING REQUIREMENTS

All interested persons may appear at such hearing.

By Order of Zoning Board of Adjustment,

October 2, 1953

Mr. Lawrence K. Thomas
3181 Mayflower Road
Plymouth Meeting, Pa.

Dear Mr. Thomas:

Your petition before the Whitemarsh Township Zoning Board of Adjustment is hereby granted.

Before construction can begin it will be necessary for you to secure a building permit from this office.

Very truly yours,

MICHAEL J. LAPUTKA
Secretary Treasurer
NOTICE OF
PUBLIC HEARING

Before Zoning Board of Adjustment

A hearing will be held on the application of LAWRENCE K. THOMAS

at the Township Building, Ridge Pike and Crescent Avenue, on MONDAY
SEPTEMBER 28, 1953 AT 8:00 P.M.

The property involved is 3181 MAYFLOWER ROAD, PLYMOUTH MEETING, PA.

The applicant requests TO BUILD PATIO AND PORCH WITH LESSER SIDE YARD THAN
MINIMUM REQUIREMENTS UNDER THE ZONING ORDINANCE

All interested persons may appear at such hearing.

By Order of Zoning Board of Adjustment,
APPLICANTS: Edward A. Gross IV and Shannon D. Gross

PROPERTY LOCATION: Parcel #65-00-03487-00-3
Block 043D, Unit 026
4023 Fairway Road
Lafayette Hill, PA 19444

ZONING DISTRICT: A-Residential District

SUMMARY OF RELIEF REQUEST:

The Applicants are proposing to construct an addition with a 2-car garage and master suite above. The following relief is requested:

1. **Variance from Section 116-169.A.** which allows a maximum of 18% impervious ground cover based on the Property’s location in the A-Residential District and having a steep slope ratio between 15% to 50% (this property has a steep slope ratio of 34%). An impervious ground cover of 34.6% is proposed.

2. **Variance from Section 116-194.A.** to allow an increase in nonconforming impervious ground cover of 29.9% (to the proposed 34.6%). This section permits expansions/alterations as long as existing nonconformities are not increased.

PRIOR DECISIONS:
NONE

Respectfully Submitted,

[Signature]
Charles L. Guttenplan, AICP
Director of Planning and Zoning/Zoning Officer
APPEAL TO ZONING HEARING BOARD
WHITEMARSH TOWNSHIP
COMMONWEALTH OF PENNSYLVANIA

APPEAL NO: 2020-02

Applicant/Appellant: Edward and Shannon Gross
Address: 4023 Fairway Road, Lafayette Hill, PA 19444
Phone #: Cell Number: E-Mail: 

Owner: Edward and Shannon Gross
Address: 4023 Fairway Road, Lafayette Hill, PA 19444
Phone #: Cell Number: E-Mail: 

Location of the Property Involved: 4023 Fairway Road, Lafayette Hill, PA 19444
Block #: 0430 Unit #: 020 Parcel #: 05-00-03487-00-3

NATURE OF APPLICATION (Describe proposed use and/or construction: type of appeal requested and specific section(s) of Whitemarsh Township Zoning Code which is (are) relied upon):
Two car garage and master suite

GROUNDs FOR APPEAL (State reasons for appeal and nature of hardship, if claimed):
**Attach additional sheets if necessary

Due to our steep slope ratio, we are asking for a variance for our already, non-conforming impervious coverage. Also, we are claiming a hardship due to space, as our family continues to grow and we need a little more room.

Legal Counsel (if represented): N/A
Address: Phone #: E-Mail: 

My (Our) signature(s) authorize(s) permission to pose my (our) property and permission to the Zoning Hearing Board and their representative to enter thereon for inspection purposes.

I (We) certify the information provided on this application and supporting documentation and plans are true and correct to the best of my (our) knowledge, information, and belief. You are required to submit proof that you are one of the following:

☒ Owner(s) of Legal Title
☐ Owner(s) of Equitable Title
☐ Tenant(s) with permission of Owner(s) of Title
(Enclose letter attesting to same)

Signature of Applicant/Appellant:

Signature of Applicant/Appellant:

RECEIVED

JAN 2, 2020

WHITEMARSH TOWNSHIP
ZONING & ENGINEERING

Date: 1/14/2020
**116-169 STEEP SLOPE OVERLAY**

**2 FOOT CONTOURS**

**116-169A (STEEP SLOPES TABLE)**

## Maximum Impervious Ground Cover (per lot)

### Steep Slope Ratio

<table>
<thead>
<tr>
<th>District</th>
<th>15% to 50%</th>
<th>50% to 75%</th>
<th>75% or More</th>
</tr>
</thead>
<tbody>
<tr>
<td>AAAA</td>
<td>0.08</td>
<td>0.07</td>
<td>0.06</td>
</tr>
<tr>
<td>AAA</td>
<td>0.09</td>
<td>0.09</td>
<td>0.08</td>
</tr>
<tr>
<td>AA</td>
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<td>0.11</td>
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<tr>
<td>A</td>
<td>0.18</td>
<td>0.17</td>
<td>0.16</td>
</tr>
<tr>
<td>B</td>
<td>0.24</td>
<td>0.22</td>
<td>0.19</td>
</tr>
</tbody>
</table>

**ZONING DISTRICT:** A

**LOT AREA:** 10,500 SF

**AREA WITH SLOPES > 8%:** 3,536 SF

**STEEP SLOPE RATIO:** (PERCENT OF SLOPES > 8%) 34%

**MAXIMUM IMPERVIOUS GROUND COVER REQUIREMENT FROM TABLE 116-169A:** 18%

**PROPERTY ADDRESS:**

4023 FAIRWAY ROAD
LAFAYETTE HILL, PA 19444

**NOTE:**

DEPICTION OF EXISTING FEATURES BASED ON INFORMATION GATHERED FROM TAX MAPS, AERIAL PHOTOGRAPHY, AND FIELD INSPECTIONS. NO TOPOGRAPHIC OR BOUNDARY SURVEY WAS PERFORMED AS PART OF THIS PROJECT.
ZONING CODE
WHITE MARSH TOWNSHIP ZONING CODE

ZONING REQUIREMENTS AND ANALYSIS

<table>
<thead>
<tr>
<th>Topic</th>
<th>Code Requirement</th>
<th>Existing</th>
<th>Proposed</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zoning Classification</td>
<td>A</td>
<td>A</td>
<td>NO CHANGE</td>
<td></td>
</tr>
<tr>
<td>Permitted Use</td>
<td>Single Family Dwelling</td>
<td>Single Family Dwelling</td>
<td>NO CHANGE</td>
<td></td>
</tr>
<tr>
<td>Permitted Building Type</td>
<td>Detached</td>
<td>Detached</td>
<td>NO CHANGE</td>
<td></td>
</tr>
<tr>
<td>Minimum Lot Area</td>
<td>15,000 Sq.</td>
<td>15,000 Sq.</td>
<td>NO CHANGE</td>
<td></td>
</tr>
<tr>
<td>Minimum Lot Width</td>
<td>100'-0&quot;</td>
<td>100'-0&quot;</td>
<td>NO CHANGE</td>
<td></td>
</tr>
<tr>
<td>Minimum Front Yard Setback</td>
<td>40'-0&quot;</td>
<td>40'-0&quot;</td>
<td>NO CHANGE</td>
<td></td>
</tr>
<tr>
<td>Minimum Side Yard Setback</td>
<td>12'-0&quot; + 10'-0&quot;</td>
<td>10'-11&quot;</td>
<td>NO CHANGE</td>
<td></td>
</tr>
<tr>
<td>Minimum Rear Yard Setback</td>
<td>30'-0&quot;</td>
<td>28'-10&quot;</td>
<td>NO CHANGE</td>
<td></td>
</tr>
<tr>
<td>Maximum Building Height</td>
<td>30'-0&quot;</td>
<td>28'-10&quot;</td>
<td>NO CHANGE</td>
<td></td>
</tr>
<tr>
<td>Maximum Impervious Coverage</td>
<td>18.0%</td>
<td>29.9%</td>
<td>34.4%</td>
<td></td>
</tr>
</tbody>
</table>

Graphic Scale: 0'-0" = 1'-0"

Scale: 1/16" = 1'-0"
EXISTING BASEMENT FLOOR PLAN
SCALE: 1/8" = 1'-0"

EXISTING REAR ELEVATION
SCALE: 1/8" = 1'-0"
1. PROPOSED BASEMENT FLOOR PLAN
   SCALE: 1/8" = 1'-0"

2. PROPOSED FIRST FLOOR PLAN
   SCALE: 1/8" = 1'-0"
1. **PROPOSED REAR ELEVATION**
   SCALE: 1/8" = 1'-0"

2. **PROPOSED SIDE ELEVATION**
   SCALE: 1/8" = 1'-0"

3. **PROPOSED SIDE ELEVATION**
   SCALE: 1/8" = 1'-0"
Dear Neighbors,

My family and I have lived here now for 4 years and we are starting to outgrow our home. We love our neighborhood and have become friends with you all. As you know, we just had our third child and we are looking to add a little more space to our home. We will be proposing to build a small addition onto the rear of our existing home and are hoping to receive your support in this matter. The township has asked for multiple steps to be completed as a part of the process and we are doing our best to comply with those steps, this being an optional step. If you are in support of us building this addition, please kindly sign below with your name and address. Again, we really love it here and would like to be able to complete this addition so we can stay in the neighborhood that we've come to love.

Thank you for your support,

The Gross Family

* Moon Smith 4035 Fairway Rd

Greg Vesuvio 4027 Fairway Rd

Bernadette M. McCarthy 4024 Fairway Rd

Patti Too 4021 Fairway Rd

Nancy Mc 4026 Fairway Rd
ZHB APPEAL #2020-03
SUMMARY

APPLICANTS: Duane and Bernadette McCarthy

PROPERTY LOCATION: Parcel #65-00-03418-00-9
Block 043D, Unit 034
4024 Fairway Road
Lafayette Hill, PA 19444

ZONING DISTRICT: A-Residential District

SUMMARY OF RELIEF REQUEST:

The Applicants are proposing to remove an existing covered porch and crumbling foundation and replace with a new enclosed space to occupy an expanded kitchen. The following relief is requested:

1. **Variance from Section 116-202.B.** to allow less than the 12’ minimum/35’ required aggregate side yard; 4’ minimum/25’ aggregate side yard is proposed. The side yard setback is regulated by this section of the Zoning Ordinance because this house was built prior to June 23, 1966 (it was originally built in 1954).

PRIOR DECISIONS:

None

Respectfully Submitted,

Charles L. Guttenplan, AICP
Director of Planning and Zoning/Zoning Officer
APPEAL TO ZONING HEARING BOARD  
WHITEMARSH TOWNSHIP  
COMMONWEALTH OF PENNSYLVANIA

APPEAL NO: AP10-03

Applicant/Appellant: Bernadette & Duane McCarthy
Address: 4024 Fairway Rd, Lafayette Hill, PA 19444
Phone #: (xxx)xxx-xxxx   Cell Number: (xxx)xxx-xxxx   E-Mail: bernadette.mccarthy@email.com

Owner: Bernadette & Duane McCarthy
Address: 4024 Fairway Rd, Lafayette Hill, PA 19444
Phone #: (xxx)xxx-xxxx   Cell Number: (xxx)xxx-xxxx   E-Mail: bernadette.mccarthy@email.com

Location of the Property Involved:
Block #: 043D   Unit #: 034   Parcel #: 65-00-03418-00-9

NATURE OF APPLICATION (Describe proposed use and/or construction: type of appeal requested and specific section(s) of Whitemarsh Township Zoning Code which is (are) relied upon):

WE ARE REMOVING A CRUMBLY FOUNDATION OF OVER 35 YRS OF OUR SIDE COVERED PORCH WHICH ENCRUSTS ON SIDE YARD SETBACK RESTRICTIONS. THIS NEW ENCLOSED SPACE WILL OCCUPY AN EXPANDED KITCHEN. THIS WILL ONE STORY OVER BASEMENT FOUNDATION. SEEKING VARIANCE FROM 114-202-B.50 YARD SETBACK. (12.85 REQUIRED 41.85 PROPOSED)

GROUND FOR APPEAL (State reasons for appeal and nature of hardship, if claimed):

**Attach additional sheets if necessary

Our existing porch built prior to our purchase does not meet current side yard setbacks or combined aggregate side yard requirements. A narrow lot inhibits the use of these requirements.

Legal Counsel (if represented):
Address: 
Phone #: E-Mail: 

My (Our) signature(s) authorize(s) permission to pose my (our) property and permission to the Zoning Hearing Board and their representative to enter thereon for inspection purposes.

I (We) certify the information provided on this application and supporting documentation and plans are true and correct to the best of my (our) knowledge, information, and belief. You are required to submit proof that you are one of the following:

I am (We are)  
☐ Owner(s) of Legal Title  
☐ Owner(s) of Equitable Title  
☐ Tenant(s) with permission of Owner(s) of Title
(Enclose letter attesting to same)

Signature of Applicant/Appellant: Bernadette McCarthy

Signature of Applicant/Appellant:
APPLICANTS: Whitemarsh Valley Country Club

PROPERTY LOCATION: Parcel #65-00-11680-00-9
Block 023, Unit 002
815 Thomas Road
Lafayette Hill, PA 19444

ZONING DISTRICT: AAA-Residential District
Recreational District Overlay
Floodplain Conservation Overlay District
Riparian Corridor Conservation Overlay District

SUMMARY OF RELIEF REQUEST:

The applicant is proposing to build two replacement golf cart/pedestrian bridges in the floodplain and floodway of the Wissahickon Creek, one of which was destroyed in a storm and the other which is in deteriorated condition. The following is being requested:

1. **Variance from Section 116-165.B.(2)** for structures other than the bridges (e.g., cart path, abutments, wingwalls, piers, etc.) which are not included as permitted uses as part of a recreational use in the Floodplain Conservation Overlay District.

