# Township of Falls

188 Lincoln Highway, Suite 100
Fairless Hills, PA 19030
(215)-949-9000
E-Mail: admin@fallstwp.org
Website: www.fallstwp.com



August 1, 2017

Marcel L. Groen, Esquire
Fox Rothschild, LLP
10 Sentry Parkway, Suite 200
P.O. Box 3001
Blue Bell, PA 19422-3001

Re: Elcon Recycling Services, LLC zoning letter of consistency.

Dear Mr. Groen:

The requested signed and dated zoning consistency letter is enclosed.

Sincerely,

Thomas A. Bennett, CFM
188 Lincoln Highway, Suite 100
Fairless Hills, PA 19030
215-949-9000 x 251
tbennett@fallstwp.org

Is there a legal challenge by the applicant with regard to zoning for the proposed project?

No

Name and Contact Information for Municipal Zoning Officer:

Tom Bennett, Chief Code Enforcement Officer / ZoningOfficer
188 Lincoln Highway, Suite 100
Fairless Hills, PA 19030

Additional Comments (attach additional sheets if necessary):

Submitted By:

| | |
|---|---|
| Name | Tom Bennett |
| Title | Chief Code Enforcement Officer / Zoning Officer |
| Contact Information (Address & Phone) | 188 Lincoln Highway, Suite 100<br>Fairless Hills, PA 19030 (215) 949-9000, Ext. 251 |
| Signature | |
| Date | 8-1-17 |


**ATTACHMENT A1-2**

**ARMY CORPS JURISDICTIONAL DETERMINATION**

DEPARTMENT OF THE ARMY

PHILADELPHIA DISTRICT CORPS OF ENGINEERS
WANAMAKER BUILDING, 100 PENN SQUARE EAST
PHILADELPHIA, PENNSYLVANIA 19107-3390

REPLY TO
ATTENTION OF

JAN 05 2015

Regulatory Branch
Application Section I

SUBJECT: CENAP-OP-R 2014-1004-39 (Preliminary JD)
Project Name: Elcon Recycling Services
Latitude and Longitude: 40.168° N/-74.761° W

Zvi Elgat
Elcon Recycling Services
11 LeParc Drive
Princeton, New Jersey 08550

Dear Mr. Elgat:

This letter is written with regard to your request for verification of a preliminary jurisdictional determination. The property associated with your request is located at, Tax Parcel Number 13-51-1-5 adjacent to Dan Sievers Place ,AKA Kuehn Circle, in Falls Township, Bucks County, Pennsylvania.

Pursuant to Section 10 of the Rivers and Harbors Act and Section 404 of the Clean Water Act, a Department of the Army permit is required for work or structures in navigable waters of the United States and the discharge of dredged and/or fill material into waters of the United States, including adjacent and isolated wetlands. Any proposal to perform the above activities within any waters of the United States, including wetlands, requires the prior approval of this office.

The plans identified on the following page depict all delineated waters and wetlands on the subject site that may be jurisdictional under Section 10 of the Rivers and Harbor Act and/or Section 404 of the Clean Water Act. This preliminary determination has been conducted to identify the location(s) of waters and wetlands that may be waters of the United States for the particular site identified in this request. This determination may not be valid for the wetland conservation provisions of the Food Security Act of 1985, as amended. If you or your tenant are U.S. Department of Agriculture (USDA) program participants, or anticipate participating in USDA programs, you should request a certified wetland determination from the local office of the Natural Resources Conservation Service prior to starting work.

This preliminary jurisdictional determination is non-binding and indicates that there may be waters of the United States, including wetlands, on the parcel. Preliminary JDs are advisory in nature and may not be appealed (See attached Notification of Appeal Form (Enclosure 1)); however, the applicant retains the right to request an approved Jurisdictional Determination, which may be appealed, for the site. Also enclosed (Enclosure 2) is a copy of the Preliminary

Jurisdictional Determination Form signed by the applicant or his agent agreeing to accept a preliminary jurisdictional determination. Please be aware that for purposes of computation of impacts, compensatory mitigation requirements, and other resource protection measures, a permit decision made on the basis of a preliminary JD will treat all waters and wetlands that would be affected in any way by the permitted activity on the site as if they are jurisdictional waters of the U.S.

This letter is valid for a period of five (5) years. This preliminary jurisdictional determination is issued in accordance with current Federal regulations and is based upon the existing site conditions and information provided by you in your application. This office reserves the right to reevaluate and modify the preliminary jurisdictional determination at any time should existing site conditions or Federal regulations change, or should the information provided by you prove to be false, incomplete, or inaccurate.

If you have any questions regarding this matter, please contact Mr. Lawrence Slavitter at (215) 656-6734 or write to the above address.

Sincerely,

Lawrence M. Slavitter
Biologist

**********

SUBJECT PROPERTY: Elcon Recycling Services; 32 acres; Tax Map Parcel Number 13-51-1-5; adjacent to Dan Sievers Place (AKA Kuehn Circle, in Falls Township, Bucks County, Pennsylvania.

**********

SURVEY DESCRIPTION: Plot plan prepared by Gilmore and Associates, Incorporated, entitled "ALTA/ACSM Land Title Survey..."; dated March 28, 2014; last revised November 14, 2014, scale 1" = 50'; sheet 1 of 1.

**********

COMMENTS: Site inspection by representative of this office on November 14, 2014.

**********

Enclosures

Copies Furnished:
PADEP, SE Regional Office (Norristown, PA)
Bucks County Conservation District

Scott Bush
Conestoga-Rovers & Associates, Inc.
410 Eagleview Boulevard Suite 110
Exton, Pennsylvania 19341

ENGINEERS

1720 Walton Road, Blue Bell, PA 19422 610-828-3078 Fax 610-828-7842

April 17, 2019


E-MAIL
Mr. Erik Garton, P.E.
Vice President, Municipal Services Manager
Gilmore & Associates, Inc.
65 E. Butler Avenue, Suite 100
New Britain, PA 18901

Subject: Sanitary Sewer and Water Service Calculations
Elcon Recycling, Falls Township, Pennsylvania, Facility
IES Project No. EG181065.02

Dear Erik:

Please find attached the calculation sheets for the estimated sanitary sewer and water service to the buildings at the proposed Elcon Recycling facility in Falls Township, Pennsylvania. The calculations are based on the preliminary architectural programming. The sanitary sewer service demand is estimated to be approximately 4,900 gpd. The water service demand to the buildings is estimated to be approximately 4,700 gpd. In addition, there will be an estimated 40,000 gpd water demand to support the process, primarily for steam generation. This results in a total estimate of 44,700 gpd fresh water demand for the site.

Please do not hesitate to contact me if you have any questions.

Very truly yours,

*James R. Rutenbar* /e/
James R. Rutenbar, P.E., LEED AP
Director,
Engineering and Construction

Attachments
cc: Z. Elgat, Elcon
M. Fitzpatrick, IES
A. Soni, IES

| Job Number & Name | Calc By | Chkd By |
|---|---|---|
| Elcon Recycling - 18307 | RR | RR |
| Description | | Date |
| Building Sanitary Waste Demand | | 04/15/19 |

The site sanitary waste water demand shall be determined by calculating the following: The total number of occupants (total site population), mechanical waste and or floor drain waste demands, and Mechanical Equipment.

**Office Building:**

| | Miscillaneous Equipment | Assumed Visitor Population | Programmed Building Population | | Gallons per Day per Person (see note # 1) | | Total Gallons per Day |
|---|---|---|---|---|---|---|---|
| Visitor Population | | 8 | | x | 20 | = | 160 |
| Building Population | | | 30 | x | 20 | = | 600 |
| Ice machine in refrigerators | 1 | | | x | 0.5 | = | 1 |
| Mothers Room | 1 | | | x | 5 | = | 5 |
| SUB-TOTAL GALLONS | | | | | | = | 766 |

**Maintenance Building:**

| | Miscillaneous Equipment | Programmed Building Population | | Gallons per Day per Person (see note # 1) | | Total Gallons per Day |
|---|---|---|---|---|---|---|
| Building Population | | 20 | x | 20 | = | 400 |
| Wash hose station | 1 | | x | 7 | = | 7 |
| Combo Emergency/eyewsh Shower | 1 | | x | 300 | = | 300 |
| SUB-TOTAL GALLONS | | | | | = | 707 |

**Utilities Building:**

| | Miscillaneous Equipment | Programmed Building Population | | Gallons per Day per Person (see note # 1) | | Total Gallons per Day |
|---|---|---|---|---|---|---|
| Building Population | | 40 | x | 20 | = | 800 |
| Wash hose station | 1 | | x | 7 | = | 7 |
| Combo Emergency/eyewsh Shower | 1 | | x | 300 | = | 300 |
| SUB-TOTAL GALLONS | | | | | = | 1,107 |

**Production Plant:**

| | Miscillaneous Equipment | Programmed Building Population | | Gallons per Day per Person (see note # 1) | | Total Gallons per Day |
|---|---|---|---|---|---|---|
| Building Population | | 30 | x | 20 | = | 600 |
| Wash hose station | 1 | | x | 7 | = | 7 |
| Combo Emergency/eyewsh Shower | 1 | | x | 300 | = | 300 |
| Ice machine in refrigerators | 1 | | x | 0.5 | = | 1 |
| SUB-TOTAL GALLONS | | | | | = | 908 |

**Production Warehouse:**

| | Miscillaneous Equipment | Programmed Building Population | | Gallons per Day per Person (see note # 1) | | Total Gallons per Day |
|---|---|---|---|---|---|---|
| Building Population | | 15 | x | 20 | = | 300 |
| Wash hose station | 1 | | x | 7 | = | 7 |
| Combo Emergency/eyewsh Shower | 1 | | x | 300 | = | 300 |
| SUB-TOTAL GALLONS | | | | | = | 607 |

**Lab and Break Room:**

| | Miscillaneous Equipment | Assumed Visitor Population | Programmed Building Population | | Gallons per Day per Person (see note # 1) | | Total Gallons per Day |
|---|---|---|---|---|---|---|---|
| Visitor Population | | 4 | | x | 20 | = | 80 |
| Building Population | | | 20 | x | 20 | = | 400 |
| Wash hose station | 1 | | | x | 7 | = | 7 |
| Combo Emergency/eyewsh Shower | 1 | | | x | 300 | = | 300 |
| SUB-TOTAL GALLONS | | | | | | = | 787 |

| | | |
|---|---|---|
| Office Building | | 766 |
| Maintenance Building | | 707 |
| Utilities Building | | 1,107 |
| Production Plant | | 908 |
| Production Warehouse | | 607 |
| Lab and Break Room | | 787 |
| TOTAL | = | 4,881 |

**Sub-Total Building Sanitary Waste Water Loads:** = 4,881

| | | | | | | |
|---|---|---|---|---|---|---|
| | | **Total Gallons per Day** | | | = | 4,881 |
| 4,881 | Gal's /Day | x | 30 | Days | = | 146,430 |
| | | **Total Gallons per Month** | | | = | 146,430 |
| 146,430 | Gal's /Day | x | 12 | Months | = | 1,757,160 |
| | | **Total Gallons per Year** | | | = | 1,757,160 |

**Notes:**

1. Refer to EPA "Manual of Individual Water Supply Systems" planning guide for water use values provided for gallons per day per person (GPD/Person).

| Job Number & Name | Calc By | Chkd By |
|---|---|---|
| Elcon Recycling - 18307 | RR | RR |
| Description | | Date |
| Building Water Demand | | 04/15/19 |

The site water demand shall be determined by calculating the following: The total number of occupants (total site population), Mechanical cooling make-up water demands, and Mechanical Equipment.