2. **Special Exception from Section 116-166.A.(2).** Bridges are permitted in a floodway by Special Exception provided that they are in compliance with provisions of the underlying districts, they cause no increase in flood heights or velocities; and are not prohibited by any other ordinance.

3. **Variance from Section 116-264.A.** is sought to not reestablish forest cover and woodland habitat as none exists now and the Creek is flanked by golf course. Introducing this vegetation would restrict the play of golf.

4. **Variance from Section 116-265.C.** is sought to permit crossings at a distance with less than 1,000 feet of buffer length. Existing bridges do not have such separation and are being replaced in the same location. Bridge separation is approximately 400 feet.

PRIOR DECISIONS:

ZHB#2010-12 Special Exception/Variances (3 new bridges)
ZHB#1995-17 Special Exception (Cellular Telephone Equipment & Chimney Structure)

Respectfully Submitted,

[Signature]
Charles L. Guttenplan, AICP
Director of Planning and Zoning/Zoning Officer

G:ZONING HEARING BOARD/ZHB 2020/ZHB#2020-04 WVCC/Summary
APPEAL TO ZONING HEARING BOARD
WHITEMARSH TOWNSHIP
COMMONWEALTH OF PENNSYLVANIA

APPEAL NO: 2676-89

Applicant/Appellant: Whitemarsh Valley Country Club c/o Jim Coffey, General Manager
Address: 815 Thomas Road, Lafayette Hill, PA 19444
Phone #: [redacted]  Cell Number: [redacted]  E-Mail: [redacted]

Owner: Whitemarsh Valley County Club
Address: same
Phone #: same  Cell Number: same  E-Mail: same

Location of the Property Involved: 815 Thomas Road
Block #: 023  Unit #: 002  Parcel #: 65-00-11680-00-9

NATURE OF APPLICATION (Describe proposed use and/or construction: type of appeal requested and specific section(s) of Whitemarsh Township Zoning Code which is (are) relied upon):
Applicant seeks to build two replacement golf cart/pedestrian bridges in the floodplain and floodway of the Wissahickon Creek and requires variances under Section 116-165 and 116-257 et al and Special Exception under 116-166.
See attachment for further descriptions and details.

GROUND FOR APPEAL (State reasons for appeal and nature of hardship, if claimed):
**Attach additional sheets if necessary
See attached statement "Grounds for Appeal"

Legal Counsel (if represented): Timothy Lawn
Address: 1845 Walnut Street, Suite 2000, Philadelphia, PA 19103
Phone #: 215 568-6190  E-Mail: trlawn@rayneslaw.com

My (Our) signature(s) authorize(s) permission to pose my (our) property and permission to the Zoning Hearing Board and their representative to enter thereon for inspection purposes.

I (We) certify the information provided on this application and supporting documentation and plans are true and correct to the best of my (our) knowledge, information, and belief. You are required to submit proof that you are one of the following:

☑ Owner(s) of Legal Title
☐ Owner(s) of Equitable Title

Tenant(s) with permission of Owner(s) of Title
(Enclose letter attesting to same)

Signature of Applicant/Appellant:

Signature of Applicant/Appellant:
Application Attachment

Appeal to Zoning Hearing Board
Whitemarsh Township
Whitemarsh Valley Country Club
Bridge Replacements

Nature of Application

Seek to replace two cart path/pedestrian bridges (#4b and 5) in the floodplain and floodway of the Wissahickon Creek. One was destroyed when a tree fell on it during a fall storm. The second is in deteriorated condition and needs replacement. Both are needed for golfers to use the full course. The construction is within the floodway and the Riparian Corridor Zones 1 and 2. The bridges will be constructed off site in pieces and assembled on site and have been fully designed, engineered and certified by Contech Engineered Solutions, LLC. The support infrastructure (concrete abutments, wingwalls, & helical pier foundations) have been designed and certified by CBC Engineers. Structures to support these bridges will be built on site and will include asphalt approach paths, wing walls, helical piers, abutments, and such other appurtenant components. The new bridges are replacements at the same location as the existing crossings and perpendicular to the Creek. They will be longer (70' x 6' and 70' x 10') and will be higher elevation to span the Creek and create less obstruction during normal and smaller storm flow. The replacements will be an improvement over the prior bridges. In major storms, the structures will be submerged.

Grounds for Appeal and Justification

Relief is sought as follows:

Section 116-165. B. (2) Variance for structures other than the bridges (e.g., cart path, abutments, wingwalls, piers, etc.) which are not permitted. Note: Golf course is a permitted use.

Section 116-166 A.(2) Special Exception - Bridges are permitted in floodways by Special Exception provided that they are in compliance with provisions of the underlying districts (AAA-Residential and Recreation Overlay); they cause no increase in flood heights or velocities; and are not prohibited by any other ordinance. The underlying district is Residential AAA/Golf Course; the higher/wider bridges will permit improved flow; no ordinance prohibits them. Note that they are a permitted use in the Riparian Corridor Overlay District under Section 116-259 B. & C. and 116-260. F. Variances (2) are sought for code sections pertaining to Management and Corridor Crossing Standards per below.

Section 116-264 A. – Management - Variance is sought to not reestablish forest cover and woodland habitat as none exists now and the Creek is flanked by golf course. Introducing this vegetation would restrict the play of golf. The disturbed areas will be stabilized for erosion control.

Section 116-265 C. Corridor Crossing Standards – Variance is sought to permit crossings at a distance with less than 1,000 feet of buffer length. Existing bridges do not have such separation and are being replaced in the same location. As positioned, they allow golfer to move among contiguous golf holes. Bridge separation is ~400 feet.
PARID: 650011680009
WHITEMARSH VALLEY COUNTRY CLUB

Parcel

TaxMapID 65023 002
Parid 65-00-11680-00-9
Land Use Code 0515
Land Use Description C - PREFERENTIAL ASSESSMENT
Property Location 815 THOMAS RD
Lot #: 78.82 ACRES
Front Feet 3391
 Municipality WHITEMARSH
 School District COLONIAL
 Utilities ALL PUBLIC/

Owner

Name(s) WHITEMARSH VALLEY COUNTRY CLUB
Name(s)
Mailing Address THOMAS RD
Care Of
Mailing Address
Mailing Address LAFAYETTE HILL PA 19444

Current Assessment

Appraised Value 4,464,000
Assessed Value 4,089,470
Restrict Code 515

Estimated Taxes

County 14,145
Montco Community College 1,595
Municipality 8,334
School District 93,125
Total 117,199
Tax Lien

Tax Claim Bureau Parcel Search

Last Sale

Sale Date 01-JAN-00
Sale Price $0
Tax Stamps
Deed Book and Page 0619-00367
Grantor WHITEMARSH VALLEY COUNTRY CLUB
Whitemarsh Valley Country Club
Bridge Replacements
Bridge #4b
Bridge #4b (con’t)
Bridge #4b (con’t)
Bridge #5
Bridge #5 (con’t)
WHITEMARSH TOWNSHIP

ZONING HEARING BOARD

APPLICATION 95-17 of AWACS, Inc d/b/a Comcast Metrophe

First Hearing Date 8/2/95 Date Decided 8/2/95 Copy Mailed 8/3/95

At a public hearing of the above application, the Zoning Hearing Board decides and orders as follows:

1. The Special Exception in accordance with Section 116-35.C(1) of the Whitemarsh Township Code necessary to allow cellular telephone equipment to be located in the clubhouse and a proposed chimney structure of the Whitemarsh Country Club at 815 Thomas Road is hereby granted.

THIS DECISION IS SUBJECT TO THE FOLLOWING CONDITIONS:

1. All use and development allowed by any granted application shall conform to the exhibits and testimony presented at the hearing unless inconsistent with these conditions in which case these conditions shall take precedence.

2. Applicant has agreed that the equipment shall be for its exclusive use and this decision is subject to that condition.

3. Each channel shall broadcast at no more than 25 watts.

Robert A. Boccia

Lee E. Plante

John M. Leavitt

This Decision and Order of the Board is final and any appeal of it must be filed with the Court of Common Pleas of Montgomery County within 30 days following the copy mailing date set out above.

Section 116-223 of the Whitemarsh Township Code provides that all applications granted by the Board shall automatically expire 365 days after the expiration of the last day to appeal to the Court of Common Pleas of Montgomery County or to an Appellate Court, if, during that time, the applicant has not acted upon the granted application by obtaining the granted permit and paying the required fee for same. Any request for an extension must be submitted in writing to the Board at least thirty (30) days prior to the expiration date.
WHITEMARSH TOWNSHIP ZONING HEARING BOARD

DECISION AND ORDER

APPLICATION NO.: 2010-12
APPLICANT: Whitemarsh Valley Country Club
Block 023, Unit 002
815 Thomas Road
Lafayette Hill, PA 19444
AAA - Residential District
REC - Recreational Overlay

FIRST HEARING DATE: 08/04/10
DECISION: 08/04/10
COPY MAILED: 08/05/10

After completion of a public hearing on the above-referenced Application, pursuant to public notice as required by law, the Zoning Hearing Board of Whitemarsh Township decided and orders as follows:

1. Special Exceptions under Section 116-166.A(2) and Section 116-166.B(1) and (2) to permit the installation of three new bridges within the floodway and floodway fringe are GRANTED.

2. Variances from Sections 116-260.A and Section 116-264.A related to riparian corridor vegetation clearing and planting requirements are GRANTED.

3. A variance from Section 116-265.C which requires a minimum distance of 1,000 feet between crossings in a riparian corridor is GRANTED.
THIS DECISION IS SUBJECT TO THE FOLLOWING CONDITIONS:

1. All use and development permitted by this Decision shall conform to the exhibits and testimony presented by the Applicant, unless inconsistent with any specific conditions imposed by this Board, in which case these specific conditions shall take precedence.

2. The Applicant shall apply for and obtain all permits required by the Township Codes in a timely manner.

This Decision and Order of the Board is final and any appeal of it must be filed with the Court of Common Pleas of Montgomery County within thirty (30) days following the copy mailing date set out above.

Section 116-223 of the Zoning Ordinance provides as follows:

Expiration of granted appeals. Unless otherwise specified by the Board, all approvals granted by the Zoning Hearing Board shall automatically expire 365 days after the date of the decision unless: (1) the applicant has acted upon the approval by obtaining the required permit(s) and paying the prescribed fees for same, or (2) the Zoning Hearing Board decision is on appeal to the courts, at which point, the approval, if upheld on appeal, shall expire 365 days after final determination on appeal.

The Zoning Hearing Board may extend the expiration date of approvals for a 180 day period upon request by the applicant, provided that the applicant is, in the opinion of the Zoning Hearing Board, diligently pursuing governmental and/or regulatory approvals as required. Requests for extensions shall be in writing and submitted to the Zoning Hearing Board at least 30 days before any applicable expiration date. Only one (1) extension may be provided for any application.

However, note:
Act 46 of 2010 provides for a suspension of the expiration of governmental approvals under the Pennsylvania Municipalities Planning Code until July 1, 2013.
WHITEMARSH TOWNSHIP ZONING HEARING BOARD:

James Behr, Chair

William E. Kramer

Jack Cohen

Robert A. Bacine, Vice Chair

Marc Weinstein

(ALTERNATE)

Randi Rubin Goldstein
January 16, 2020

Contech Engineered Solutions LLC
71 US Route 1
Suite F
Scarborough, Maine 04074

Attn: Mr. Justin Reardon, P.E.
Truss Consultant

Re: Design of Concrete Abutments and Wingwalls on Helical Pier Foundations for Two (2) Proposed Pedestrian Bridges (613585); Whitemarsh Valley Country Club, Lafayette, Pennsylvania; CBC Report No. 22963D-1-0120-05

Ladies & Gentlemen:

We are pleased to submit our report for the above referenced project. The purpose of this project is to provide the design of the abutments and wingwalls on helical pier foundations for the above referenced structures. All other aspects of this project including the bridges themselves are being designed by others, and the loads for the bridges have been furnished to CBC for our use in design of the above items.

This report contains the design of the above referenced components. If you have any questions, please contact us.

Respectfully submitted,

CBC Engineers & Associates, Ltd.

[Signature]

Deepa Nair, M.S., P.E.
Project Engineer

[Signature]

Mitchell T. Hardert, P.E.
Chief Engineer

DN/MTH/leh
cc: Client (jreardon@conteches.com)
cc: Bill Gray (wgray@conteches.com)
cc: Ben Hurst (bhurst@conteches.com)
cc: Melinda Fugate (mfugate@conteches.com)
1-File
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II SPECIFICATIONS

APPENDIX A – CALCULATIONS

APPENDIX B - PRINTS
SECTION I

TEXT
1.0 **AUTHORIZATION**

Authorization to proceed with this project was given by Mr. Justin Reardon of Contech Engineered Solutions LLC. Work was to proceed in accordance with CBC Engineers & Associates, Ltd. Quotation No. 20-003-05, dated January 2, 2020, and the terms and conditions of the Master Agreement for Engineering Services dated July 30, 2009.

2.0 **STRUCTURE DESCRIPTION**

The structures to be constructed at this location are two (2) pedestrian bridges – Bridge #4B (613585-020) with a width of 5'-3 5/8" (center to center of anchor bolts) and length of 70'-2" (backwall to backwall), and Bridge #5 (613585-010) with a width of 9'-3 5/8" (center to center of anchor bolts) and length of 70'-2" (backwall to backwall). The structures are supported on girders which bear on abutments on either side of the structures. The purpose of this report is to provide the design of the abutments for the structures. It is necessary to support the bridge on abutments supported by helical piers. The loads on the abutments are both vertical and horizontal. Each abutment acts as a retaining wall to retain the soil behind it as well as supporting the weight of the bridge. Figure 1 shows a conceptual view of the loads on the abutment.

![Figure 1](image_url)

The abutments act as concrete retaining walls that will hold back the fill in the approaches to the bridges. The abutments have extended wingwalls to contain the slope of the
fill. The locations and geometry of the abutments and wingwalls have been determined based on the project drawings dated December 9, 2019 (Project No. 19-51) from Irick Eberhardt & Mientus Inc. Others are responsible for the bridge design.

3.0 **SOIL FOUNDATION EVALUATION**

We have been provided a geotechnical engineering report prepared by Advanced GeoServices Corp., a Montrose Environmental Group Company; their Project No. 2019-3991-01 dated November 11, 2019. The following is an excerpt from the geotechnical report.

"*Foundations (Helical Piles)*

*Helical piles should consist of galvanized steel multiple-helix units with a 1 ½-inch square shaft. The piles should bear within the stiff silts/medium dense sands encountered below 10 feet. The estimated allowable capacities for various helix configurations for each bridge location are shown below.*

<table>
<thead>
<tr>
<th>Helix Configuration</th>
<th>Pile Tip Depth</th>
<th>Bridge 4</th>
<th>Bridge 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>6&quot;-8&quot;-10&quot;</td>
<td>15 ft.</td>
<td>16.5 kips</td>
<td>10 kips</td>
</tr>
<tr>
<td>8&quot;-10&quot;</td>
<td>15 ft.</td>
<td>13.5 kips</td>
<td>8 kips</td>
</tr>
<tr>
<td>8&quot;-10&quot;-12&quot;</td>
<td>15 ft.</td>
<td>26.0 kips</td>
<td>15 kips</td>
</tr>
<tr>
<td>10&quot;-12&quot;-14&quot;</td>
<td>15 ft.</td>
<td>37.0 kips</td>
<td>22 kips</td>
</tr>
</tbody>
</table>

We have designed the foundations for the abutments for #4B bridge utilizing helical piers to be advanced to a minimum embedment depth of 15 ft. below the bottom of the pile caps to achieve a minimum allowable axial compressive capacity of 26 kips/pier and a minimum allowable flexural capacity (ASD) of 1750 ft.-lbs. Helical piers have been analyzed considering 1 ½-inch square shaft with 8"-10"-12" helix configuration and piers spaced longitudinally at 36 inches (3 x 12" max. helix plate diameter). We have designed the foundations for the abutments
for #5 bridge utilizing helical piers to be advanced to a minimum embedment depth of 15 ft. below the bottom of the pile caps to achieve a minimum allowable axial compressive capacity of 22 kips/pier and a minimum allowable flexural capacity (ASD) of 900 ft.-lbs. Helical piers have been analyzed considering 1 ½-inch square shaft with 10"-12"-14" helix configuration and piers spaced longitudinally at 42 inches (3 x 14" max. helix plate diameter). The final design of the helical piers (i.e. shaft properties, number and size of helices, top bracket, etc.) to achieve the above required allowable vertical loads and flexural capacities is the responsibility of the special contractor chosen for the project. It should be noted that CBC Engineers and Associates, Ltd. has not made any independent evaluation of the foundation conditions. We are relying totally on the information provided relative to the foundation conditions at the locations of the structures. The pier vertical loads and flexural capacities should be confirmed by a geotechnical engineer in the field at the time piers are installed. If the actual capacities are less than design, then problems to the structures could develop. The evaluation of scour is the responsibility of others than CBC Engineers and Associates, Ltd.

4.0 DESIGN OF BACKFILL AROUND THE ABUTMENTS

Any backfill immediately around the abutments and wingwalls should consist of a free draining granular material so that water is not built up around the abutments. The material should be placed in accordance with the plans and specifications in this report. The backfill material should be AASHTO A-1 material compacted to 95% of the maximum modified Proctor dry unit weight and placed in accordance with the specifications for backfill included in Section II of this report. We have also utilized a maximum unit weight of 120 pcf and a minimum angle of internal friction of 34 degrees for the soil in the select backfill zone around the abutments and wingwalls, and these parameters should be verified in the field by a geotechnical engineer prior to construction. Please note: it is essential to use good granular backfill to prevent water from building up around the wall, and for the filter fabric to be installed properly so as to ensure the backfill pores do not become clogged. It is recommended that the select backfill be extended to a distance of at least 10 feet laterally from the edge of the walls and a filter fabric should be placed between the backfill and any soil. Figure 2 shows the recommended extent of the granular fill and the filter fabric.
Figure 2

The backfill slope behind the abutments has been assumed to be approximately level. CBC should be contacted if actual backfill slope requirements differ from those described.

5.0 DESIGN OF ABUTMENTS

The bridge loading on each of the abutments as per the Contech drawings is as follows:

<table>
<thead>
<tr>
<th>Bridge Type</th>
<th>Bridge 4B (613585-020)</th>
<th>Bridge 5 (613585-010)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Backwall to Backwall Bridge Span</td>
<td>70'-2&quot;</td>
<td>70'-2&quot;</td>
</tr>
<tr>
<td>Total Vertical Dead Load (DC)</td>
<td>36.0 kips</td>
<td>43.0 kips</td>
</tr>
<tr>
<td>Vertical Live Load (LL)</td>
<td>21.0 kips</td>
<td>35.0 kips</td>
</tr>
<tr>
<td>Longitudinal Thermal Load (TU)</td>
<td>5.3 kips</td>
<td>6.5 kips</td>
</tr>
<tr>
<td>Wind Load (Horizontal)</td>
<td>8.5 kips</td>
<td>8.5 kips</td>
</tr>
</tbody>
</table>
The height of the abutments for the proposed bridge #4B and #5 is approximately 5.27 feet and 5.5 feet respectively above the top of the 3.0' thick pile cap footings. The bridge geometry has been prepared based on the information provided to us by Contech (Project Drawings #613585-010 and 613585-020) dated December 16, 2019. All elevations, geometry and locations of the abutments must be field verified prior to construction. The design of the abutments has been performed as per AASHTO LRFD design methodology.

The total maximum vertical Service load on the abutment for Bridge 4B (613585-020) is about 95.3 kips including abutment weight. The maximum total Service horizontal load on the abutment for Bridge 4B (613585-020) in the longitudinal direction is about 26.6 kips which includes lateral soil loading from active soil pressure, live load surcharge, and thermal bridge loads. The total maximum vertical Service load on the abutment for Bridge 5 (613585-010) is about 134 kips including abutment weight. The maximum total Service horizontal load on the abutment for Bridge 5 (613585-010) in the longitudinal direction is about 36.7 kips which includes lateral soil loading from active soil pressure, live load surcharge, and thermal bridge loads. Figure 3 shows the three-dimensional loading on each abutment.

The amount of steel and concrete has been designed for these loads based on AASHTO LRFD criteria and the foundations have been designed for both the vertical and horizontal loads. The calculations are included in Appendix A.
Each abutment must be stable against sliding and overturning due to the vertical and horizontal loads. Based on the loading conditions each abutment must be the dimensions and contain the reinforcing steel shown on the drawings.

### 6.0 FOUNDATIONS

The foundations for the abutments must be designed to take the horizontal as well as the vertical loads. In addition to the above, the foundations must be designed for scour protection, so they are not scoured out by high water. We have designed the foundations for the abutments for #4B bridge utilizing helical piers to be advanced to a minimum embedment depth of 15 ft. below the bottom of the pile caps to achieve a minimum allowable axial compressive capacity of 26 kips/pier and a minimum allowable flexural capacity (ASD) of 1750 ft.-lbs. Helical piers have been analyzed considering 1 ½-inch square shaft with 8"-10"-12" helix configuration and piers spaced longitudinally at 36 inches (3 x 12" max. helix plate diameter). We have designed the foundations for the abutments for #5 bridge utilizing helical piers to be advanced to a minimum embedment depth of 15 ft. below the bottom of the pile caps to achieve a minimum allowable axial compressive capacity of 22 kips/pier and a minimum allowable flexural capacity (ASD) of 900 ft.-lbs. Helical piers have been analyzed considering 1 ½-inch square shaft with 10"-12"-14" helix configuration and piers spaced longitudinally at 42 inches (3 x 14" max. helix plate diameter). As stated, the final design of the helical piers (i.e. shaft properties, number and size of helices, top bracket, etc.) to achieve the above required allowable vertical loads and flexural capacities is the responsibility of the special contractor chosen for the project.

The helical piers must also be designed for the horizontal loads placed upon them. The horizontal loads place a moment at the top of the pile. Figure 4 shows the loading at the top of the pile.
The pile cap foundation has been analyzed using the computer program Group 4. The helical piers must be designed for the horizontal loads, vertical loads and moments placed upon them. The horizontal loads at the top of the pile distribute the vertical load in the pile group and require a lateral pile capacity. The GROUP4 model accounts for pile location and loading. The soil parameters (soil-modulus parameter (k) and friction angle/strength parameters) utilized in GROUP4 analysis have been obtained from the boring log data in the geotechnical report (borings B-4A and B-4B for Bridge #4B, and B-5A and B-5B for Bridge 5).

The structure foundation has been analyzed as a typical group of six (6) helical piers-two (2) rows of 3 helical piers each (three (3) vertical helical piers in the back row and three (3) battered helical piers (10 degree batter) in the front row each at 3'-0" o.c.) using the computer program GROUP4 for Bridge #4B. The structure foundation has been analyzed as a typical group of eight (8) helical piers-two (2) rows of four helical piers each (four (4) vertical helical piers in the back row and four (4) battered helical piers (10 degree batter) in the front row each at 3'-6" o.c.) using the computer program GROUP4 for Bridge #5. The calculations are attached in Appendix A. The helical piers should be installed in strict conformance with the project specifications and the manufacturer’s recommendations by a licensed contractor approved by the manufacturer. The design drawings are attached in Appendix B of this report.

7.0 PILE CAPS

The pile caps must be designed as a beam to transfer the load of the structure onto the helical piers. Based on the loadings on the abutments and the pile positions, the pile caps must be 5'-0" wide and 36" deep. The minimum embedment of the helical piers into the pile cap must be
1'-6". The reinforcing bars in the pile cap must be as shown on the drawings. The pile cap is reinforced with #5 stirrups at 12" on center for shear and torsion.

8.0 DESIGN OF WINGWALLS

The wingwalls will be connected to the abutments to retain the approach embankments. Each wingwall will extend for 7.0 ft. length at 45 degree angles to the abutments as shown on the attached drawings. There is a maximum of about 5'-0" of fill behind the wingwalls. The required geometry of the wingwalls should be verified (by others) prior to construction. The thickness of the wingwalls is 12 inches. The design of the wingwalls and the reinforcing steel required is included on the drawings.

9.0 SCOUR

It is beyond the scope of this report to evaluate scour. The depth of the bottom of the pile caps for the structures and the depth of the piers should be evaluated for scour before foundations are constructed.

10.0 WARRANTY

Our professional services have been performed, our findings obtained and our recommendations prepared in accordance with generally accepted geotechnical engineering principles and practices. No other warranty, expressed or implied, is made.

This report has been prepared for the exclusive use of Contech Engineered Solutions LLC, for specific application to the structure herein described. Specific recommendations have been provided in the various sections of the report. The report shall, therefore, be used in its entirety. This report is not a bidding document and shall not be used for that purpose. Anyone reviewing this report must interpret and draw their own conclusions regarding specific construction techniques and methods chosen. CBC Engineers & Associates, Ltd. is not responsible for the independent conclusions, opinions or recommendations made by others.
SECTION II

SPECIFICATIONS
I - GENERAL

1.0 STANDARDS AND DEFINITIONS

1.1 STANDARDS - All standards refer to latest edition unless otherwise noted.

1.1.1 ASTM D-698-70 (Method C) "Standard Test Methods for Moisture, Density Relations of Soils and Soil Aggregate Mixtures Using 5.5-lb (2.5 kg.) Rammer and 12-inch (305-mm) Drop".

1.1.2 ASTM D-2922 "Standard Test Method for Density of Soil and Soil Aggregate in Place by Nuclear methods (Shallow Depth)".

1.1.3 ASTM D-1556 "Standard Test Method for Density of Soil in place by the Sand-Cone Method".

1.1.4 ASTM D-1557 "Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort."

1.1.5 All construction and materials shall be in accordance with the latest AASHTO LRFD Bridge Design Specifications.

1.2 DEFINITIONS

1.2.1 Owner - In these specifications the word "Owner" shall mean Whitemarsh Valley Country Club, PA.

1.2.2 Engineer - In these specifications the word "Engineer" shall mean the Owner designated engineer.

1.2.3 Design Engineer - In these specifications the words "Design Engineer" shall mean CBC Engineers and Associates, Ltd.

1.2.4 Contractor - In these specifications the word "Contractor" shall mean the firm or corporation undertaking the execution of any work under the terms of these specifications.

1.2.5 Approved - In these specifications the word "approved" shall refer to the approval of the Engineer or his designated representative.