**Office Building:**

| | Miscillaneous Equipment | Assumed Visitor Population | Programmed Building Population | | Gallons per Day per Person (see note # 2) | | Total Gallons per Day |
|---|---|---|---|---|---|---|---|
| Visitor Population | | 8 | | x | 15 | = | 120 |
| Building Population | | | 30 | x | 15 | = | 450 |
| Ice machine in refrigerators | 1 | | | x | 5 | = | 5 |
| Mothers Room | 1 | | | x | 5 | = | 5 |
| Mechanical make-up water | 1 | | | x | 25 | = | 25 |
| SUB-TOTAL GALLONS | | | | | | = | 605 |

**Maintenance Building:**

| | Miscillaneous Equipment | Programmed Building Population | | Gallons per Day per Person (see note # 2) | | Total Gallons per Day |
|---|---|---|---|---|---|---|
| Building Population | | 20 | x | 15 | = | 300 |
| Wash hose station | 1 | | x | 7 | = | 7 |
| Mechanical make-up water | 1 | | x | 3 | = | 3 |
| Combo Emergency/eyewsh Shower | 1 | | x | 300 | = | 300 |
| SUB-TOTAL GALLONS | | | | | = | 610 |

**Utilities Building:**

| | Miscillaneous Equipment | Programmed Building Population | | Gallons per Day per Person (see note # 2) | | Total Gallons per Day |
|---|---|---|---|---|---|---|
| Building Population | | 40 | x | 15 | = | 600 |
| Wash hose station | 1 | | x | 7 | = | 7 |
| Mechanical make-up water | 1 | | x | 50 | = | 50 |
| Combo Emergency/eyewsh Shower | 1 | | x | 300 | = | 300 |
| SUB-TOTAL GALLONS | | | | | = | 957 |

**Production Plant:**

| | Miscillaneous Equipment | Programmed Building Population | | Gallons per Day per Person (see note # 2) | | Total Gallons per Day |
|---|---|---|---|---|---|---|
| Building Population | | 30 | x | 15 | = | 450 |
| Wash hose station | 1 | | x | 7 | = | 7 |
| Mechanical make-up water | 1 | | x | 50 | = | 50 |
| Combo Emergency/eyewsh Shower | 1 | | x | 300 | = | 300 |
| Ice machine in refrigerators | 1 | | x | 5 | = | 5 |
| SUB-TOTAL GALLONS | | | | | = | 812 |

**Production Warehouse:**

| | Miscillaneous Equipment | Programmed Building Population | | Gallons per Day per Person (see note # 2) | | Total Gallons per Day |
|---|---|---|---|---|---|---|
| Building Population | | 15 | x | 15 | = | 225 |
| Wash hose station | 1 | | x | 7 | = | 7 |
| Mechanical make-up water | 1 | | x | 25 | = | 25 |
| Combo Emergency/eyewsh Shower | 1 | | x | 300 | = | 300 |
| SUB-TOTAL GALLONS | | | | | = | 557 |

**Lab and Break Room:**

| | Miscellaneous Equipment | Assumed Visitor Population | Programmed Building Population | | Gallons per Day per Person (see note # 2) | | Total Gallons per Day |
|---|---|---|---|---|---|---|---|
| Visitor Population | | 4 | | x | 15 | = | 60 |
| Building Population | | | 20 | x | 15 | = | 300 |
| Wash hose station | 1 | | | x | 7 | = | 7 |
| Mechanical make-up water | 1 | | | x | 25 | = | 25 |
| Combo Emergency/eyewsh Shov | 1 | | | x | 300 | = | 300 |
| SUB-TOTAL GALLONS | | | | | | = | 692 |

| | | |
|---|---|---|
| Office Building | | 605 |
| Maintenance Building | | 610 |
| Utilities Building | | 957 |
| Production Plant | | 812 |
| Production Warehouse | | 557 |
| Lab and Break Room | | 692 |
| TOTAL | = | 4,233 |

**Safety Factor:**

Safety Factor for Miscellaneous water consumption (see note # 1)

| | | | | | | |
|---|---|---|---|---|---|---|
| 4,233 | Gal's /Day | x | 0.10 | = | 423.3 |
| SUB-TOTAL | | | | = | 423.3 |

| | | | | | | |
|---|---|---|---|---|---|---|
| **Sub-Total Building Water Loads:** | | | | = | 4,233 |
| **Safety Factor:** | | | | = | 423.3 |
| | | **Total Gallons per Day** | | = | 4,656 |
| 4,656 | Gal's /Day | x | 30 Days | = | 139,689 |
| | | **Total Gallons per Month** | | = | 139,689 |
| 139,689 | Gal's /Day | x | 12 Months | = | 1,676,268 |
| | | **Total Gallons per Year** | | = | 1,676,268 |

**Notes:**

1. Safety Factor shall equate to 10% of the site total daily water consumption plus HVAC peak cooling load.
2. Refer to EPA "Manual of Individual Water Supply Systems" planning guide for water use values provided for gallons per day per person (GPD/Person).

ENGINEERS

1720 Walton Road, Blue Bell, PA 19422 610-828-3078 Fax 610-828-7842

April 17, 2019



E-MAIL
Mr. Erik Garton, P.E.
Vice President, Municipal Services Manager
Gilmore & Associates, Inc.
65 E. Butler Avenue, Suite 100
New Britain, PA 18901

Subject: Fire Suppression System Calculations
Elcon Recycling, Falls Township, Pennsylvania, Facility
IES Project No. EG181065.02

Dear Erik:

Please find attached the calculation sheets for the fire protection systems at the proposed Elcon Recycling facility in Falls Township, Pennsylvania. The calculations are based on the preliminary architectural programming for the site, the International Fire Code, and NFPA 13, 20, and 22.

It is planned to install two fire pumps, each rated at 2,000 gpm. One pump will be electric and the other will be powered by a diesel engine. In addition, a 500,000-gallon storage tank will be installed to store firewater, which is approximately 67% larger than what the calculations specify. Please do not hesitate to contact me if you have any questions.

Very truly yours,

*James R. Rutenbar* /e/
James R. Rutenbar, P.E., LEED AP
Director,
Engineering and Construction

Attachments
cc: Z. Elgat, IES
M. Fitzpatrick, IES
A. Soni, IES

# Sprinkler Design Criteria Schedule & Calcs

| OCCUPANCY/ SPACE TYPES | OCCUPANCY/ COMMODITY CLASSIFICATION | SYSTEM TYPE | MAX AREA/ SPRINKLER (SQ FT) | CEILING DESIGN DENSITY (GPM/SQ FT) | CEILING DESIGN AREA (SQ FT) | # OF DESIGN SPRINKLERS AT CEILING | MINIMUM OPERATING PRESSURE - CEILING SPRINKLERS (PSIG) | HOSE STREAM ALLOWANCE (GPM) | TOTAL ESTIMATED FLOW (GPM) | CODE REFERENCE |
|---|---|---|---|---|---|---|---|---|---|---|
| Office Building | LIGHT HAZARD | WET PIPE | 225 | 0.10 | 1500 | N/A | 7 | 100 | 280 | NFPA 13 11.2.3.3.1 |
| Maintenance Building | ORDINARY HAZARD GR II | WET PIPE | 130 | 0.20 | 1500 | N/A | 7 | 250 | 610 | NFPA 13 11.2.3.3.1 |
| Utilities Building | ORDINARY HAZARD GR II | WET PIPE | 130 | 0.20 | 1500 | N/A | 7 | 250 | 610 | NFPA 13 11.2.3.3.1 |
| Production Plant | EXTRA HAZARD GR 2 | WET PIPE | 100 | 0.40 | 2500 | N/A | 7 | 500 | 1700 | NFPA 13 11.2.3.3.1 |
| Production Warehouse | SINGLE/DOUBLE ROW OPEN FRAME RACK STG OF CLASS I-IV COMMODITIES TO HT OF 25 FT W/MAX CLG HT OF 35 FT | WET PIPE | 100 | N/A | N/A | 12 - K-25.2 PENDENT SPKRS, 4 ON EACH OF 3 REMOTE B-LINES | 20 | 500 | 2125 | NFPA 13, TABLE 16.2.3.1 |
| Electrical Room | EXTRA HAZARD GR 2, FM GLOBAL HC-3 | WET PIPE | 100 | 0.15 | 1500 | N/A | 7 | 250 | 520 | NFPA 13 11.2.3.3.1 |
| Lab and Break Room | ORDINARY HAZARD GR II | WET PIPE | 130 | 0.20 | 1500 | N/A | 7 | 250 | 610 | NFPA 13 11.2.3.3.1 |

Fire pump is rated at 2000 gpm. Per NFPA 20, the pump must operate at 150% of its rated flow = 3000 gpm. NFPA 20 requires a 2000 gpm rated fire pump to have a min. 10 inch suction and 10 inch discharge per Table 5.25(b).

The water storage tank is sized to accommodate the largest square foot area of all combined floors in the Productrion Plant for a Type II Construction in accordacne with IFC 2015 Appendix B.