1.2.6 As Directed - In these specifications the words "as directed" shall refer to the directions to the Contractor from the Owner or his designated representative.
2.0 GENERAL CONDITIONS

2.1 The Contractor shall furnish all labor, material and equipment and perform all work and services except those set out and furnished by the Owner, necessary to complete in a satisfactory manner the site preparation, excavation, filling, compaction, grading as shown on the plans and as described therein.

This work is to be accomplished under the observation of the Owner or his designated representative.

2.2 Prior to bidding the work, the Contractor shall examine, investigate and inspect the construction site as to the nature and location of the work, and the general and local conditions at the construction site, including, without limitation, the character of surface or subsurface conditions and obstacles to be encountered on and around the construction site; and shall make such additional investigation as he may deem necessary for the planning and proper execution of the work.

If conditions other than those indicated are discovered by the Contractor, the Owner should be notified immediately. The material which the Contractor believes to be a changed condition should not be disturbed so that the owner can investigate the condition.

2.3 The construction shall be performed under the direction of an experienced engineer who is familiar with the design plan.
II – PILE CAP FOOTINGS

1.0 The dimension of the pile caps shall be 60" wide and 36" deep.

2.0 The concrete and steel in the pile caps shall meet the requirements of Section IV of these specifications.

3.0 The pile caps shall be reinforced as shown on the construction drawings.

4.0 Foundation excavation shall consist of the removal of all material, of whatever nature, necessary for the construction of foundations.

4.1 It shall be the responsibility of the Contractor to identify and relocate all existing utilities which conflict with the proposed foundation locations shown on the plan. The Contractor must call the appropriate utility company at least 48 hours before any excavation to request exact field location of utilities, and coordinate removal and installation of all utilities with the respective utility company.

4.2 All federal, state, and local regulations should be strictly adhered to relative to excavation side-slope geometry. The adoption of suitable excavation techniques is the responsibility of the Contractor.

4.3 Excavated material shall be disposed in accordance with the plan established by the Engineer.
III – HELICAL PIERS

1.0 The final design of the helical piers (i.e. shaft properties, number and size of helices, top bracket, etc.) to achieve a minimum allowable axial compressive capacity of 26 kips/pier and a minimum allowable flexural capacity (ASD) of 1750 ft.-lbs for Bridge #4B and a minimum allowable axial compressive capacity of 22 kips/pier and a minimum allowable flexural capacity (ASD) of 900 ft.-lbs for Bridge #5 is the responsibility of the special contractor chosen for the project.
IV – CONCRETE

1.0 CODES AND STANDARDS

1.1 Reinforced concrete shall conform to the requirements of AASHTO Standard Specifications for Highway Bridges, Division II - Construction, Section 8, "Concrete Structures", for Class A concrete, having a minimum compressive strength of 4,000 psi.

2.0 STANDARDS FOR MATERIALS

2.1 Portland Cement - Conforming to ASTM Specification C-150, Type I or II.

2.2 Water - The water shall be drinkable, clean free from injurious amounts of oils, acids, alkalis, organic materials, or deleterious substances.

2.3 Aggregates - Fine and coarse aggregates shall conform to current ASTM Specification C-33 "Specification for Concrete Aggregates" except that local aggregates which have been shown by tests and by actual service to produce satisfactory qualities may be used when approved by the Engineer.

2.4 Submittals - Test data and/or certifications to the Owner shall be furnished upon request.

3.0 PROPORTIONING OF CONCRETE

3.1 COMPOSITION

3.1.1 The concrete shall be composed of cement, fine aggregate, coarse aggregate and water.

3.1.2 The concrete shall be homogeneous, readily placeable and uniformly workable and shall be proportioned in accordance with ACI-211.1.

3.1.3 Proportions shall be established on the basis of field experience with the materials to be employed. The amount of water used shall not exceed the maximum 0.49 water/cement ratio, and shall be reduced as necessary to produce concrete of the specified consistency at the time of placement.

3.1.4 An air-entraining admixture, conforming to the requirements of ASTM C260, shall be used in all concrete furnished under this contract. The quantity of admixture shall be such as to produce an air content in the freshly mixed concrete of 6 percent plus or minus 1 percent as determined in accordance with ASTM C231 or C173.
3.2 Qualities Required - As indicated in the table below:

<table>
<thead>
<tr>
<th>ITEM</th>
<th>QUALITY REQUIRED</th>
</tr>
</thead>
<tbody>
<tr>
<td>AASHTO Class</td>
<td>A</td>
</tr>
<tr>
<td>Type of Cement</td>
<td>I or II</td>
</tr>
<tr>
<td>Compressive Strength fc @ 28 days</td>
<td>4,000 psi</td>
</tr>
<tr>
<td>Slump, inches</td>
<td>2 - 4 in.</td>
</tr>
</tbody>
</table>

3.3 Maximum Size of Coarse Aggregates - Maximum size of coarse aggregates shall not be larger than 19 mm (3/4 inches).

3.4 Rate of Hardening of Concrete - Concrete mix shall be adjusted to produce the required rate of hardening for varied climatic conditions:

Under 40°F Ambient Temperature – All work to be performed in strict conformance with the recommendations of ACI-306R "Cold Weather Concreting."

4.0 MIXING AND PLACING

4.1 Equipment - Ready Mix Concrete shall be used and shall conform to the "Specifications for Ready-Mix Concrete," ASTM C-94. Approval is required prior to using job mixed concrete.

4.2 Preparation - All work shall be in accordance with ACI-304, "Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete." All construction debris and extraneous matter shall be removed from within the forms. Concrete shall be placed on clean surfaces, free from water. Concrete that has to be dropped four (4) feet or more shall be placed through a tremie.

4.3 All concrete shall be consolidated by internal mechanical vibration immediately after placement. Vibrators shall be of a size appropriate for the work, capable of transmitting vibration to concrete at frequencies of not less than 4,500 impulses per minute.

5.0 FORM WORK

5.1 Forms shall be of wood, steel or other approved material and shall be set and held true to the dimensions, lines and grades of the structure prior to and during the placement of concrete.

5.2 Forms shall not be removed until the concrete has sufficient strength to prevent concrete drainage and/or damage.
5.2 Forms shall not be removed until the concrete has sufficient strength to prevent concrete drainage and/or damage.

6.0 CURING

6.1 Fresh concrete shall be protected from rains, flowing water and mechanical injury for a period of at least four (4) days. No loads shall be placed on the concrete until it has reached its design strength.

7.0 REINFORCING STEEL

7.1 MATERIAL

7.1.1 All reinforcing bars shall be deformed bars (ASTM-A615) Grade 60.

7.2 BENDING AND SPLICING

7.2.1 Bar reinforcement shall be cut and bent to the shapes shown on the plans. Fabrication tolerances shall be in accordance with ACI 315. All bars shall be bent cold, unless otherwise permitted.

7.2.2 All reinforcement shall be furnished in the full lengths indicated on the plans unless otherwise permitted. Except for splices shown on the plans and splices for No. 5 or smaller bars, splicing of bars will not be permitted without written approval. Splices shall be staggered as far as possible.

7.2.3 In lapped splices, the bars shall be placed and wired in such a manner as to maintain the minimum distance to the surface of the concrete shown on the plans.

7.2.4 Substitution of different size bars will be permitted only when authorized by the engineer. The substituted bars shall have an area equivalent to the design area, or larger.

7.3 PLACING AND FASTENING

7.3.1 Steel reinforcement shall be accurately placed as shown on the plans and firmly held in position during the placing and setting of concrete. Bars shall be tied at all intersections around the perimeter of each mat and at not less than 2 foot centers or at every intersection, whichever is greater, elsewhere. Welding of cross bars (tack welding) will not be permitted for assembly of reinforcement.

7.3.2 Reinforcing steel shall be supported in its proper position by use of mortar blocks, wire bar supports, supplementary bars or other approved devices. Such devices shall be of such height and placed at sufficiently frequent
intervals so as to maintain the distance between the reinforcing and the formed surface or the top surface within 1/4 inch of that indicated on the plans.
V - FILTER FABRIC

1.0 Filter fabric shall be placed at all locations shown on the construction drawings and as necessary to maintain a soil-tight system.

2.0 Filter fabric cloth shall conform to Contech specification for C60-NW or equivalent and shall meet the following ASTM tests:

   2.1 ASTM D4751 - Apparent opening size equal to #70 U.S. Standard Sieve Size.

   2.2 ASTM D4632 (Grab Tensile Test) - Minimum Strength = 160 pounds.

   2.3 ASTM D4632 (Grab Elongation) - 30-70%.

   2.4 ASTM D4533 (Trapezoidal Tear) - Minimum Strength = 60 pounds.

   2.5 ASTM D4355 (Stabilized for Heat and Ultra-Violet Degradation) - 70% strength retained.

3.0 The minimum fabric coefficient of permeability (ASTM D4491) shall be 0.24 cm/sec.

4.0 The fabric shall be non-woven with a minimum thickness (ASTM D5199) of 60 mils.

5.0 Fabric shall not be placed over sharp or angular rocks that could tear or puncture it.

6.0 Care should be exercised to prevent any puncturing or rupture of the filter fabric. Should such rupture occur the damaged area should be covered with a patch of filter fabric using an overlap minimum of one (1) foot.
APPENDIX A

CALCULATIONS
### Bridge Loadings

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dead Weight (lbs)</td>
<td>35000</td>
</tr>
<tr>
<td>Live load (psf)</td>
<td>20000</td>
</tr>
<tr>
<td>Length of the abutment (ft)</td>
<td>8</td>
</tr>
<tr>
<td>Height above bridge deck (ft)</td>
<td>2.76</td>
</tr>
<tr>
<td>Height below bridge deck (ft)</td>
<td>2.5</td>
</tr>
<tr>
<td>Width above bridge deck (ft)</td>
<td>8</td>
</tr>
<tr>
<td>Weight of asphalt (lbs)</td>
<td>4473</td>
</tr>
<tr>
<td>Live load (psf)</td>
<td>2750</td>
</tr>
<tr>
<td>Length of the abutment (ft)</td>
<td>8</td>
</tr>
<tr>
<td>Weight of asphalt (lbs)</td>
<td>4473</td>
</tr>
<tr>
<td>Live load (psf)</td>
<td>2750</td>
</tr>
<tr>
<td>Thermal load (lbs)</td>
<td>5300</td>
</tr>
</tbody>
</table>

### Bridge Dimensions

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length (ft)</td>
<td>8</td>
</tr>
<tr>
<td>Height above bridge deck (ft)</td>
<td>2.76</td>
</tr>
<tr>
<td>Height below bridge deck (ft)</td>
<td>2.5</td>
</tr>
<tr>
<td>Width above bridge deck (ft)</td>
<td>8</td>
</tr>
<tr>
<td>Weight of asphalt (lbs)</td>
<td>4473</td>
</tr>
<tr>
<td>Live load (psf)</td>
<td>2750</td>
</tr>
<tr>
<td>Length of the abutment (ft)</td>
<td>8</td>
</tr>
<tr>
<td>Weight of asphalt (lbs)</td>
<td>4473</td>
</tr>
<tr>
<td>Live load (psf)</td>
<td>2750</td>
</tr>
<tr>
<td>Thermal load (lbs)</td>
<td>5300</td>
</tr>
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</table>

### Load Combinations

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
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</thead>
<tbody>
<tr>
<td>Load from bridge deck wall (lbs)</td>
<td>3422.0</td>
</tr>
<tr>
<td>Load from below the bridge deck wall (lbs)</td>
<td>7500.0</td>
</tr>
<tr>
<td>Weight of asphalt (lbs)</td>
<td>5198.0</td>
</tr>
<tr>
<td>Weight of asphalt (lbs)</td>
<td>3422.0</td>
</tr>
<tr>
<td>Load from bridge (lbs)</td>
<td>18000.0</td>
</tr>
<tr>
<td>Dead load (lbs)</td>
<td>5198.0</td>
</tr>
<tr>
<td>Live load (psf)</td>
<td>2750</td>
</tr>
<tr>
<td>Thermal load (lbs)</td>
<td>5300</td>
</tr>
<tr>
<td>Total vertical load (lbs)</td>
<td>43110.0</td>
</tr>
</tbody>
</table>

### Horizontal Load Combinations

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lateral load from soil (lbs)</td>
<td>9275.0</td>
</tr>
<tr>
<td>Live load on abutment (lbs)</td>
<td>4695.4</td>
</tr>
<tr>
<td>Live load on abutment (lbs)</td>
<td>4695.4</td>
</tr>
<tr>
<td>Live load on abutment (lbs)</td>
<td>4695.4</td>
</tr>
<tr>
<td>Thermal load (lbs)</td>
<td>5290.0</td>
</tr>
<tr>
<td>Friction load (lbs)</td>
<td>5198.0</td>
</tr>
<tr>
<td>Total horizontal load (lbs)</td>
<td>29548.1</td>
</tr>
</tbody>
</table>

### Moment Combinations

<table>
<thead>
<tr>
<th>Description</th>
<th>Moment (k-in)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moment about (lbs)</td>
<td>4854.5</td>
</tr>
<tr>
<td>Moment about (lbs)</td>
<td>117.3</td>
</tr>
<tr>
<td>Total Moment (lbs)</td>
<td>364.6</td>
</tr>
</tbody>
</table>

### Maximum Moment

- Maximum moment (lbs) in the abutment: 364.6 k-in
- Maximum moment (kips) in the abutment: 26.6 k

### Hinge Moment

\[ H_{net} = 26.6 - P_{false} \]

\[ P_{false} = \frac{1}{2} (3.0)(0.12)(3.0) \left( \frac{8.0}{2} \right) = 12.96 k \]

\[ \delta H = 26.6 - 12.96 = 13.64 k \]
PILE GROUP ANALYSIS PROGRAM—GROUP
PC VERSION 4.0 (C) COPYRIGHT ENSOFT, INC. 1996

THE PROGRAM WAS COMPILED USING MICROSOFT FORTRAN
POWERSTATION 4.0 (C) COPYRIGHT MICROSOFT CORPORATION, 1991.

WHITEMARSH VALLEY COUNTRY CLUB LAFAYETTE, PA

***** INPUT INFORMATION *****

Bridge #4

* TABLE C * LOAD AND CONTROL PARAMETERS

UNITS—ENGL
V LOAD, LBS    H LOAD, LBS    MOMENT, LBS-IN
.9530E+05    .1364E+05    -.9803E+05

* THE LOADING IS STATIC *

KPYOP = 1 (CODE TO GENERATE P-Y CURVES)
{ KPYOP = 1 IF P-Y YES; = 0 IF P-Y NO; = -1 IF P-Y ONLY }

* CONTROL PARAMETERS *
TOLERANCE ON CONVERGENCE OF FOUNDATION REACTION = .100E-02 IN
TOLERANCE ON DETERMINATION OF DEFLECTIONS = .100E-02 IN
MAX NO OF ITERATIONS ALLOWED FOR FOUNDATION ANALYSIS = 300
MAXIMUM NO. OF ITERATIONS ALLOWED FOR PILE ANALYSIS = 300

* TABLE D * ARRANGEMENT OF PILE GROUPS

GROUP CONNECT NO OF PILE PILE NO L-S CURVE P-Y CURVE
1   FIX     3    1    1    1    0
2   FIX     3    1    1    1    0

GROUP    VERT, IN  HON, IN  SLOPE, IN/IN  GROUND, IN SPRING, LBS-IN
1   .0000E+00  .1500E+02  .1745E+00  .0000E+00  .0000E+00
2   .0000E+00  -.1500E+02  .0000E+00  .0000E+00  .0000E+00

* TABLE E * PILE GEOMETRY AND PROPERTIES

PILE SEC INC   LENGTH, IN   E, LBS/IN**2
1   1 100   .1800E+03   .2900E+08
2   1 100   .1800E+03   .2900E+08

PILE FROM, IN   TO, IN  DIAM, IN  AREA, IN**2  I, IN**4
1    .0000E+00  .1800E+03  .1500E+01  .2250E+01  .4200E+00
2    .0000E+00  .1800E+03  .1500E+01  .2250E+01  .4200E+00

* THE PILE ABOVE IS OF LINEARLY ELASTIC MATERIAL *

* TABLE F * AXIAL LOAD VS SETTLEMENT

(The LOAD-SETTLEMENT CURVE IS GENERATED INTERNALLY)

NUM OF CURVES 2
**TABLE H**  
SOIL DATA FOR AUTO P-Y CURVES

**SOILS INFORMATION**

**AT THE GROUND SURFACE**  
= .00 IN

**2 LAYER(S) OF SOIL**

**LAYER 1**  
THE SOIL IS A SOFT CLAY  
X AT THE TOP OF THE LAYER = .00 IN  
X AT THE BOTTOM OF THE LAYER = 96.00 IN  
MODULUS OF SUBGRADE REACTION = .200E+02 LBS/IN**3

**LAYER 2**  
THE SOIL IS A SAND  
X AT THE TOP OF THE LAYER = .00 IN  
X AT THE BOTTOM OF THE LAYER = 96.00 IN  
MODULUS OF SUBGRADE REACTION = .600E+02 LBS/IN**3

**DISTRIBUTION OF EFFECTIVE UNIT WEIGHT WITH DEPTH**

4 POINTS

<table>
<thead>
<tr>
<th>X, IN</th>
<th>WEIGHT, LBS/IN**3</th>
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</thead>
<tbody>
<tr>
<td>.0000</td>
<td>.3300E-01</td>
</tr>
<tr>
<td>96.000</td>
<td>.3300E-01</td>
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<tr>
<td>96.000</td>
<td>.3300E-01</td>
</tr>
<tr>
<td>240.000</td>
<td>.3300E-01</td>
</tr>
</tbody>
</table>

**DISTRIBUTION OF STRENGTH PARAMETERS WITH DEPTH**

---

**CURVE 1**  
NUM OF POINTS 19

<table>
<thead>
<tr>
<th>POINT</th>
<th>AXIAL LOAD, LBS</th>
<th>SETTLEMENT, IN</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>-.2795E+06</td>
<td>-.2406E+01</td>
</tr>
<tr>
<td>2</td>
<td>-.2658E+06</td>
<td>-.1358E+01</td>
</tr>
<tr>
<td>3</td>
<td>-.2589E+06</td>
<td>-.8340E+00</td>
</tr>
<tr>
<td>4</td>
<td>-.2561E+06</td>
<td>-.4205E+00</td>
</tr>
<tr>
<td>5</td>
<td>-.2551E+06</td>
<td>-.3650E+00</td>
</tr>
<tr>
<td>6</td>
<td>-.1632E+06</td>
<td>-.1506E+00</td>
</tr>
<tr>
<td>7</td>
<td>-.1100E+06</td>
<td>-.4220E-01</td>
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<td>8</td>
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<td>-.1547E-02</td>
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<td>.0000E+00</td>
<td>.0000E+00</td>
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<td>.1332E+05</td>
<td>.8053E-02</td>
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<tr>
<td>12</td>
<td>.2933E+05</td>
<td>.2932E-01</td>
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<tr>
<td>13</td>
<td>.1309E+06</td>
<td>.1053E+00</td>
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<tr>
<td>14</td>
<td>.1764E+06</td>
<td>.1725E+00</td>
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<td>.2583E+06</td>
<td>.3729E+00</td>
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<td>.2578E+06</td>
<td>.4262E+00</td>
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<td>17</td>
<td>.2615E+06</td>
<td>.0456E+00</td>
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<td>.2424E+01</td>
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**CURVE 2**  
NUM OF POINTS 19

<table>
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<th>AXIAL LOAD, LBS</th>
<th>SETTLEMENT, IN</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>-.2795E+06</td>
<td>-.2406E+01</td>
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<tr>
<td>2</td>
<td>-.2658E+06</td>
<td>-.1358E+01</td>
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<tr>
<td>3</td>
<td>-.2589E+06</td>
<td>-.8340E+00</td>
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<tr>
<td>4</td>
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<td>9</td>
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<td>10</td>
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<td>.0000E+00</td>
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<td>.2424E+01</td>
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4 POINTS

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<tr>
<th>X</th>
<th>C</th>
<th>PHI, DEGREES</th>
<th>E50</th>
<th>PMAX</th>
<th>TIPMAX</th>
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<tr>
<td>IN</td>
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<td>LBS/IN**2</td>
<td>LBS/IN**2</td>
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<tr>
<td>.00</td>
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<td>.000</td>
<td>.2000E+01</td>
<td>.1000E+04</td>
<td>.1000E+04</td>
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<tr>
<td>96.00</td>
<td>.2000E+01</td>
<td>.000</td>
<td>.2000E+01</td>
<td>.1000E+04</td>
<td>.1000E+04</td>
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<tr>
<td>96.00</td>
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<td>240.00</td>
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<td>.2000E+01</td>
<td>.1000E+04</td>
<td>.1000E+04</td>
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</table>

REDUCTION FACTORS FOR CLOSELY-SPACED PILE GROUPS

<table>
<thead>
<tr>
<th>GROUP NO</th>
<th>P-FACTOR</th>
<th>Y-FACTOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>2</td>
<td>1.00</td>
<td>1.00</td>
</tr>
</tbody>
</table>

WHITEMARSH VALLEY COUNTRY CLUB LAFAYETTE, PA

***** COMPUTATION RESULTS *****

VERT. LOAD, LBS  HORI. LOAD, LBS  MOMENT, IN-LBS

| .9530E+05 | .1364E+05 | -.9808E+05 |

DISPLACEMENT OF GROUPED PILE FOUNDATION

VERTICAL, IN  HORIZONTAL, IN  ROTATION, RAD

| -.5078E-01 | .7057E+00 | -.4118E-02 |

NUMBER OF ITERATIONS = 7

* TABLE I *  COMPUTATION ON INDIVIDUAL PILE

* PILE GROUP * 1

PILE TOP DISPLACEMENTS AND REACTIONS

THE GLOBAL STRUCTURE COORDINATE SYSTEM

XDISPL, IN  YDISPL, IN  SLOPE  AXIAL, LBS  LAT, LBS  BM, LBS-IN  STRESS, LBS/IN**2

| -.113E+00 | .705E+00 | -.412E-02 | .162E+05 | .370E+04 | -.209E+05 | .447E+05 |

THE LOCAL MEMBER COORDINATE SYSTEM

XDISPL, IN  YDISPL, IN  SLOPE  AXIAL, LBS  LAT, LBS  BM, LBS-IN  STRESS, LBS/IN**2

| .117E-01 | .714E+00 | -.412E-02 | .166E+05 | .833E+03 | -.209E+05 | .447E+05 |

LATERALLY LOADED PILE

<table>
<thead>
<tr>
<th>X</th>
<th>DEFLECTION</th>
<th>MOMENT</th>
<th>SHEAR</th>
<th>SOIL</th>
<th>TOTAL</th>
<th>FLEXURAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>IN</td>
<td>IN</td>
<td>LBS-IN</td>
<td>LBS</td>
<td>LBS/IN</td>
<td>LBS/IN**2</td>
<td>LBS-IN**2</td>
</tr>
</tbody>
</table>

| .00 | .714E+00 | -.209E+05 | .635E+03 | .900E+01 | .447E+05 | .122E+00 |
| 1.80 | .719E+00 | -.195E+05 | .627E+03 | .109E+02 | .422E+05 | .122E+00 |
**PILE GROUP**  2

**PILE TOP DISPLACEMENTS AND REACTIONS**

**THE GLOBAL STRUCTURE COORDINATE SYSTEM**

\[
\begin{array}{cccccccc}
XDISPL.IN & XDISPL.IN & SLOPE & AXIAL, LBS & LAT, LBS & BM, LBS-IN & STRESS, LBS-IN**2 \\
.110e+01 & .705e+00 & -.412e-02 & .156e+05 & .845e+03 & -.208e+05 & .441e+05 \\
\end{array}
\]

**THE LOCAL MEMBER COORDINATE SYSTEM**

\[
\begin{array}{cccccccc}
XDISPL.IN & XDISPL.IN & SLOPE & AXIAL, LBS & LAT, LBS & BM, LBS-IN & STRESS, LBS-IN**2 \\
.110e+01 & .705e+00 & -.412e-02 & .156e+05 & .845e+03 & -.208e+05 & .441e+05 \\
\end{array}
\]

**LATERALLY LOADED PILE**

\[
\begin{array}{cccccccc}
X & DEFLECTION & MOMENT & SHEAR & SOIL & TOTAL & FLEXURAL \\
IN & IN & LBS-IN & LBS & REACTION & STRESS & RIGIDITY \\
\end{array}
\]

\[
\begin{array}{cccccccc}
.00 & .705e+00 & -.208e+05 & .845e+03 & .905e+01 & .441e+05 & .122e+08 \\
1.80 & .710e+00 & -.194e+05 & .837e+03 & .109e+02 & .415e+05 & .122e+08 \\
3.60 & .718e+00 & -.178e+05 & .818e+03 & .128e+02 & .398e+05 & .122e+08 \\
5.40 & .704e+00 & -.164e+05 & .795e+03 & .147e+02 & .362e+05 & .122e+08 \\
7.20 & .695e+00 & -.148e+05 & .768e+03 & .166e+02 & .334e+05 & .122e+08 \\
9.00 & .681e+00 & -.133e+05 & .738e+03 & .184e+02 & .307e+05 & .122e+08 \\
10.80 & .664e+00 & -.118e+05 & .708e+03 & .203e+02 & .279e+05 & .122e+08 \\
12.60 & .644e+00 & -.102e+05 & .669e+03 & .222e+02 & .252e+05 & .122e+08 \\
14.40 & .621e+00 & -.875e+04 & .629e+03 & .241e+02 & .225e+05 & .122e+08 \\
16.20 & .596e+00 & -.730e+04 & .585e+03 & .259e+02 & .200e+05 & .122e+08 \\
18.00 & .569e+00 & -.591e+04 & .538e+03 & .265e+02 & .175e+05 & .122e+08 \\
19.80 & .540e+00 & -.458e+04 & .491e+03 & .261e+02 & .151e+05 & .122e+08 \\
21.60 & .510e+00 & -.335e+04 & .444e+03 & .255e+02 & .128e+05 & .122e+08 \\
23.40 & .479e+00 & -.211e+04 & .398e+03 & .248e+02 & .107e+05 & .122e+08 \\
25.20 & .447e+00 & -.988e+03 & .353e+03 & .245e+02 & .869e+04 & .122e+08 \\
27.00 & .416e+00 & -.613e+02 & .309e+03 & .239e+02 & .704e+04 & .122e+08 \\
28.80 & .384e+00 & -.365e+02 & .266e+03 & .233e+02 & .877e+04 & .122e+08 \\
30.60 & .352e+00 & -.215e+02 & .224e+03 & .226e+02 & .104e+05 & .122e+08 \\
32.40 & .322e+00 & -.174e+02 & .183e+03 & .220e+02 & .118e+05 & .122e+08 \\
34.20 & .291e+00 & -.135e+02 & .143e+03 & .212e+02 & .131e+05 & .122e+08 \\
36.00 & .262e+00 & -.966e+02 & .105e+03 & .205e+02 & .143e+05 & .122e+08 \\
37.80 & .234e+00 & -.697e+02 & .682e+03 & .198e+02 & .153e+05 & .122e+08 \\
39.60 & .207e+00 & -.447e+02 & .326e+03 & .190e+02 & .161e+05 & .122e+08 \\
41.40 & .181e+00 & -.151e+00 & .182e+02 & .168e+05 & .122e+08 \\
43.20 & .157e+00 & -.586e+00 & .342e+02 & .173e+02 & .174e+05 & .122e+08 \\
45.00 & .135e+00 & -.159e+00 & .654e+02 & .165e+02 & .187e+05 & .122e+08 \\
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<th>Phi (IN)</th>
<th>Gamma 1 (LBS/IN**3)</th>
<th>A</th>
<th>B</th>
<th>Pct</th>
<th>Fcd</th>
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<td>.18D+03</td>
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<th>Dia (IN)</th>
<th>Phi (IN)</th>
<th>Gamma 1 (LBS/IN**3)</th>
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<th>B</th>
<th>Pct</th>
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</table>
DESIGN OF PILE CAP: (ABUTMENT 4)