In accordance with the highlighted items in Tables B105.1(2) and B105.2 below, = .25 x 4500 gpm x 240 minutes = 270,000 gallons rounded to 300,000 gallons

**APPENDIX B**

**TABLE B105.1(2)**
**REFERENCE TABLE FOR TABLES B105.1(1) AND B105.2**

| FIRE-FLOW CALCULATION AREA (square feet) | | | | | FIRE-FLOW (gallons per minute)[b] | FLOW DURATION (hours) |
|---|---|---|---|---|---|---|
| Type IA and IB[a] | Type IIA and IIIA[a] | Type IV and V-A[a] | Type IIB and IIIB[a] | Type V-B[a] | | |
| 0-22,700 | 0-12,700 | 0-8,200 | 0-5,900 | 0-3,600 | 1,500 | |
| 22,701-30,200 | 12,701-17,000 | 8,201-10,900 | 5,901-7,900 | 3,601-4,800 | 1,750 | |
| 30,201-38,700 | 17,001-21,800 | 10,901-12,900 | 7,901-9,800 | 4,801-6,200 | 2,000 | |
| 38,701-48,300 | 21,801-24,200 | 12,901-17,400 | 9,801-12,600 | 6,201-7,700 | 2,250 | 2 |
| 48,301-59,000 | 24,201-33,200 | 17,401-21,300 | 12,601-15,400 | 7,701-9,400 | 2,500 | |
| 59,001-70,900 | 33,201-39,700 | 21,301-25,500 | 15,401-18,400 | 9,401-11,300 | 2,750 | |
| 70,901-83,700 | 39,701-47,100 | 25,501-30,100 | 18,401-21,800 | 11,301-13,400 | 3,000 | |
| 83,701-97,700 | 47,101-54,900 | 30,101-35,200 | 21,801-25,900 | 13,401-15,600 | 3,250 | 3 |
| 97,701-112,700 | 54,901-63,400 | 35,201-40,600 | 25,901-29,300 | 15,601-18,000 | 3,500 | |
| 112,701-128,700 | 63,401-72,400 | 40,601-46,400 | 29,301-33,500 | 18,001-20,600 | 3,750 | |
| 128,701-145,900 | 72,401-82,100 | 46,401-52,500 | 33,501-37,900 | 20,601-23,300 | 4,000 | |
| 145,901-164,200 | 82,101-92,400 | 52,501-59,100 | 37,901-42,700 | 23,301-26,300 | 4,250 | |
| 164,201-183,400 | 92,401-103,100 | 59,101-66,000 | 42,701-47,700 | 26,301-29,300 | 4,500 | |
| 183,401-203,700 | 103,101-114,600 | 66,001-73,300 | 47,701-53,000 | 29,301-32,600 | 4,750 | |
| 203,701-225,200 | 114,601-126,700 | 73,301-81,100 | 53,001-58,600 | 32,601-36,000 | 5,000 | |
| 225,201-247,700 | 126,701-139,400 | 81,101-89,200 | 58,601-65,400 | 36,001-39,600 | 5,250 | |
| 247,701-271,200 | 139,401-152,600 | 89,201-97,700 | 65,401-70,600 | 39,601-43,400 | 5,500 | |
| 271,201-295,900 | 152,601-166,500 | 97,701-106,500 | 70,601-77,000 | 43,401-47,400 | 5,750 | |
| 295,901-Greater | 166,501-Greater | 106,501-115,800 | 77,001-83,700 | 47,401-51,500 | 6,000 | 4 |
| — | — | 115,801-125,500 | 83,701-90,600 | 51,501-55,700 | 6,250 | |
| — | — | 125,501-135,500 | 90,601-97,900 | 55,701-60,200 | 6,500 | |
| — | — | 135,501-145,800 | 97,901-106,800 | 60,201-64,800 | 6,750 | |
| — | — | 145,801-156,700 | 106,801-113,200 | 64,801-69,600 | 7,000 | |
| — | — | 156,701-167,900 | 113,201-121,300 | 69,601-74,600 | 7,250 | |
| — | — | 167,901-179,400 | 121,301-129,600 | 74,601-79,800 | 7,500 | |
| — | — | 179,401-191,400 | 129,601-138,300 | 79,801-85,100 | 7,750 | |
| — | — | 191,401-Greater | 138,301-Greater | 85,101-Greater | 8,000 | |

For SI: 1 square foot = 0.0929 m², 1 gallon per minute = 3.785 L/m, 1 pound per square inch = 6.895 kPa.
a. Types of construction are based on the *International Building Code*.
b. Measured at 20 psi residual pressure.

**TABLE B105.2**
**REQUIRED FIRE-FLOW FOR BUILDINGS OTHER THAN ONE- AND TWO-FAMILY DWELLINGS, GROUP R-3 AND R-4 BUILDINGS AND TOWNHOUSES**

| AUTOMATIC SPRINKLER SYSTEM (Design Standard) | MINIMUM FIRE-FLOW (gallons per minute) | FLOW DURATION (hours) |
|---|---|---|
| No automatic sprinkler system | Value in Table B105.1(2) | Duration in Table B105.1(2) |
| Section 903.3.1.1 of the *International Fire Code* | 25%[a] of the value in Table B105.1(2) | Duration in Table B105.1(2) at the reduced flow rate |
| Section 903.3.1.2 of the *International Fire Code* | 25%[b] of the value in Table B105.1(2) | Duration in Table B105.1(2) at the reduced flow rate |

For SI: 1 gallon per minute = 3.785 L/m.

a. The reduced fire-flow shall be not less than 1,000 gallons per minute.
b. The reduced fire-flow shall be not less than 1,500 gallons per minute.

Calc for flow of max 3000 gpm through 10 inch DIP, CL 52 below.



# Flow Calculator

Choose any diameter and instantly obtain the flow rate (gpm) and head-loss (ft/1,000 ft) results for the design-default velocity of 5.0 fps. Override any of the result values to easily recalculate all other parameters at the touch of a single button. (Employs the standardized Hazen-Williams hydraulic equations and principals)

**Diameter (in)**
10

**Class**
52

**Velocity (ft/sec)**
11.61

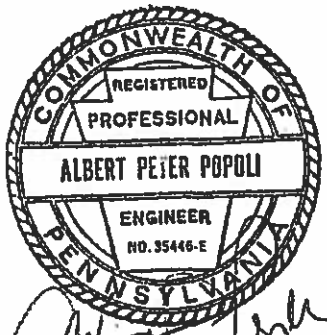
**Flow Rate (gal/min)**
3000

**Head Loss (ft/1000 ft of Pipe)**
36.02

***Hazen-Williams C factor***
140

# Structural Calculations
# Containments
# Elcon Recycling Facility
# Falls Township, PA



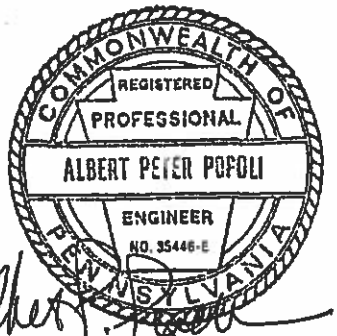



4/17/2019

Prepared By:

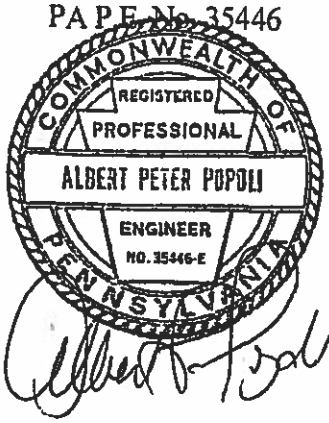
IES Engineers
1720 Walton Road
Blue Bell, PA 19422
IES Project No. EG151065

REV 1




1/24/2019

Albert P. Popoli
PA P.E. No. 35446




1/6/2017

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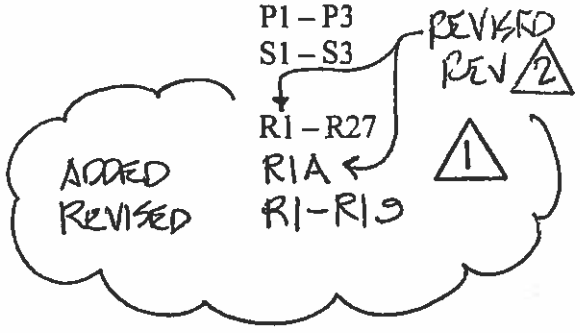



REV 1 1/24/2019

**Geotechnical Recommendations**

The Report offered two options for support: Ground Improvement or 30 ton timber piles. An economic analysis by Contractors will determine which system is used. All buildings and containments will be supported by the selected system.

The allowable soil bearing for ground improvement is 6000 pounds per square foot. The equivalent average soil bearing for piles spaced at three feet on center is 30(2000)/(3x3) = 6667 psf. These equivalent bearing pressures are within eleven percent, a design based on soil bearing will be conservative provided the mat is thick enough to resist punching shear for a fully loaded pile.

Groundwater was measured at (-15 feet) below grade (El. 3.0). The 100 year flood (El. 16.8) level is below the bottom of the lowest containment mat.

**Project Approach**

Design walls and mats for containment. Wall heights were established by the Containment Calculations. Determine the minimum required concrete thickness and reinforcing.

Wall designs will be based on a fluid level at the top of the wall, regardless of the calculated spill depth. Mat designs will be based on either the spill load or the typical operating condition. Differential settlement within the mat shall also be considered.

Wind or seismic loads will be applied for the tank farm containments. Given the large width of the foundations, overturning from lateral loads is expected to be minimal.

**Summary**

Minimum wall and mat thicknesses and reinforcing have been established for the containments and the building foundations that also serve as containments. Other factors (frost protection, pipe racks, final vendor loads) may require an increase the wall/mat thickness or reinforcing.

Seismic and wind were considered for tank farms, the effects had no impact on the final design. Seismic and wind forces for the main process building may require an increase in mat thickness or reinforcing beyond that required by the containment criteria.

A3

# USGS Design Maps Summary Report

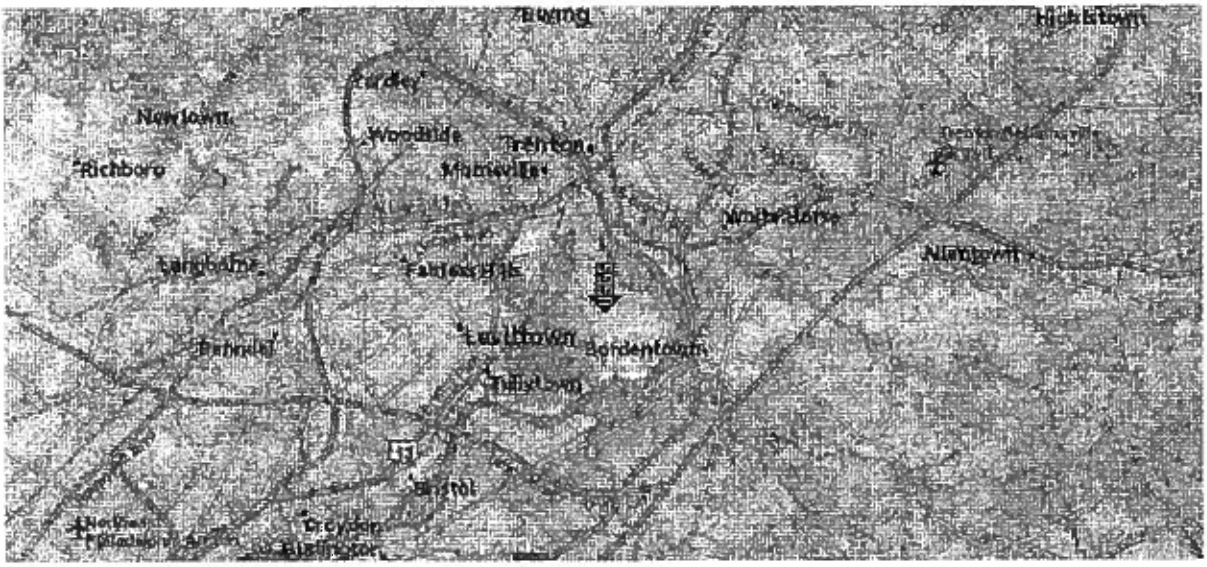
## User-Specified Input

**Building Code Reference Document** 2006/2009 International Building Code
(which utilizes USGS hazard data available in 2002)