Maximum load on the pile cap (kips):
Spacing between piles (ft)
Maximum factored moment (kips-ft)
Maximum service moment (kips-ft)

CHECK FOR PILE CAP SHEAR:
Maximum shear (kips)
d (inches)

CHECK FOR PILE CAP TORSION:

Shear capacity of the pile cap (kips)
Aviard (in*2/ft.)(V-U-ΦVQ)0.85.fy.dv
sreq =Avd(Avsvreq)
Shear capacity of pile cap =

FACTORED DESIGN

16.2
3.0
16.2
13.4

48.6
28.8

(see below) \( V_{0}2 + (0.9p)k-\theta_2/(240)^{2}0.5 \)

kips. Provide stirrups #5@12" o.c

0.00
0.0
a.k

0.85*0.0315*0.05*0.05*0.05*bv.dv

287.35

#5 stirrups

287.35 kips

3.10
7.77

sx= spacing of the reinforcement (in)

12

0.0007
### Bridge Design

**Backfill Soil Unit Weight:** 120 psf

**Foundation Soil Unit Weight:** 120 psf

**Soil Bearing Pressure Coefficient:** 84.0 psi

---

#### Bridge Loads

<table>
<thead>
<tr>
<th>Load Description</th>
<th>Load (lbs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dead Weight</td>
<td>43000</td>
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<tr>
<td>Live Load (lbs)</td>
<td>80000</td>
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<tr>
<td>Length of the Abutment (ft)</td>
<td>12</td>
</tr>
<tr>
<td>Dead Weight (lbs/ft)</td>
<td>3583.7</td>
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<tr>
<td>Thermal load (lbs)</td>
<td>6000.0</td>
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</table>

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#### Bridge Dimensions

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<tr>
<th>Dimension</th>
<th>Value</th>
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<tr>
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<tr>
<td>Height above bridge deck (ft)</td>
<td>3.5</td>
</tr>
<tr>
<td>Height below bridge deck (ft)</td>
<td>2.5</td>
</tr>
<tr>
<td>Width above bridge deck (ft)</td>
<td>3.0</td>
</tr>
<tr>
<td>Width below bridge deck (ft)</td>
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#### Load Combinations

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<tr>
<th>Load Combination</th>
<th>Moment arm (ft)</th>
<th>Moment (in-lb)</th>
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<tbody>
<tr>
<td>Vertical Load from Keys</td>
<td>5625.0</td>
<td>-24521.5</td>
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<tr>
<td>Weight of bridge deck (lbs)</td>
<td>1172.8</td>
<td>1079.5</td>
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<tr>
<td>Casting Load (lbs)</td>
<td>0.0</td>
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<tr>
<td>Total Vertical Load (lbs)</td>
<td>12998.8</td>
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#### Horizontal Loads

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<th>Load Description</th>
<th>Load (lbs)</th>
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<tr>
<td>Lateral Load from Soil (lbs)</td>
<td>15353.3</td>
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<tr>
<td>Live Load and Impact (lbs)</td>
<td>7200.0</td>
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<tr>
<td>Impact Load from live load (lbs)</td>
<td>4092.7</td>
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<tr>
<td>Total impact load (lbs)</td>
<td>14950.5</td>
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<tr>
<td>Thermal Load (lbs)</td>
<td>6000.0</td>
</tr>
<tr>
<td>Casting Load (lbs)</td>
<td>0.0</td>
</tr>
<tr>
<td>Total Horizontal Load (lbs)</td>
<td>15593.3</td>
</tr>
</tbody>
</table>

### Analysis

- **Total Moment about Key (in-lb):** 
  
  \[
  \text{Total Moment} = 15593.3 \text{ in-lb} 
  \]

- **Moment about Key (M):**

  \[
  M = -15593.3 \text{ in-lb} 
  \]

**Hnet = 36.7 - 6.25**

**P_{passive} = \frac{1}{2} (3.0) (0.12) (3.0)^2 (12.5) = 20.25 \text{ kN}**

**\delta H = 36.7 - 20.25 = 16.45 \text{kN}**
PILE GROUP ANALYSIS PROGRAM-ROUTE
PC VERSION 4.0 (C) COPYRIGHT EMSOFT, INC. 1996

THE PROGRAM WAS COMPILED USING MICROSOFT FORTRAN
POWERSTATION 4.0 (C) COPYRIGHT MICROSOFT CORPORATION, 1991.

WRITEMARSH VALLEY COUNTRY CLUB LAFAYETTE, PA

****** INPUT INFORMATION ******

Bridge #5

* TABLE C * LOAD AND CONTROL PARAMETERS

UNITS--ENGL
V LOAD, LBS H LOAD, LBS MOMENT, LBS-IN
.1340E+06 .1645E+05 -.1838E+05

* THE LOADING IS STATIC *

KPYOP = 1  (CODE TO GENERATE P-Y CURVES)
( KPYOP = 1 IF P-Y YES; = 0 IF P-Y NO; = -1 IF P-Y ONLY )

* CONTROL PARAMETERS *
TOLERANCE ON CONVERGENCE OF FOUNDATION REACTION = .100E-02 IN
TOLERANCE ON DETERMINATION OF DEFLECTIONS = .100E-02 IN
MAX NO OF ITERATIONS ALLOWED FOR FOUNDATION ANALYSIS = 300
MAXIMUM NO. OF ITERATIONS ALLOWED FOR PILE ANALYSIS = 300

* TABLE D * ARRANGEMENT OF PILE GROUPS

GROUP CONNECT NO OF PILE PILE NO L-S CURVE P-Y CURVE
1 FIX 4 1 1 0
2 FIX 4 1 1 0

GROUP VERT,IN HUR,IN SLOPE,IN/IN GROUND,IN SPRING, IN LBS-IN
1 .0000E+00 .1500E+02 .1745E+00 .0000E+00 .0000E+00
2 .0000E+00 -.1500E+02 .0000E+00 .0000E+00 .0000E+00

* TABLE E * PILE GEOMETRY AND PROPERTIES

PILE SEC INC LENGTH, IN E, LBS/IN**2
1 1 100 .1800E+03 .2900E+08
2 1 100 .1800E+03 .2900E+08

PILE FROM, IN TO, IN DIAM, IN AREA, IN**2 I, IN**4
1 .0000E+00 .1800E+03 .1500E+01 .2250E+01 .4200E+00
* THE PILE ABOVE IS OF LINEARLY ELASTIC MATERIAL *
2 .0000E+00 .1800E+03 .1500E+01 .2250E+01 .4200E+00
* THE PILE ABOVE IS OF LINEARLY ELASTIC MATERIAL *

* TABLE F * AXIAL LOAD VS SETTLEMENT

(THE LOAD-SETTLEMENT CURVE IS GENERATED INTERNALLY)
NUM OF CURVES 2
CURVE 1  NUM OF POINTS 19

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<th>AXIAL LOAD, LBS</th>
<th>SETTLEMENT, IN</th>
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<tbody>
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<td>-.444E+06</td>
<td>-.2960E+01</td>
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<tr>
<td>2</td>
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<td>-.1951E+01</td>
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<td>3</td>
<td>-.441E+06</td>
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<td>-.1011E+06</td>
<td>-.1794E+00</td>
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<td>-.2837E+05</td>
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<td>.2070E+00</td>
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CURVE 2  NUM OF POINTS 19

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</tr>
<tr>
<td>19</td>
<td>.4481E+06</td>
<td>.2977E+01</td>
</tr>
</tbody>
</table>

* TABLE H *  SOIL DATA FOR AUTO P-Y CURVES

SOILS INFORMATION

AT THE GROUND SURFACE = .00 IN

2 LAYER(S) OF SOIL

LAYER 1
THE SOIL IS A CLAY
X AT THE TOP OF THE LAYER = .00 IN
X AT THE BOTTOM OF THE LAYER = 168.00 IN
MODULUS OF SUBGRADE REACTION = .200E+02 LBS/IN**3

LAYER 2
THE SOIL IS A SAND
X AT THE TOP OF THE LAYER = 168.00 IN
X AT THE BOTTOM OF THE LAYER = 240.00 IN
MODULUS OF SUBGRADE REACTION = 600E+02 LBS/IN**3

DISTRIBUTION OF EFFECTIVE UNIT WEIGHT WITH DEPTH
4 POINTS

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<th>WEIGHT, LBS/IN**3</th>
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DISTRIBUTION OF STRENGTH PARAMETERS WITH DEPTH
4 POINTS

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REDUCTION FACTORS FOR CLOSELY-SPACED PILE GROUPS

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WHITEMARSH VALLEY COUNTRY CLUB LAFAYETTE, PA

***** COMPUTATION RESULTS *****

VERT. LOAD, LBS  HORI. LOAD, LBS  MOMENT, IN-LBS
1.340E+06  1.645E+05  -1.038E+05

DISPLACEMENT OF GROUPED PILE FOUNDATION

VERTICAL, IN  HORIZONTAL, IN  ROTATION, RAD
-.117E-01  .267E+00  -.153E-02

NUMBER OF ITERATIONS = 4

* TABLE I * COMPUTATION ON INDIVIDUAL PILE

* PILE GROUP * 1

PILE TOP DISPLACEMENTS AND REACTIONS

THE GLOBAL STRUCTURE COORDINATE SYSTEM

<table>
<thead>
<tr>
<th>XDISPL, IN</th>
<th>YDISPL, IN</th>
<th>SLOPE AXIAL, LBS</th>
<th>LAT, LBS</th>
<th>BM, LBS-IN</th>
<th>STRESS, LBS/IN**2</th>
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<td>-.347E-01</td>
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<td>-.153E-02</td>
<td>.173E+05</td>
<td>.359E+04</td>
<td>-.107E+05</td>
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<td>.267E+00</td>
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THE LOCAL MEMBER COORDINATE SYSTEM

<table>
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<th>XDISPL, IN</th>
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<th>STRESS, LBS/IN**2</th>
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<tr>
<td>.122E-01</td>
<td>.269E+00</td>
<td>-.153E-02</td>
<td>.177E+05</td>
<td>.527E+03</td>
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LATERALLY LOADED PILE

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<td>-.107E+05</td>
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149.40  .730E-29  .138E-19  -.913E-18  -.503E-18  .785E+04  .122E+08
151.20  .622E-31  -.270E-22  -.771E-20  -.429E-20  .785E+04  .122E+08
153.00  .119E-33  .255E-24  .168E-22  .813E-23  .785E+04  .122E+08
154.80  .105E-35  .436E-27  .131E-24  .727E-25  .785E+04  .122E+08
156.60  .192E-38  .386E-29  -.214E-27  -.133E-27  .785E+04  .122E+08
158.40  .179E-40  .110E-24  .618E-29  .113E-29  .785E+04  .122E+08
160.20  .312E-43  .674E-34  .591E-32  .215E-32  .785E+04  .122E+08
162.00  .303E-45  .115E-36  .375E-34  .209E-34  .785E+04  .122E+08
163.80  .506E-48  .114E-38  -.632E-37  -.347E-37  .785E+04  .122E+08
165.60  .182E-41  -.160E-42  -.635E-39  -.353E-39  .785E+04  .122E+08
167.40  .828E-53  -.362E-44  .103E-41  .571E-42  .785E+04  .122E+08
169.20  .415E-50  -.290E-44  .319E-45  .965E-47  .785E+04  .122E+08
171.00  .756E-50  -.220E-46  .301E-45  .183E-46  .785E+04  .122E+08
172.80  .104E-49  -.161E-44  .268E-45  .262E-46  .785E+04  .122E+08
174.60  .128E-49  -.984E-45  .221E-45  .337E-46  .785E+04  .122E+08
176.40  .149E-49  -.517E-45  .160E-45  .409E-46  .785E+04  .122E+08
178.20  .169E-49  -.181E-45  .866E-46  .492E-46  .785E+04  .122E+08
180.00  .189E-49  -.892E-59  .000E+00  .558E-46  .785E+04  .122E+08