**Site Coordinates** 40.17°N, 74.76°W

**Site Soil Classification** Site Class D – "Stiff Soil"

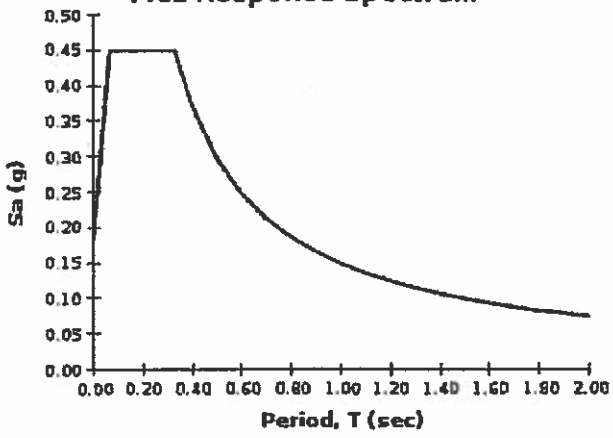
**Occupancy Category** I/II/III



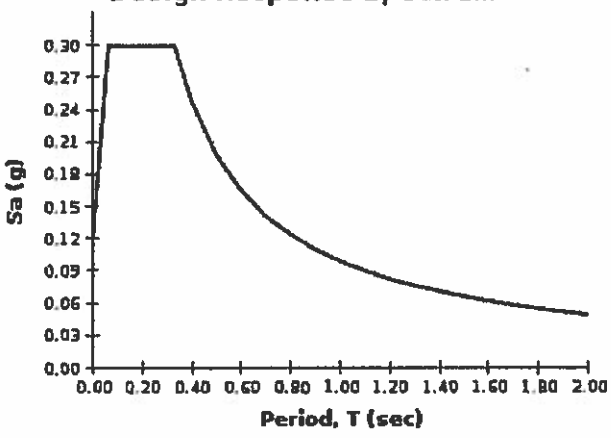

## USGS-Provided Output

| | | | | | |
|---|---|---|---|---|---|
| $S_S$ = | 0.286 g | $S_{MS}$ = | 0.449 g | $S_{DS}$ = | 0.299 g |
| $S_1$ = | 0.062 g | $S_{M1}$ = | 0.148 g | $S_{D1}$ = | 0.099 g |

**MCE Response Spectrum**




**Design Response Spectrum**



A4

# USGS Design Maps Detailed Report

## 2006/2009 International Building Code (40.17°N, 74.76°W)

Site Class D – "Stiff Soil", Occupancy Category I/II/III

### Section 1613.5.1 — Mapped acceleration parameters

Note: Maps in the 2006 and 2009 International Building Code are provided for Site Class B. Adjustments for other Site Classes are made, as needed, in Section 1613.5.3.

**From Figure 1613.5(1) [1]** $S_S = 0.286$ g

**From Figure 1613.5(2) [2]** $S_1 = 0.062$ g

### Section 1613.5.2 — Site class definitions

| SITE CLASS | SOIL PROFILE NAME | Soil shear wave velocity, $\bar{v}_s$, (ft/s) | Standard penetration resistance, $\bar{N}$ | Soil undrained shear strength, $\bar{s}_u$, (psf) |
|---|---|---|---|---|
| A | Hard rock | $\bar{v}_s > 5{,}000$ | N/A | N/A |
| B | Rock | $2{,}500 < \bar{v}_s \leq 5{,}000$ | N/A | N/A |
| C | Very dense soil and soft rock | $1{,}200 < \bar{v}_s \leq 2{,}500$ | $\bar{N} > 50$ | >2,000 psf |
| D | Stiff soil profile | $600 \leq \bar{v}_s < 1{,}200$ | $15 \leq \bar{N} \leq 50$ | 1,000 to 2,000 psf |
| E | Stiff soil profile | $\bar{v}_s < 600$ | $\bar{N} < 15$ | <1,000 psf |
| E | — | Any profile with more than 10 ft of soil having the characteristics:<br>1. Plasticity index $PI > 20$,<br>2. Moisture content $w \geq 40\%$, and<br>3. Undrained shear strength $\bar{s}_u < 500$ psf | | |
| F | — | Any profile containing soils having one or more of the following characteristics:<br>1. Soils vulnerable to potential failure or collapse under seismic loading such as liquefiable soils, quick and highly sensitive clays, collapsible weakly cemented soils.<br>2. Peats and/or highly organic clays ($H > 10$ feet of peat and/or highly organic clay where $H$ = thickness of soil)<br>3. Very high plasticity clays ($H > 25$ feet with plasticity index $PI > 75$)<br>4. Very thick soft/medium stiff clays ($H > 120$ feet) | | |

For SI: 1ft/s = 0.3048 m/s 1lb/ft² = 0.0479 kN/m²

A5

## Section 1613.5.3 — Site coefficients and adjusted maximum considered earthquake spectral response acceleration parameters

TABLE 1613.5.3(1)
VALUES OF SITE COEFFICIENT $F_a$

| Site Class | Mapped Spectral Response Acceleration at Short Period | | | | |
|---|---|---|---|---|---|
| | $S_S \le 0.25$ | $S_S = 0.50$ | $S_S = 0.75$ | $S_S = 1.00$ | $S_S \ge 1.25$ |
| A | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 |
| B | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 |
| C | 1.2 | 1.2 | 1.1 | 1.0 | 1.0 |
| D | 1.6 | 1.4 | 1.2 | 1.1 | 1.0 |
| E | 2.5 | 1.7 | 1.2 | 0.9 | 0.9 |
| F | See Section 11.4.7 of ASCE 7 | | | | |

Note: Use straight-line interpolation for intermediate values of $S_S$

**For Site Class = D and $S_s$ = 0.286 g, $F_a$ = 1.571**

TABLE 1613.5.3(2)
VALUES OF SITE COEFFICIENT $F_v$

| Site Class | Mapped Spectral Response Acceleration at 1-s Period | | | | |
|---|---|---|---|---|---|
| | $S_1 \le 0.10$ | $S_1 = 0.20$ | $S_1 = 0.30$ | $S_1 = 0.40$ | $S_1 \ge 0.50$ |
| A | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 |
| B | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 |
| C | 1.7 | 1.6 | 1.5 | 1.4 | 1.3 |
| D | 2.4 | 2.0 | 1.8 | 1.6 | 1.5 |
| E | 3.5 | 3.2 | 2.8 | 2.4 | 2.4 |
| F | See Section 11.4.7 of ASCE 7 | | | | |

Note: Use straight-line interpolation for intermediate values of $S_1$

**For Site Class = D and $S_1$ = 0.062 g, $F_v$ = 2.400**

AG

In the equations below, the equation number corresponding to the 2006 edition is listed first, and that corresponding to the 2009 edition is listed second.

**Equation (16-37; 16-36):** $S_{MS} = F_a S_S = 1.571 \times 0.286 = 0.449$ g

**Equation (16-38; 16-37):** $S_{M1} = F_v S_1 = 2.400 \times 0.062 = 0.148$ g

Section 1613.5.4 — Design spectral response acceleration parameters

**Equation (16-39; 16-38):** $S_{DS} = \frac{2}{3} S_{MS} = \frac{2}{3} \times 0.449 = 0.299$ g USE 0.30g

**Equation (16-40; 16-39):** $S_{D1} = \frac{2}{3} S_{M1} = \frac{2}{3} \times 0.148 = 0.099$ g USE 0.10g

A7

## Section 1613.5.6 — Determination of seismic design category

TABLE 1613.5.6(1)
SEISMIC DESIGN CATEGORY BASED ON SHORT-PERIOD RESPONSE ACCELERATION

| VALUE OF $S_{DS}$ | OCCUPANCY CATEGORY | | |
|---|---|---|---|
| | I or II | III | IV |
| $S_{DS} < 0.167g$ | A | A | A |
| $0.167g \le S_{DS} < 0.33g$ | B | B | C |
| $0.33g \le S_{DS} < 0.50g$ | C | C | D |
| $0.50g \le S_{DS}$ | D | D | D |

**For Occupancy Category = I and $S_{DS}$ = 0.299 g, Seismic Design Category = B**

TABLE 1613.5.6(2)
SEISMIC DESIGN CATEGORY BASED ON 1-SECOND PERIOD RESPONSE ACCELERATION

| VALUE OF $S_{D1}$ | OCCUPANCY CATEGORY | | |
|---|---|---|---|
| | I or II | III | IV |
| $S_{D1} < 0.067g$ | A | A | A |
| $0.067g \le S_{D1} < 0.133g$ | B | B | C |
| $0.133g \le S_{D1} < 0.20g$ | C | C | D |
| $0.20g \le S_{D1}$ | D | D | D |

**For Occupancy Category = I and $S_{D1}$ = 0.099 g, Seismic Design Category = B**

Note: When $S_1$ is greater than or equal to 0.75g, the Seismic Design Category is **E** for buildings in Occupancy Categories I, II, and III, and **F** for those in Occupancy Category IV, irrespective of the above.

Seismic Design Category ≡ "the more severe design category in accordance with Table 1613.5.6(1) or 1613.5.6(2)" = B

---

Note: See Section 1613.5.6.1 for alternative approaches to calculating Seismic Design Category.

## References

1. *Figure 1613.5(1)*: http://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/IBC-2006-Figure1613_5(01).pdf
2. *Figure 1613.5(2)*: http://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/IBC-2006-Figure1613_5(02).pdf

IES ENGINEERS

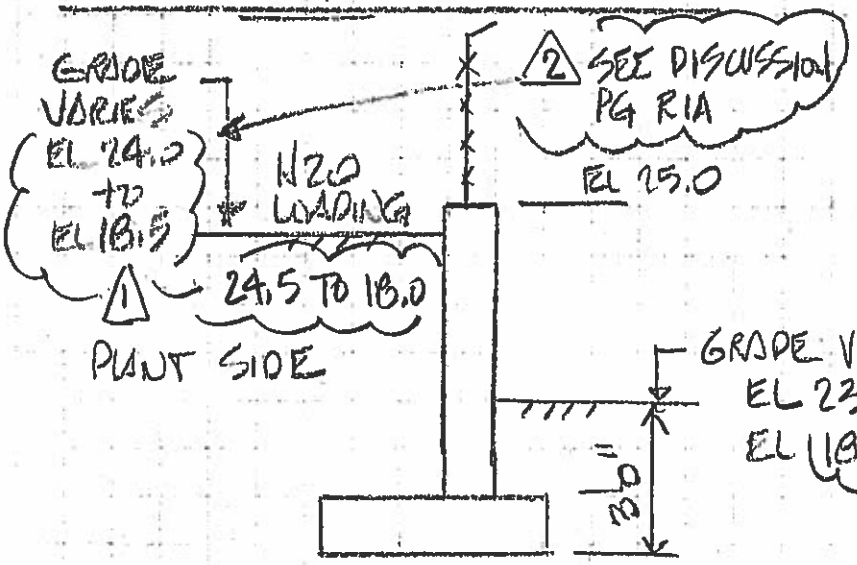
SUBJECT ELCON | REV 2 APPROVED 4/17/2019 | SHEET# | OF | R1

BY XPPgdl | DATE 5/24/2016

PROJECT# REV 1 APPgdl 1/23/2019

(REV 1: GRADE CHANGES - SEE PG R1A)

# PERIMETER/SECURITY WALL



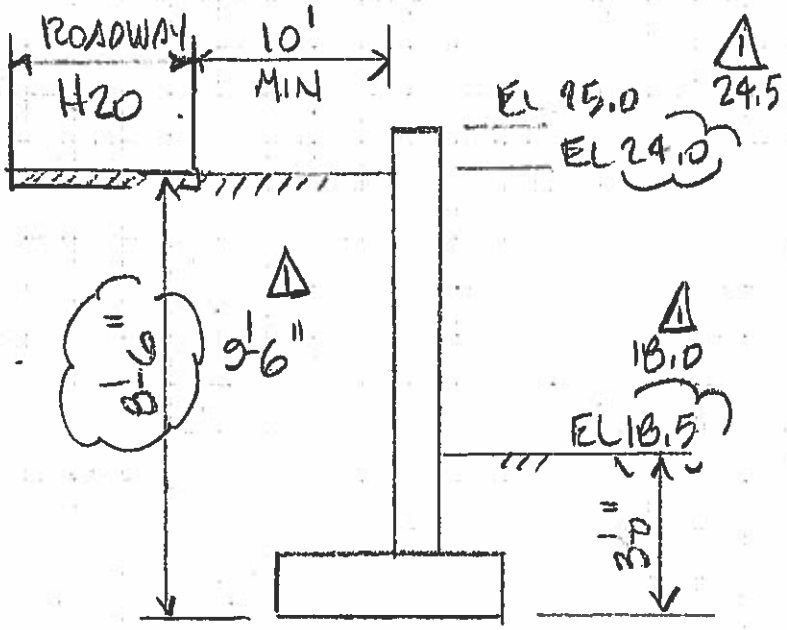

TYPICAL CROSS SECTION

REF GEOTECH REPORT FOR SOIL PROPERTIES:

$\gamma = 125$ pcf

$K_a = 0.31$ $K_p = 3.25$

$\mu = 0.35$ @ BASE




WORST CASE — SOIL + SURCHARGE LOADING (TYPE 1 RETAINING WALL)

## DESIGN CONDITIONS

LC1: D+L (SURCHARGE), NORMAL GWT

LC2: D+L (SURCHARGE), 100 YEAR FLOOD

LC3 D+L+SEISMIC, NORMAL GWT (D+H+0.175(.7E)+0.75L)

LC4: D+L+WIND, NORMAL GWT D+H+.75L+0.75W

CONSIDER H20 AS 250psf @ SURFACE BEHIND WALL (NEGLECT ROAD OFFSET)

IES ENGINEERS

SUBJECT ELCON SHEET# OF RIA

BY AP Pajak DATE 1/23/2019

PROJECT# REV 2 AP Pajak 4/17/2019

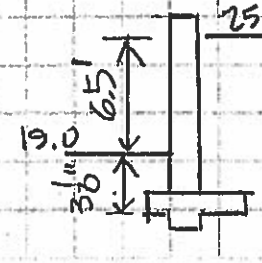
# RETAINING WALL CHANGES - REVISION 1

LAYOUT AND REVIEW COMMENTS CREATED GRADING CHANGES (GILMORE & ASSOCIATES, "GRADING AND DRAINAGE PLAN" DATED 12/10/18). THE "TYPE 1" RETAINING WALL DESIGN WAS REVIEWED AND CHANGED TO ACCOMODATE A ONE FOOT INCREASE IN RETAINED HEIGHT. REVISED CALCULATION PAGES FOLLOW.

NOTE: ORIGINAL CALCS USED INCORRECT (TOO HIGH) 100 YEAR FLOOD FOR LOAD COMBINATION 2. CALCS REWORKED USING 500 YEAR FLOOD

NO CHANGES REQUIRED FOR SHORTER (TYPE 2) WALL. GROUND GRADES ON EACH SIDE LEVEL, AND THERE AREN'T ANY TRUCK LOADINGS. DESIGN LEFT AS-IS.

## REVISION 2 CHANGE




PER GILMORE GRADING DWG 4/15/2019, MAX GRADE BEHIND WALL RAISED 1'0" BUT LOW SIDE ALSO RAISED 1'0". NO CHANGE TO DESIGN, STILL BASED ON 6'-6" Δ HEIGHT

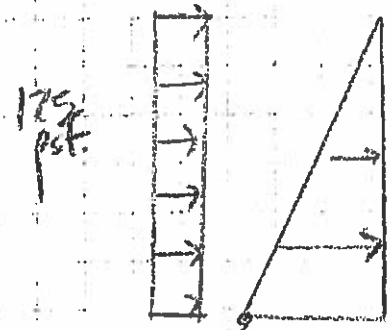
IES ENGINEERS

SUBJECT ELCON SHEET# OF

BY [illegible] DATE 5/24/2016

PROJECT# REV 1 [illegible] 1/23/2019

H2O LOADING : TYPICALLY CONSIDERED AS 2 FT OF SOIL (250 psf)




PRESCRIBED PRESSURE
0.31(125) = 38.75 USE 39 psf.

125(8.5)(.31) = 329 psf 368 psf

ANALYSIS PROGRAM USES ONE VALUE OF Ka.
MODIFY H2O LOAD IN PROGRAM TO GET SAME LOAD REQ'D BY GEOTECH (Ka = 0.5 FOR SURCHARGE)

W(.31) = 125 psf W = 403 Say 400 psf.
400(.31) = 124 psf OK.

WALL STABILITY ANALYSIS USING CSC/TEDDS SOFTWARE. CALCS FOLLOW

| Tedds<br>IES Engineers<br><br>Blue Bell, PA 19422 | Project<br>Elcon Recycling | | | | Job Ref<br>R3 | |
|---|---|---|---|---|---|---|
| | Section<br>Perimeter Wall - Max Height + surcharge, normal GWT | | | | Sheet no./rev.<br>1 | |
| | Calc. by<br>A. Popoli | Date<br>1/24/2019 | Chk'd by | Date | App'd by | Date |

## RETAINING WALL ANALYSIS LC1

**In accordance with IBC 2009**

Tedds calculation version 2.4.06

### Retaining wall details

| | | | |
|---|---|---|---|
| Stem type | Cantilever | | |
| Stem height | $h_{stem}$ = 9 ft | | |
| Stem thickness | $t_{stem}$ = 12 in | | |
| Angle to rear face of stem | $\alpha$ = 90 deg | | |
| Stem density | $\gamma_{stem}$ = 150 pcf | | |
| Toe length | $l_{toe}$ = 1 ft | | |
| Heel length | $l_{heel}$ = 4 ft | | |
| Base thickness | $t_{base}$ = 12 in | | |
| Key depth | $d_{key}$ = 1 ft | Key thickness | $t_{key}$ = 12 in |
| Key position | $p_{key}$ = 1 ft | | |
| Base density | $\gamma_{base}$ = 150 pcf | | |
| Height of retained soil | $h_{ret}$ = 6.5 ft | Angle of soil surface | $\beta$ = 0 deg |
| Depth of cover | $d_{cover}$ = 2 ft | | |

### Retained soil properties

| | | | |
|---|---|---|---|
| Soil type | Medium dense well graded sand | | |
| Moist density | $\gamma_{mr}$ = 125 pcf | | |
| Saturated density | $\gamma_{sr}$ = 145 pcf | | |
| Effective angle of internal resistance | | $\phi_r$ = 32 deg | |
| Effective wall friction angle | $\delta_r$ = 16 deg | | |

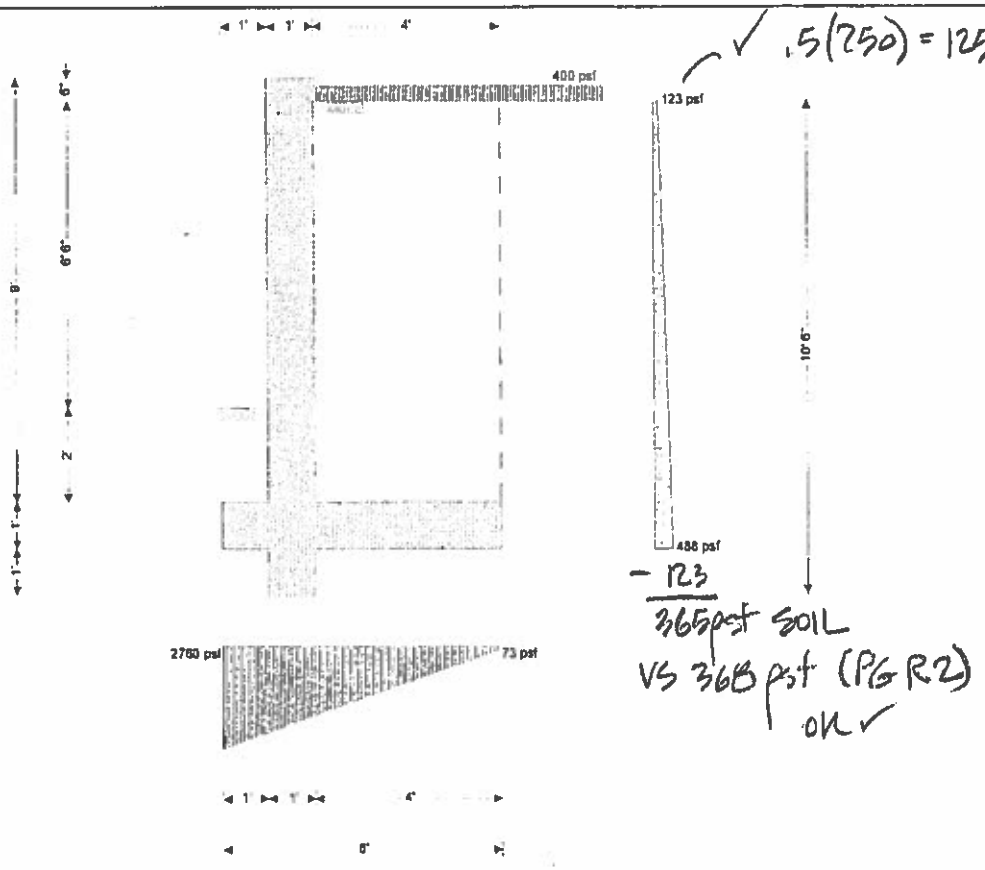
### Base soil properties

| | | | |
|---|---|---|---|
| Soil type | Medium dense well graded sand | | |
| Moist density | $\gamma_{mb}$ = 125 pcf | | |
| Cohesion | $c_b$ = 0 psf | | |
| Effective angle of internal resistance | | $\phi_b$ = 32 deg | |
| Effective wall friction angle | $\delta_b$ = 15 deg | | |
| Effective base friction angle | $\delta_{bb}$ = 30 deg | | |
| Allowable bearing pressure | $P_{bearing}$ = 3500 psf | | |