NUMBER OF ITERATIONS IN LLP = 7

* PILE GROUP * 2

PILE TOP DISPLACEMENTS AND REACTIONS

THE GLOBAL STRUCTURE COORDINATE SYSTEM

XDISPL, IN YDISPL, IN SLOPE AXIAL, LBS LAT, LBS SM, LBS-IN STRESS, LBS/IN**2

.112E-01  .267E+00  -.153E-02  .162E+05  .536E+03  -.107E+05  .264E+05

THE LOCAL MEMBER COORDINATE SYSTEM

XDISPL, IN YDISPL, IN SLOPE AXIAL, LBS LAT, LBS SM, LBS-IN STRESS, LBS/IN**2

.112E-01  .267E+00  -.153E-02  .162E+05  .536E+03  -.107E+05  .264E+05

LATERALLY LOADED PILE

X DEFLECTION MOMENT SHEAR SOIL TOTAL FLEXURAL

IN IN LBS-IN LBS LBS-IN LBS-IN**2 LBS-IN**2

***** ******** ******** ******** ******** ******** ********

.00  .267E+00  -.107E+05  .536E+03  .687E+01  .264E+05  .122E+08
.40  .268E+00  -.900E+04  .530E+03  .933E+01  .247E+05  .122E+08
.80  .267E+00  -.866E+04  .515E+03  .976E+01  .230E+05  .122E+08
1.20  .264E+00  -.790E+04  .498E+03  .112E+02  .213E+05  .122E+08
1.60  .258E+00  -.665E+04  .477E+03  .152E+02  .196E+05  .122E+08
2.00  .250E+00  -.601E+04  .455E+03  .138E+02  .175E+05  .122E+08
2.40  .241E+00  -.508E+04  .430E+03  .150E+02  .163E+05  .122E+08
2.80  .230E+00  -.419E+04  .403E+03  .162E+02  .147E+05  .122E+08
3.20  .219E+00  -.333E+04  .374E+03  .172E+02  .131E+05  .122E+08
3.60  .208E+00  -.251E+04  .343E+03  .182E+02  .117E+05  .122E+08
4.00  .193E+00  -.173E+04  .310E+03  .185E+02  .103E+05  .122E+08
4.40  .179E+00  -.101E+04  .277E+03  .181E+02  .901E+04  .122E+08
4.80  .165E+00  -.348E+03  .244E+03  .176E+02  .782E+04  .122E+08
5.20  .153E+00  -.180E+03  .213E+03  .171E+02  .679E+04  .122E+08
5.60  .137E+00  .815E+03  .182E+03  .166E+02  .865E+04  .122E+08
6.00  .124E+00  .131E+04  .152E+03  .160E+02  .954E+04  .122E+08
6.40  .110E+00  .175E+04  .123E+03  .154E+02  .103E+05  .122E+08
6.80  .979E+01  .751E+04  .948E+02  .148E+02  .110E+05  .122E+08
7.20  .851E+01  .246E+04  .688E+02  .142E+02  .116E+05  .122E+08
7.60  .734E+01  .272E+04  .432E+02  .135E+02  .121E+05  .122E+08
8.00  .624E+01  .293E+04  .189E+02  .129E+02  .124E+05  .122E+08
8.40  .522E+01  .309E+04  .414E+01  .121E+02  .127E+05  .122E+08
8.80  .428E+01  .320E+04  .259E+02  .114E+02  .129E+05  .122E+08
9.20  .343E+01  .325E+04  .464E+02  .108E+02  .130E+05  .122E+08
9.60  .264E+01  .326E+04  .658E+02  .903E+01  .130E+05  .122E+08
10.00  .196E+01  .322E+04  .831E+02  .892E+01  .129E+05  .122E+08

### GENERATED P-Y CURVES FOR FILE GROUP NO. 2

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<th>DEPTH BELOW GS</th>
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<th>C</th>
<th>GAMMA</th>
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|                |      | .001 |         |         |         |         |
|                |      | .019 |         |         |         |         |
|                |      | .037 |         |         |         |         |
|                |      | .056 |         |         |         |         |
|                |      | .075 |         |         |         |         |
|                |      | .094 |         |         |         |         |
|                |      | .113 |         |         |         |         |
|                |      | .131 |         |         |         |         |
|                |      | .150 |         |         |         |         |
|                |      | .169 |         |         |         |         |
|                |      | .187 |         |         |         |         |
|                |      | .206 |         |         |         |         |
|                |      | .225 |         |         |         |         |
|                |      | .600 |         |         |         |         |
|                |      | 1.125|         |         |         |         |
|                |      | 1.500|         |         |         |         |

<table>
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<p>| 150.00         | 1.500| .000 | .2000D+01 | .3300D-01 | .2000D-01 |
|                |      | .000 |         |         |         |         |
|                |      | .001 |         |         |         |         |
|                |      | .019 |         |         |         |         |
|                |      | .037 |         |         |         |         |
|                |      | .056 |         |         |         |         |
|                |      | .075 |         |         |         |         |
|                |      | .094 |         |         |         |         |
|                |      | .113 |         |         |         |         |
|                |      | .131 |         |         |         |         |
|                |      | .150 |         |         |         |         |
|                |      | .169 |         |         |         |         |
|                |      | .187 |         |         |         |         |
|                |      | .206 |         |         |         |         |
|                |      | .225 |         |         |         |         |
|                |      | .600 |         |         |         |         |
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|                |      | 1.500|         |         |         |         |</p>
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<tr>
<td>Live load (lbs)</td>
<td>30900</td>
<td>Load from before the bridge back wall (lbs)</td>
</tr>
<tr>
<td>Length of the approach (ft)</td>
<td>52</td>
<td>Height of parapet (lbs)</td>
</tr>
<tr>
<td>Load Weight (lbs)</td>
<td>13535.3</td>
<td>Rating width - ft</td>
</tr>
<tr>
<td>Thermal load (lbs)</td>
<td>38457</td>
<td>Rating height - ft</td>
</tr>
<tr>
<td>Unit</td>
<td>34.0</td>
<td>Rating weight - lbs</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th></th>
<th>Moment arm (ft) from (lbs)</th>
<th>Moment about toe (lbs-ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>VERTICAL</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Load from bridge back wall</td>
<td>4.50</td>
<td>2.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Load from before the bridge back wall</td>
<td>4.07</td>
<td>-56953.4</td>
<td>0.00</td>
</tr>
<tr>
<td>Height of parapet</td>
<td>2015.3</td>
<td>4.75</td>
<td>-64150.8</td>
</tr>
<tr>
<td>Rating width</td>
<td>35166.1</td>
<td>2.03</td>
<td>54799.6</td>
</tr>
<tr>
<td>Rating height</td>
<td>139080.0</td>
<td>2.42</td>
<td>-13206.7</td>
</tr>
<tr>
<td>Rating weight</td>
<td>0.9</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Rating arm</td>
<td>0.0</td>
<td>0.417</td>
<td>0.00</td>
</tr>
</tbody>
</table>

| HORIZONTAL | | | |
| Load from wind (lbs) | 22000.7 | 3.00 | 62500.0 |
| Load from wind (lbs) | 35485.8 | 4.75 | 53793.8 |
| Load from wind (lbs) | 3353.9 | 4.67 | 29452.0 |
| Load from wind (lbs) | 1808.2 | 5.60 | 10995.1 |
| Thermal load (lbs) | 7806.0 | 5.60 | 51590.0 |
| Braking load (lbs) | 0.0 | 3.50 | 0.00 |

| Total moment about toe (lbs-ft) | 30485.8 |
| Moment about (lbs-ft) | 215.0 |
| Total in (lbs-ft) | 16.7 |
| Total M (lbs-ft) | 30485.8 |
DESIGN OF PILE CAP: (ABUTMENT 5)

Maximum load on the pile cap (kips)/ft
Spacing between piles (ft)
Maximum factored moment (kips-ft)
Maximum service moment (kips-ft)

CHECK FOR PILE CAP SHEAR:
Maximum shear (kips)
d (inches)

CHECK FOR PILE CAP TORSION:
Shear capacity of the pile cap (kips)
Aviareq (in2/lin.) (Vu=ΦVc)/0.85 fy.dv
Avireq = Avireq(Avireq)
Shear capacity of pile cap =

FACTORED DESIGN

14.8
3.5
22.7
18.4
51.8
28.8

(see below) \( (V_u^2 + (0.9 p_h T_u/2 A_o) r^2) \times 0.5 \)

kips. Provide stimps #5@12" o.c.

0.00
0.0
0.0

278.52 kips

0.05^0.0316^0.5*bv.dv
278.52 kips

3.00
7.77
0.008

\( b = 4.8(1+750.85)/51(58+80) \)
\( s = 2.0 \times 1.38(58+0.63) \)
\( c_{sp} = (Mult + \Phi)/\Phi[Es, Ax] \)

sp = spacing of the reinforcement (in) 12
ABUTMENT FOOTING DESIGN:

1.0 CHECK FOR THE DISTRIBUTION OF REINFORCEMENT FOR FLEXURAL CRACKING CONTROL
AASHTO LRFD SPECIFICATIONS SECTION 5.7.3.4

Size of the bar #  #6
Width of the beam, b (in)  12.0
Net design depth, d (in)  32.00
dc (in)  4.00
bar diameter (in)  0.75
c/s area of the bar (in^2)  0.44
spacing (in)  12.0
no: of bars (n)  1.00
Area of steel, As (in^2)  0.44
fy (kips/in^2)  60
f'c (kips/in^2)  4000
M (ft-kips) (service load moment)  16.40
M' (ft-kips) (factored load moment)  22.7
γ e (exposure factor)  0.75
fss (ksi)  14.0

\[ \beta_s = 1 + \frac{dc}{0.7(h - dc)} \]

\[ \text{Note: } sact < 700 \text{ye/} \beta_s \cdot \text{fss - 2 de} \]

700 ye/βs fss - 2 de  23.7  O.K

2.0 CHECK FOR MINIMUM REINFORCEMENT FOR CRACKING CONTROL
AASHTO LRFD SPECIFICATION 5.7.3.3.2

<table>
<thead>
<tr>
<th>Total Depth (in)</th>
<th>36</th>
</tr>
</thead>
</table>

\begin{array}{|c|c|c|c|}
\hline
fcr (psi) & lg (in^4) & yt & Mcr (ft-k) \\
\hline
480.0 & 46656.0 & 18.0 & 103.7 \\
\hline
\end{array}

Criterion:
\[ \varphi M_n \geq \text{the lesser of } M_{cr} \text{ and } 1.33 M_u \]

3.0 [1.33Mu]

<table>
<thead>
<tr>
<th>Mu (ft-kips)</th>
<th>a (in) (assumed)</th>
<th>b (in)</th>
<th>d (in)</th>
<th>As (in^2)</th>
<th>a cal (in)</th>
</tr>
</thead>
<tbody>
<tr>
<td>30.19</td>
<td>0.31</td>
<td>12.0</td>
<td>32.0</td>
<td>0.21</td>
<td>0.31</td>
</tr>
</tbody>
</table>

As provided = 0.44 sq.in

[\varphi M_n (ft-kips) > 1.33 Mu (ft-kips)] O.K

CBC # 22865
ABUTMENT WALL DESIGN:

1.0  CHECK FOR THE DISTRIBUTION OF REINFORCEMENT FOR FLEXURAL CRACKING CONTROL:
AASHTO LRFD SPECIFICATIONS SECTION 5.7.3.4

Size of the bar #  #6
Width of the wall, b (in)  12.0
Net design depth, d (in)  26.63
dc (in)  3.38
bar diameter (in)  0.75
c/s area of the bar (in^2)  0.44
spacing (in)  12.0
no. of bars (n)  1.00
Area of steel, As (in^2)  0.44
fy (kips/in^2)  60
f'c (kips/in^2)  4000
M (ft-kips) (service load moment)  13.93
M (ft-kips) (factored load moment)  21.0
γ e (exposure factor)  0.75
fss (ksi)  14.4

\[ β_s = 1 + \frac{dc}{0.7(h - dc)} \]

\[ 1.181 \]

Note: \[ sact < 700ye/βs.fss - 2 de \]

700ye/βs.fss - 2 de  24.2  O.K

2.0  CHECK FOR MINIMUM REINFORCEMENT FOR CRACKING CONTROL:
AASHTO LRFD SPECIFICATION 5.7.3.3.2

<table>
<thead>
<tr>
<th>Total Depth (in)</th>
<th>30</th>
</tr>
</thead>
<tbody>
<tr>
<td>fcr (psi)</td>
<td>480.0</td>
</tr>
<tr>
<td>lg (in^4)</td>
<td>27000.0</td>
</tr>
<tr>
<td>γt</td>
<td>15.0</td>
</tr>
<tr>
<td>Mcr (ft-k)</td>
<td>72.0</td>
</tr>
</tbody>
</table>

Criterion:
\[ φMn ≥ the \ lesser \ of \ Mcr \ and \ 1.33 \ Mu \]

3.0  (1.33Mu)

<table>
<thead>
<tr>
<th>Mu (ft-kips)</th>
<th>a (in) (assumed)</th>
<th>b (in)</th>
<th>d (in)</th>
<th>As (in^2)</th>
<th>a cal (in)</th>
</tr>
</thead>
<tbody>
<tr>
<td>27.87</td>
<td>0.34</td>
<td>12.0</td>
<td>26.6</td>
<td>0.23</td>
<td>0.34</td>
</tr>
</tbody>
</table>

As provided = 0.44 sq.in

\[ φMn (ft-kips) > 1.33 \ Mu (ft-Kips) \]

O.K
WING WALL DESIGN:

1.0 CHECK FOR THE DISTRIBUTION OF REINFORCEMENT FOR
FLEXURAL CRACKING CONTROL:
AASHTO LRFD SPECIFICATIONS SECTION 5.7.3.4