### Loading details

| | |
|---|---|
| Live surcharge load | $Surcharge_L$ = 400 psf |

| Tedds<br>IES Engineers<br><br>Blue Bell, PA 19422 | Project<br>Elcon Recycling | | | | Job Ref.<br>R4 |
|---|---|---|---|---|---|
| | Section<br>Perimeter Wall - Max Height + surcharge, normal GWT | | | | Sheet no./rev.<br>2 |
| | Calc. by<br>A. Popoli | Date<br>1/24/2019 | Chk'd by | Date | App'd by | Date |




✓ .5(250) = 125psf.

- R3
365psf soil
vs 368 psf (pg R2)
ok ✓

**Calculate retaining wall geometry**

| | | | |
|---|---|---|---|
| Base length | $l_{base}$ = 6 ft | | |
| Base height | $h_{base}$ = 2 ft | | |
| Moist soil height | $h_{moist}$ = 8.5 ft | | |
| Length of surcharge load | $l_{sur}$ = 4 ft | | |
| Vertical distance | $x_{sur\_v}$ = 4 ft | | |
| Effective height of wall | $h_{eff}$ = 10.5 ft | | |
| Horizontal distance | $x_{sur\_h}$ = 4.25 ft | | |
| Horizontal distance above key | $x_{sur\_h\_a}$ = 4.75 ft | | |
| Area of wall stem | $A_{stem}$ = 9 ft² | Vertical distance | $x_{stem}$ = 1.5 ft |
| Area of wall base | $A_{base}$ = 7 ft² | Vertical distance | $x_{base}$ = 2.786 ft |
| Area of moist soil | $A_{moist}$ = 34 ft² | Vertical distance | $x_{moist\_v}$ = 4 ft |
| | | Horizontal distance | $x_{moist\_h}$ = 2.5 ft |
| | | Horizontal distance above key | $x_{moist\_h\_a}$ = 3.167 ft |
| Area of base soil | $A_{pass}$ = 2 ft² | Vertical distance | $x_{pass\_v}$ = 0.5 ft |
| | | Horizontal distance | $x_{pass\_h}$ = 0.333 ft |
| Area of excavated base soil | $A_{exc}$ = 2 ft² | Vertical distance | $x_{exc\_v}$ = 0.5 ft |
| | | Horizontal distance | $x_{exc\_h}$ = 0.333 ft |

**Using Rankine theory**

| | | | |
|---|---|---|---|
| Active pressure coefficient | $K_A$ = 0.307 ✓ | Passive pressure coefficient | $K_P$ = 3.255 ✓ |

| Tedds<br>IES Engineers<br><br>Blue Bell, PA 19422 | Project<br>Elcon Recycling | | | | Job Ref.<br>R5 | |
|---|---|---|---|---|---|---|
| | Section<br>Perimeter Wall - Max Height + surcharge, normal GWT | | | | Sheet no./rev.<br>3 | |
| | Calc. by<br>A. Popoli | Date<br>1/24/2019 | Chk'd by | Date | App'd by | Date |

CHECK SLIDING COMPONENTS

**From IBC 2009 cl.1807.2.3 Safety factor**

Load combination 1 — 1.0 × Dead + 1.0 × Live + 1.0 × Lateral earth

$P_p$ = 4(125)(3.125) = 1625 (4' triangle)

**Sliding check**

**Vertical forces on wall**

Total — $F_{total\_v} = F_{stem} + F_{base} + F_{moist\_v} + F_{exc\_v} = 6900$ plf × .35 = 2415# BASE FRICTION

**Horizontal forces on wall**

$P_p = 1625(4)/2 = 3250$ PASSIVE PRESS

Total — $F_{total\_h} = F_{moist\_h} + F_{sur\_h} = 3408$ plf → 5665# ✓ OK

**Check stability against sliding**

Resistance to sliding — $F_{rest} = 5584$ plf — Factor of safety — $FoS_{sl} = 1.639 > 1.5$

***PASS - Factor of safety against sliding is adequate***

**Overturning check**

**Vertical forces on wall**

Total — $F_{total\_v} = F_{stem} + F_{base} + F_{moist\_v} + F_{exc\_v} = 6900$ plf

**Horizontal forces on wall**

Total — $F_{total\_h} = F_{moist\_h} + F_{exc\_h} + F_{sur\_h} = 1301$ plf

**Overturning moments on wall**

Total — $M_{total\_OT} = M_{moist\_OT} + M_{sur\_OT} = 11034$ lb_ft/ft

**Restoring moments on wall**

Total — $M_{total\_R} = M_{stem\_R} + M_{base\_R} + M_{moist\_R} + M_{exc\_R} = 22608$ lb_ft/ft

**Check stability against overturning**

Factor of safety — $FoS_{ot} = 2.049 > 1.5$

***PASS - Factor of safety against overturning is adequate***

**Bearing pressure check**

**Vertical forces on wall**

Total — $F_{total\_v} = F_{stem} + F_{base} + F_{moist\_v} + F_{pass\_v} + F_{sur\_v} = 8500$ plf

**Horizontal forces on wall**

Total — $F_{total\_h} = \max(F_{moist\_h} + F_{pass\_h} + F_{sur\_h} - F_{total\_v} \times \tan(\delta_{bb}), 0\text{ plf}) = 0$ plf

**Moments on wall**

Total — $M_{total} = M_{stem} + M_{base} + M_{moist} + M_{pass} + M_{sur} = 17441$ lb_ft/ft

**Check bearing pressure**

Bearing pressure at toe — $q_{toe} = 2760$ psf — Bearing pressure at heel — $q_{heel} = 73$ psf

Factor of safety — $FoS_{bp} = 1.268$

***PASS - Allowable bearing pressure exceeds maximum applied bearing pressure***

## RETAINING WALL DESIGN

**In accordance with ACI 318-08**

Tedds calculation version 2.4.06

**Concrete details**

Compressive strength — $f_c = 4000$ psi — Concrete type — Normal weight

**Reinforcement details**

Yield strength — $f_y = 60000$ psi — Modulus of elasticity — $E_s = 29000000$ psi

| Tedds IES Engineers, Blue Bell, PA 19422 | Project: Elcon Recycling | | | | Job Ref: RG | |
|---|---|---|---|---|---|---|
| | Section: Perimeter Wall - Max Height + surcharge, normal GWT | | | | Sheet no./rev: 4 | |
| | Calc. by: A. Popoli | Date: 1/24/2019 | Chk'd by: | Date: | App'd by: | Date: |

**Cover to reinforcement**

| | | | |
|---|---|---|---|
| Front face of stem | $c_{sf}$ = 2 in | Rear face of stem | $c_{sr}$ = 3 in |
| Top face of base | $c_{bt}$ = 2 in | Bottom face of base | $c_{bb}$ = 3 in |

**From IBC 2009 cl.1605.2.1 Basic load combinations**

| | |
|---|---|
| Load combination no.1 | 1.4 × Dead |
| Load combination no.2 | 1.2 × Dead + 1.6 × Live + 1.6 × Lateral earth |
| Load combination no.3 | 1.2 × Dead + 1.0 × Earthquake + 1.0 × Live |
| Load combination no.4 | 0.9 × Dead + 1.0 × Earthquake + 1.6 × Lateral earth |

**Check stem design at base of stem**

Depth of section h = 12 in

**Rectangular section in flexure - Chapter 10**

| | | | |
|---|---|---|---|
| Factored bending moment | M = 13394 lb_ft/ft | | |
| Tens.reinforcement provided | No.6 bars @ 12" c/c | Tens.reinforcement provided | $A_{sr.prov}$ = 0.442 in²/ft |
| Max.reinforcement spacing | $s_{max}$ = 18 in | | |

*PASS - Reinforcement is adequately spaced*

| | | | |
|---|---|---|---|
| Nominal flexural strength | $M_n$ = 18334 lb_ft/ft | Strength reduction factor | $\phi_f$ = 0.9 |
| Design flexural strength | $\phi M_n$ = 16501 lb_ft/ft | M / $\phi M_n$ = 0.812 | |

*PASS - Design flexural strength exceeds factored bending moment*

| | | | |
|---|---|---|---|
| Reinforcement by analysis | $A_{sr.des}$ = 0.356 in²/ft | Min.tension reinforcement | $A_{sr.min}$ = 0.345 in²/ft |

*PASS - Area of reinforcement provided is greater than minimum area of reinforcement required*

**Rectangular section in shear - Chapter 11**

| | | | |
|---|---|---|---|
| Factored shear force | V = 3891 lb/ft | | |
| Nominal conc.shear strength | $V_c$ = 13092 lb/ft | Strength reduction factor | $\phi_s$ = 0.75 |
| Design conc.shear strength | $\phi V_c$ = 9819 lb/ft | V / $\phi V_c$ = 0.396 | |

*PASS - No shear reinforcement is required*

**Horizontal reinforcement parallel to face of stem**

| | | | |
|---|---|---|---|
| Min.area of reinforcement | $A_{sx.req}$ = 0.288 in²/ft | | |
| Trans.reinforcement provided | No.4 bars @ 8" c/c each face | Trans.reinforcement provided | $A_{sx.prov}$ = 0.589 in²/ft |

*PASS - Area of reinforcement provided is greater than area of reinforcement required*

**Check base design at toe**

Depth of section h = 12 in

**Rectangular section in flexure - Chapter 10**

| | | | |
|---|---|---|---|
| Factored bending moment | M = 1684 lb_ft/ft | | |
| Tens.reinforcement provided | No.4 bars @ 8" c/c | Tens.reinforcement provided | $A_{bb.prov}$ = 0.295 in²/ft |
| Max.reinforcement spacing | $s_{max}$ = 18 in | | |

*PASS - Reinforcement is adequately spaced*

| | | | |
|---|---|---|---|
| Nominal flexural strength | $M_n$ = 12567 lb_ft/ft | Strength reduction factor | $\phi_f$ = 0.9 |
| Design flexural strength | $\phi M_n$ = 11310 lb_ft/ft | M / $\phi M_n$ = 0.149 | |

*PASS - Design flexural strength exceeds factored bending moment*

| | | | |
|---|---|---|---|
| Reinforcement by analysis | $A_{bb.des}$ = 0.043 in²/ft | Min.tension reinforcement | $A_{bb.min}$ = 0.259 in²/ft |

*PASS - Area of reinforcement provided is greater than minimum area of reinforcement required*

| Tedds IES Engineers, Blue Bell, PA 19422 | Project: Elcon Recycling | | | | Job Ref.: R7 | |
|---|---|---|---|---|---|---|
| | Section: Perimeter Wall - Max Height + surcharge, normal GWT | | | | Sheet no./rev.: 5 | |
| | Calc. by: A. Popoli | Date: 1/24/2019 | Chk'd by: | Date: | App'd by: | Date: |

**Rectangular section in shear - Chapter 11**

Factored shear force $V = 3238$ lb/ft

Nominal conc.shear strength $V_c = 13282$ lb/ft — Strength reduction factor $\phi_s = 0.75$

Design conc.shear strength $\phi V_c = 9961$ lb/ft — $V / \phi V_c = 0.325$

***PASS - No shear reinforcement is required***

**Rectangular section in flexure - Chapter 10** HEEL

Factored bending moment $M = 12189$ lb_ft/ft

Tens.reinforcement provided No.4 bars @ 8" c/c — Tens.reinforcement provided $A_{bt,prov} = 0.295$ in²/ft

Max.reinforcement spacing $s_{max} = 18$ in

***PASS - Reinforcement is adequately spaced***

Nominal flexural strength $M_n = 14039$ lb_ft/ft — Strength reduction factor $\phi_f = 0.9$

Design flexural strength $\phi M_n = 12635$ lb_ft/ft — $M / \phi M_n = 0.965$

***PASS - Design flexural strength exceeds factored bending moment***

Reinforcement by analysis $A_{bt,des} = 0.284$ in²/ft — Min.tension reinforcement $A_{bt,min} = 0.259$ in²/ft

***PASS - Area of reinforcement provided is greater than minimum area of reinforcement required***

**Rectangular section in shear - Chapter 11**

Factored shear force $V = 4198$ lb/ft

Nominal conc.shear strength $V_c = 14799$ lb/ft — Strength reduction factor $\phi_s = 0.75$

Design conc.shear strength $\phi V_c = 11100$ lb/ft — $V / \phi V_c = 0.378$

***PASS - No shear reinforcement is required***

**Check key design**

Depth of section $h = 12$ in

**Rectangular section in flexure - Chapter 10**

Factored bending moment $M = 710$ lb_ft/ft

Tens.reinforcement provided No.4 bars @ 8" c/c — Tens.reinforcement provided $A_{k,prov} = 0.295$ in²/ft

Max.reinforcement spacing $s_{max} = 18$ in

***PASS - Reinforcement is adequately spaced***

Nominal flexural strength $M_n = 12567$ lb_ft/ft — Strength reduction factor $\phi_f = 0.9$

Design flexural strength $\phi M_n = 11310$ lb_ft/ft — $M / \phi M_n = 0.063$

***PASS - Design flexural strength exceeds factored bending moment***

Reinforcement by analysis $A_{k,des} = 0.018$ in²/ft — Min.tension reinforcement $A_{k,min} = 0.259$ in²/ft

***PASS - Area of reinforcement provided is greater than minimum area of reinforcement required***

**Rectangular section in shear - Chapter 11**

Factored shear force $V = 1331$ lb/ft

Nominal conc.shear strength $V_c = 13282$ lb/ft — Strength reduction factor $\phi_s = 0.75$

Design conc.shear strength $\phi V_c = 9961$ lb/ft — $V / \phi V_c = 0.134$

***PASS - No shear reinforcement is required***

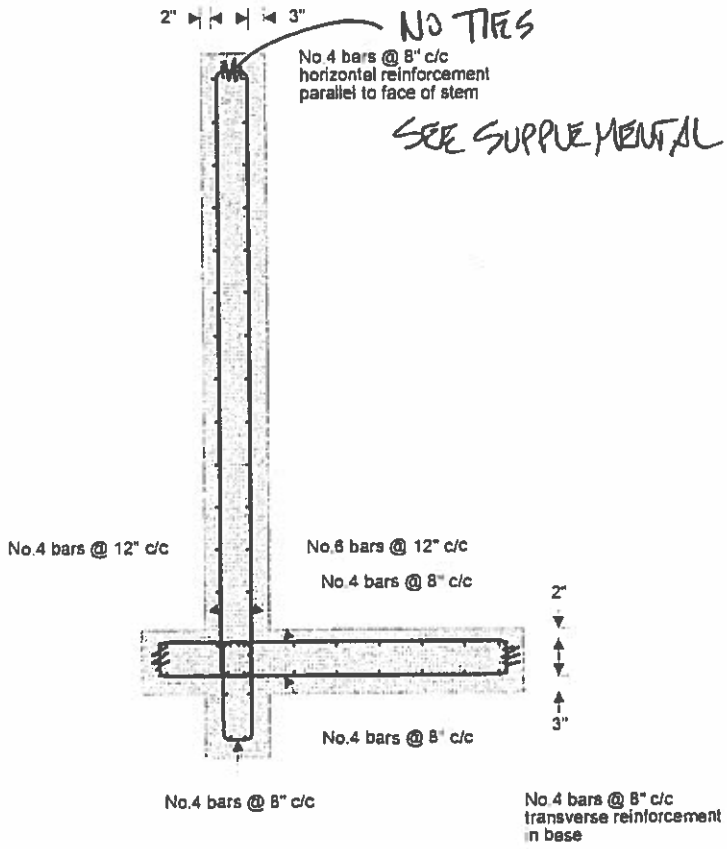
**Transverse reinforcement parallel to base**

Min.area of reinforcement $A_{bx,req} = 0.259$ in²/ft

Trans.reinforcement provided No.4 bars @ 8" c/c each face — Trans.reinforcement provided $A_{bx,prov} = 0.589$ in²/ft

***PASS - Area of reinforcement provided is greater than area of reinforcement required***

| Tedds<br>IES Engineers<br><br>Blue Bell, PA 19422 | Project<br>Elcon Recycling | | | | Job Ref.<br>RB |
|---|---|---|---|---|---|
| | Section<br>Perimeter Wall - Max Height + surcharge, normal GWT | | | | Sheet no./rev.<br>6 |
| | Calc. by<br>A. Popoli | Date<br>1/24/2019 | Chk'd by | Date | App'd by | Date |



| Tedds<br>IES Engineers<br><br>Blue Bell, PA 19422 | Project<br>Elcon Recycling | | | | Job Ref.<br>R8A | |
|---|---|---|---|---|---|---|
| | Section<br>Perimeter Wall - Max Height + surcharge, 500 Year Flood | | | | Sheet no./rev.<br>1 | |
| | Calc. by<br>A. Popoli | Date<br>1/24/2019 | Chk'd by | Date | App'd by | Date |

## RETAINING WALL ANALYSIS

LC2 (FLOOD)

**In accordance with IBC 2009**

Tedds calculation version 2.4.06

### Retaining wall details

| | | | |
|---|---|---|---|
| Stem type | Cantilever | | |
| Stem height | $h_{stem}$ = 9 ft | | |
| Stem thickness | $t_{stem}$ = 12 in | | |
| Angle to rear face of stem | $\alpha$ = 90 deg | | |
| Stem density | $\gamma_{stem}$ = 150 pcf | | |
| Toe length | $l_{toe}$ = 1 ft | | |
| Heel length | $l_{heel}$ = 4 ft | | |
| Base thickness | $t_{base}$ = 12 in | | |
| Key depth | $d_{key}$ = 1 ft | Key thickness | $t_{key}$ = 12 in |
| Key position | $p_{key}$ = 1 ft | | |
| Base density | $\gamma_{base}$ = 150 pcf | | |
| Height of retained soil | $h_{ret}$ = 6.5 ft | Angle of soil surface | $\beta$ = 0 deg |
| Depth of cover | $d_{cover}$ = 2 ft | | |
| Height of water | $h_{water}$ = 4 ft | | |
| Water density | $\gamma_w$ = 62 pcf | | |

### Retained soil properties

| | | | |
|---|---|---|---|
| Soil type | Medium dense well graded sand | | |
| Moist density | $\gamma_{mr}$ = 125 pcf | | |
| Saturated density | $\gamma_{sr}$ = 145 pcf | | |
| Effective angle of internal resistance | | $\phi_r$ = 32 deg | |
| Effective wall friction angle | $\delta_r$ = 16 deg | | |