Size of the bar #
Width of the wall, b (in)
Net design depth, d (in)
dc (in)
bar diameter (in)
c/s area of the bar (in^2)
spacing (in)
no. of bars (n)
Area of steel, As (in^2)
fy (kips/in^2)
f'c (kips/in^2)
M (ft-kips) (service load moment)
M (ft-kips) (factored load moment)
γ e (exposure factor)
Fss (ksi)

\[ \beta_s = 1 + \frac{dc}{0.7(h - dc)} = 1.341 \]

Note: sact < 700ye/βs.fss - 2 de
700ye/βs.fss - 2 de = 14.9 O.K

2.0 CHECK FOR MINIMUM REINFORCEMENT FOR CRACKING CONTROL:
AASHTO LRFD SPECIFICATION 5.7.3.3.2

<table>
<thead>
<tr>
<th>Total Depth (in)</th>
<th>12</th>
</tr>
</thead>
<tbody>
<tr>
<td>fcr (psi)</td>
<td>480.0</td>
</tr>
<tr>
<td>k (in^4)</td>
<td>1728.0</td>
</tr>
<tr>
<td>yt</td>
<td>6.0</td>
</tr>
<tr>
<td>Mcr (ft-k)</td>
<td>11.5</td>
</tr>
</tbody>
</table>

Criterion:
ϕMn ≥ the lesser of Mcr and 1.33 Mu

3.0

<table>
<thead>
<tr>
<th>Mu (ft-kips)</th>
<th>a (in) (assumed)</th>
<th>b (in)</th>
<th>d (in)</th>
<th>As (in^2)</th>
<th>a cal (in)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1.33Mu)</td>
<td>8.60</td>
<td>0.29</td>
<td>12.0</td>
<td>9.7</td>
<td>0.20</td>
</tr>
</tbody>
</table>

As provided = 0.31 sq.in

ϕMn (ft-kips) > 1.33 Mu (ft-kips) O.K
APPENDIX B
PRINTS
CONTECH ENGINEERED SOLUTIONS, LLC
DESIGN OF CONCRETE ABUTMENTS & WINGWALLS ON HELICAL PIER FOUNDATIONS FOR TWO (2) PROPOSED PEDESTRIAN BRIDGES (613585); WHITEMARSH VALLEY COUNTRY CLUB, LAFAYETTE, PENNSYLVANIA

INDEX

1. TITLE SHEET/INDEX
2. PLAN, PROFILE & DETAILS (BRIDGE #4B)
3. PLAN, PROFILE & DETAILS (BRIDGE #5)
4. TYPICAL BRIDGE & WINGWALL DETAILS
5. SPECIFICATIONS
CONTECH ENGINEERED SOLUTIONS, LLC

DESIGN OF CONCRETE ABUTMENTS & WINGWALLS ON HELICAL PIER FOUNDATIONS FOR TWO (2) PROPOSED PEDESTRIAN BRIDGES (613585); WHITEMARSH VALLEY COUNTRY CLUB, LAFAYETTE, PENNSYLVANIA

PLAN VIEW

ABUTMENT PLAN

ABUTMENT ELEVATION

COMBINE REACTIONS AS PER LOCAL OR GOVERNING BUILDING CODES AS REQUIRED

PROFILE THROUGH CENTERLINE OF BRIDGE 4B

NOTE: SCALE SHOWN ON BRIEF SHEET EXCEEDS, INC. DRAWING, SHEET 2 OF 5

1/17/20

JBE

Drawn

Date

Project No.

Sheet

Rev.

Approved

By

Scale

CBC-22963

OF GRAPHIC

CBC-22963

PLAN, PROFILE & DETAILS (BRIDGE #4 B)
CONTECH ENGINEERED SOLUTIONS, LLC
DESIGN OF CONCRETE ABUTMENTS & WINGWALLS ON HELICAL PIER FOUNDATIONS FOR TWO (2) PROPOSED PEDESTRIAN BRIDGES (613585); WHITEMARSH VALLEY COUNTRY CLUB, LAFAYETTE, PENNSYLVANIA

PLAN, PROFILE & DETAILS (BRIDGE #5)

ABUTMENT PLAN

ABUTMENT ELEVATION

PROFILE THROUGH CENTERLINE OF BRIDGE 5
CONTECH ENGINEERED SOLUTIONS, LLC
DESIGN OF CONCRETE ABUTMENTS & WINGWALLS
ON HELICAL PIER FOUNDATIONS FOR TWO (2) PROPOSED PEDESTRIAN BRIDGES (613585); WHITEMARSH VALLEY COUNTRY CLUB, LAFAYETTE, PENNSYLVANIA

TYPICAL ABUTMENT SECTION

TYPICAL WINGWALL SECTION

TYPICAL ABUTMENT/WINGWALL CORNER

NOTE:
1) STRUCTURAL DESIGN SPECIFICATIONS
AND DETAILS FOR HELICAL PIES ARE
TO BE PROVIDED BY SPECIALTY CONTRACTOR.

2) HELICAL PIES TO BE DESIGNED BY OTHERS.

TYPICAL ABUTMENT & WINGWALL DETAILS

DRAWN

CONTECH ENGINEERED SOLUTIONS, LLC
4/22/20

5/20/20

5/20/20

CONFIDENTIALITY NOTICE

CONTECH ENGINEERED SOLUTIONS, LLC

500 CONSTRUCTION PLAIN (610-708-0000)
SPECIFICATIONS

CONTECH ENGINEERED SOLUTIONS, LLC
DESIGN OF CONCRETE ABUTMENTS & WINGWALLS ON HELICAL PIER FOUNDATIONS FOR TWO (2) PROPOSED PEDESTRIAN BRIDGES (613585); WHITEMARSH VALLEY COUNTRY CLUB, PA.

1.0 GENERAL

1.1 The Contractor shall furnish all labor, material and equipment and perform all work and services except those not specifically furnished by the Owner, necessary to accomplish a satisfactory manner in the proportion, excavation, forming, placing, compacting, grading as shown on the plans and as described herein.

2.0 GENERAL CONDITIONS

2.1 The Contractor shall furnish all labor, material and equipment and perform all work and services except those not specifically furnished by the Owner, necessary to accomplish a satisfactory manner in the proportion, excavation, forming, placing, compacting, grading as shown on the plans and as described herein.

3.0 FOUNDATIONS

3.1 Foundation excavation shall consist of the removal of all materials, whatever nature, necessary for the construction of the foundations.

3.2 All works, rates, and local regulations shall be strictly adhered to relative to equipment and the man-hours necessary for the construction of the foundations.

3.3 Foundation excavation shall be performed in accordance with the plans established by the Engineer.

3.4 Foundation excavation shall be performed in accordance with the plans established by the Engineer.

4.0 CONSTRUCTION DETAILS

4.1 The Engineer shall furnish and place all foundation excavation as specified and shown on the plans.

4.2 All works, rates, and local regulations shall be strictly adhered to relative to equipment and the man-hours necessary for the construction of the foundations.

4.3 Foundation excavation shall be performed in accordance with the plans established by the Engineer.

5.0 PLACING AND FASTENING

5.1 Foundation reinforcement shall be accurately placed as shown on the plans and firmly held in position during the framing and placing of concrete. Where it shall be necessary to reduce the dimensions around the perimeter of each ramp or at increments of 6 inches or less at any other location, omission of the reinforcing within said perimeter shall be performed by the Engineer.

5.2 Shrinkage, expansion, or settlement of the Owner shall be furnished at the expense of the Owner.

5.3 All reinforcement shall be financially taken care of by the Owner.

5.4 All reinforcement shall be furnished and placed in accordance with the plans.

5.5 All reinforcement shall be furnished and placed in accordance with the plans.

5.6 All reinforcement shall be furnished and placed in accordance with the plans.

6.0 CONCRETE

6.1 All reinforcement shall be furnished and placed in accordance with the plans.

6.2 All reinforcement shall be furnished and placed in accordance with the plans.

6.3 All reinforcement shall be furnished and placed in accordance with the plans.

6.4 All reinforcement shall be furnished and placed in accordance with the plans.
1) Design Code
   a. AISC - LRFD - All design stresses shall be in accordance with the Manual of Steel Construction for Load and Resistance Factor Design (14th Ed.) as adopted by the American Institute of Steel Construction (AISC).

2) Bridge Loading:
   a. DL = Bridge Steel Weight
   b. DK = Bridge Deck Weight
   c. LL = Live Load – 100 psf uniform load reduced to 82 psf
   d. WL = Wind Load – 40 psf against the full vertical projection of the bridge, as if enclosed.
   e. VL = Vehicle Load – 20,000 lb. vehicle load

3) Load Combinations
   a. TD – Total Dead Load = DL + DK
   b. 1.2TD + 1.6LL
   c. 1.2TD + 1.0WL + 1.0LL
   d. 1.2TD + 1.0LL
   e. 0.9TD + 1.0WL
   f. 1.2TD + 1.6VL1
   g. 1.2TD + 1.6VL2

4) ConTech used STAAD for analysis and Excel for design of its bridges. Input for the program is shown; where analysis print out is not included due to its great length. Design checks are shown for the indicated critical member and their controlling load combinations. Connection checks are per AWS using E70XX electrodes. Actual electrodes used are the E80XX.

5) Deflection
   a. AISC – LRFD – Live Load deflection is limited to span length x 1/400. Wind Load deflection limited to span length x 1/500.
TITLE: PEDESTRIAN BRIDGE 70'-0" x 6'-0"
LOCATION: LAFAYETTE HILL, PA
CONTECH BRIDGE NO. 613858-20

1) Design Code
   a. AISC - LRFD - All design stresses shall be in accordance with the Manual of Steel Construction
      for Load and Resistance Factor Design (14th Ed.) as adopted by the American Institute of Steel
      Construction (AISC).

2) Bridge Loading:
   a. DL = Bridge Steel Weight
   b. DK = Bridge Deck Weight
   c. LL = Live Load – 100 psf uniform load
   d. WL = Wind Load – 40 psf against the full vertical projection of the bridge, as if enclosed.
   e. VL = Vehicle Load – 4,000 lb. vehicle load

3) Load Combinations
   a. TD = Total Dead Load = DL + DK
   b. 1.2TD + 1.6LL
   c. 1.2TD + 1.0WL + 1.0LL
   d. 1.2TD + 1.0LL
   e. 0.9TD + 1.0WL
   f. 1.2TD + 1.6VL1
   g. 1.2TD + 1.6VL2

4) Contech used STAAD for analysis and Excel for design of its bridges. Input for the program is shown;
   where analysis print out is not included due to its great length. Design checks are shown for the
   indicated critical member and their controlling load combinations. Connection checks are per AWS
   using E70XX electrodes. Actual electrodes used are the E80XX.

5) Deflection
   a. AISC – LRFD – Live Load deflection is limited to span length x 1/400. Wind Load deflection
      limited to span length x 1/500.
DECK & CONCRETE NOTES

1. Galvanized steel deck shall be 1/2" deep. Form deck will be 1" deep. Attach rollers to floor beams with 1" OD. BURST STAINLESS STEEL EXTERNAL NUTS AND BOLTS.

2. Reinforcement shall be as marked and conform to the requirements of ASTM A 615.

3. Concrete deck and reinforcement shall be as shown and designed to be furnished and installed as per this detail. The concrete strength of the deck reinforcement shall be designed for a minimum of 2800 psi flexural strength. The maximum aggregate size of 3/4". Place 3" deep roller cleats in every other 4' along the deck.

4. Concrete cover of 2 1/2" above transverse reinforcement shall be strictly maintained.

5. Concrete design, quality, mixed, and placed shall be in accordance with building code requirements for structural concrete to 240 and specification for structural concrete to ADG 301-94.

6. Compressive strength shall be 2800 psi minimum. Concrete must be cured for a minimum of 7 days after placing. Concrete cover shall be in accordance with the requirements of ADG 304-94. THE CONTRACTOR IS RESPONSIBLE FOR COMPLIANCE.

7. The contractor must exercise care to control traffic and storage in an area of at least 3 feet before pouring the slab. All work must be finished and protected against damage. Absorptive materials may require the use of a material, construction systems, or concrete placing equipment.

Note: 3 feet distant from floor slabs.

REINFORCEMENT

CONTRACTOR NOTEE
LENGTH OF REBAR
DO NOT INCLUDE HOOK LENGTHS

REBAR

DECK SLAB LAYOUT

CONTRACTOR NOTE:
REINFORCE CONCRETE DECK @ 6" TO MATCH UPLIFT REQUIREMENTS

CONTRACTOR NOTE:
REINFORCE CONCRETE DECK @ 6" TO MATCH UPLIFT REQUIREMENTS

NOTICE
IF REBAR IS REQUIRED IN LOADING, REBAR, UP SPICE LENGTH WILL BE AS SHOWN. ATTACH RCION CLEARLY MARKED, WITH 2, 3, 4, 5, OR 6" DISTANCES BETWEEN FLOOR SLABS.

LENGTH (INCHES)
SPAN / INCLUDED
HORIZONTAL / SPICE
6 / 10"-12"
84 / 6"-20"
6 / 12"-20"
4 / 12"-12"

THE TABLE SHOWN ARE FOR F = 4,000
PION (L/E)

STANDARD SPICE AND HOOK LENGTH DETAILS
NORMAL WEIGHT CONCRETE (144 PIES)

CONSTRUCTION JOINT DETAIL

CONCRETE DECK

FORM DECK

CONCRETE DECK

FORM DECK

CONCRETE DECK

FORM DECK

CONCRETE DECK

FORM DECK

CONCRETE DECK

FORM DECK

CONCRETE DECK

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