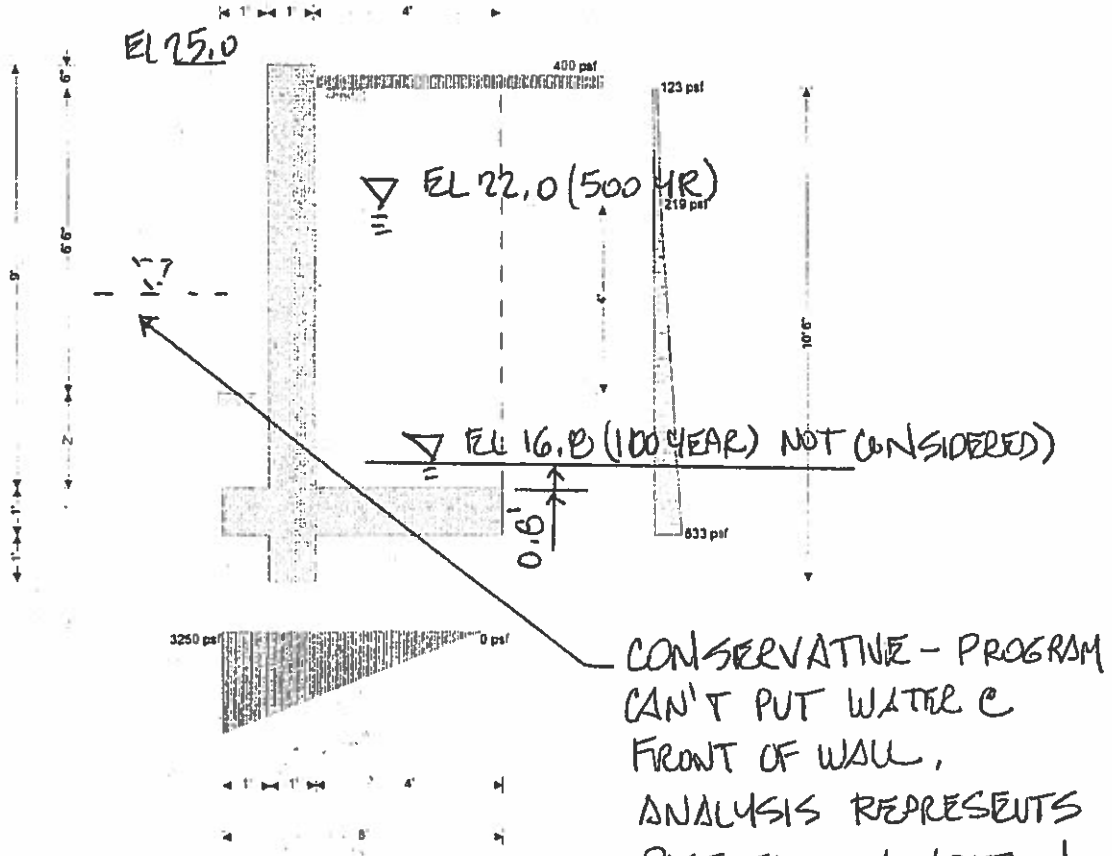
### Base soil properties

| | | | |
|---|---|---|---|
| Soil type | Medium dense well graded sand | | |
| Moist density | $\gamma_{mb}$ = 125 pcf | | |
| Cohesion | $c_b$ = 0 psf | | |
| Effective angle of internal resistance | | $\phi_b$ = 32 deg | |
| Effective wall friction angle | $\delta_b$ = 15 deg | | |
| Effective base friction angle | $\delta_{bb}$ = 30 deg | | |
| Allowable bearing pressure | $P_{bearing}$ = 3500 psf | | |

### Loading details

| | |
|---|---|
| Live surcharge load | $Surcharge_L$ = 400 psf |

| Tedds<br>IES Engineers<br><br>Blue Bell, PA 19422 | Project<br>Elcon Recycling | | | | Job Ref.<br>R9 | |
|---|---|---|---|---|---|---|
| | Section<br>Perimeter Wall - Max Height + surcharge, 500 Year Flood | | | | Sheet no./rev.<br>2 | |
| | Calc by<br>A. Popoli | Date<br>1/24/2019 | Chk'd by | Date | App'd by | Date |




**Calculate retaining wall geometry**

| | |
|---|---|
| Base length | $l_{base}$ = 6 ft |
| Base height | $h_{base}$ = 2 ft |
| Saturated soil height | $h_{sat}$ = 6 ft |
| Moist soil height | $h_{moist}$ = 2.5 ft |
| Length of surcharge load | $l_{sur}$ = 4 ft |
| Vertical distance | $x_{sur\_v}$ = 4 ft |
| Effective height of wall | $h_{eff}$ = 10.5 ft |
| Horizontal distance | $x_{sur\_h}$ = 4.25 ft |
| Horizontal distance above key | $x_{sur\_h\_a}$ = 4.75 ft |
| Area of wall stem | $A_{stem}$ = 9 ft$^2$ |
| Area of wall base | $A_{base}$ = 7 ft$^2$ |
| Area of saturated soil | $A_{sat}$ = 24 ft$^2$ |
| Area of water | $A_{water}$ = 24 ft$^2$ |
| Area of moist soil | $A_{moist}$ = 10 ft$^2$ |

| | |
|---|---|
| Vertical distance | $x_{stem}$ = 1.5 ft |
| Vertical distance | $x_{base}$ = 2.786 ft |
| Vertical distance | $x_{sat\_v}$ = 4 ft |
| Horizontal distance | $x_{sat\_h}$ = 1.667 ft |
| Horizontal distance above key | $x_{sat\_h\_a}$ = 2.333 ft |
| Vertical distance | $x_{water\_v}$ = 4 ft |
| Horizontal distance | $x_{water\_h}$ = 1.667 ft |
| Horizontal distance above key | $x_{water\_h\_a}$ = 2.333 ft |
| Vertical distance | $x_{moist\_v}$ = 4 ft |
| Horizontal distance | $x_{moist\_h}$ = 3.653 ft |
| Horizontal distance above key | $x_{moist\_h\_a}$ = 4.157 ft |

| Tedds<br>IES Engineers<br><br>Blue Bell, PA 19422 | Project<br>Elcon Recycling | | | | Job Ref.<br>R10 | |
|---|---|---|---|---|---|---|
| | Section<br>Perimeter Wall - Max Height + surcharge, 500 Year Flood | | | | Sheet no./rev.<br>3 | |
| | Calc. by<br>A. Popoli | Date<br>1/24/2019 | Chk'd by | Date | App'd by | Date |

Area of base soil $A_{pass} = 2\ ft^2$ Vertical distance $x_{pass\_v} = 0.5$ ft

Horizontal distance $x_{pass\_h} = 0.333$ ft

Area of excavated base soil $A_{exc} = 2\ ft^2$ Vertical distance $x_{exc\_v} = 0.5$ ft

Horizontal distance $x_{exc\_h} = 0.333$ ft

**Using Rankine theory**

Active pressure coefficient $K_A = 0.307$ Passive pressure coefficient $K_P = 3.255$

**From IBC 2009 cl.1807.2.3 Safety factor**

Load combination 1 1.0 × Dead + 1.0 × Live + 1.0 × Lateral earth

**Sliding check**

**Vertical forces on wall**

Total $F_{total\_v} = F_{stem} + F_{base} + F_{sat\_v} + F_{moist\_v} + F_{exc\_v} + F_{water\_v} = 7380$ plf

**Horizontal forces on wall**

Total $F_{total\_h} = F_{sat\_h} + F_{moist\_h} + F_{water\_h} + F_{sur\_h} = 4985$ plf

**Check stability against sliding**

Resistance to sliding $F_{rest} = 7515$ plf Factor of safety $FoS_{sl} = 1.507 > 1.5$

***PASS - Factor of safety against sliding is adequate***

**Overturning check**

**Vertical forces on wall**

Total $F_{total\_v} = F_{stem} + F_{base} + F_{sat\_v} + F_{moist\_v} + F_{exc\_v} + F_{water\_v} = 7380$ plf

**Horizontal forces on wall**

Total $F_{total\_h} = F_{sat\_h} + F_{moist\_h} + F_{exc\_h} + F_{water\_h} + F_{sur\_h} = 854$ plf

**Overturning moments on wall**

Total $M_{total\_OT} = M_{sat\_OT} + M_{moist\_OT} + M_{water\_OT} + M_{sur\_OT} = 13853$ lb_ft/ft

**Restoring moments on wall**

Total $M_{total\_R} = M_{stem\_R} + M_{base\_R} + M_{sat\_R} + M_{moist\_R} + M_{exc\_R} + M_{water\_R} = 25080$ lb_ft/ft

**Check stability against overturning**

Factor of safety $FoS_{ol} = 1.81 > 1.5$

***PASS - Factor of safety against overturning is adequate***

**Bearing pressure check**

**Vertical forces on wall**

Total $F_{total\_v} = F_{stem} + F_{base} + F_{sat\_v} + F_{moist\_v} + F_{pass\_v} + F_{water\_v} + F_{sur\_v} = 8980$ plf

**Horizontal forces on wall**

Total $F_{total\_h} = \max(F_{sat\_h} + F_{moist\_h} + F_{pass\_h} + F_{water\_h} + F_{sur\_h} - F_{total\_v} \times \tan(\delta_{bb}), 0\ plf) = 0$ plf

**Moments on wall**

Total $M_{total} = M_{stem} + M_{base} + M_{sat} + M_{moist} + M_{pass} + M_{water} + M_{sur} = 16542$ lb_ft/ft

**Check bearing pressure**

Bearing pressure at toe $q_{toe} = 3250$ psf Bearing pressure at heel $q_{heel} = 0$ psf

Factor of safety $FoS_{bp} = 1.077$

***PASS - Allowable bearing pressure exceeds maximum applied bearing pressure***

| Tedds<br>IES Engineers<br><br>Blue Bell, PA 19422 | Project<br>Elcon Recycling | | | | Job Ref.<br>R11 | |
|---|---|---|---|---|---|---|
| | Section<br>Perimeter Wall - Max Height + surcharge, 500 Year Flood | | | | Sheet no./rev.<br>4 | |
| | Calc. by<br>A. Popoli | Date<br>1/24/2019 | Chk'd by | Date | App'd by | Date |

## RETAINING WALL DESIGN

**In accordance with ACI 318-08**

Tedds calculation version 2.4.06

**Concrete details**

| | | | |
|---|---|---|---|
| Compressive strength | $f'_c$ = 4000 psi | Concrete type | Normal weight |

**Reinforcement details**

| | | | |
|---|---|---|---|
| Yield strength | $f_y$ = 60000 psi | Modulus of elasticity | $E_s$ = 29000000 psi |

**Cover to reinforcement**

| | | | |
|---|---|---|---|
| Front face of stem | $c_{sf}$ = 2 in | Rear face of stem | $c_{sr}$ = 3 in |
| Top face of base | $c_{ot}$ = 2 in | Bottom face of base | $c_{ob}$ = 3 in |

**From IBC 2009 cl.1605.2.1 Basic load combinations**

| | |
|---|---|
| Load combination no.1 | 1.4 × Dead |
| Load combination no.2 | 1.2 × Dead + 1.6 × Live + 1.6 × Lateral earth |
| Load combination no.3 | 1.2 × Dead + 1.0 × Earthquake + 1.0 × Live |
| Load combination no.4 | 0.9 × Dead + 1.0 × Earthquake + 1.6 × Lateral earth |

**Check stem design at base of stem**

Depth of section h = 12 in

**Rectangular section in flexure - Chapter 10**

| | | | |
|---|---|---|---|
| Factored bending moment | M = 14609 lb_ft/ft | | |
| Tens.reinforcement provided | No.6 bars @ 12" c/c | Tens.reinforcement provided | $A_{sr,prov}$ = 0.442 in²/ft |
| Max.reinforcement spacing | $s_{max}$ = 18 in | | |

*PASS - Reinforcement is adequately spaced*

| | | | |
|---|---|---|---|
| Nominal flexural strength | $M_n$ = 18334 lb_ft/ft | Strength reduction factor | $\phi_f$ = 0.9 |
| Design flexural strength | $\phi M_n$ = 16501 lb_ft/ft | $M / \phi M_n$ = 0.885 | |

*PASS - Design flexural strength exceeds factored bending moment*

| | | | |
|---|---|---|---|
| Reinforcement by analysis | $A_{sr,des}$ = 0.389 in²/ft | Min.tension reinforcement | $A_{sr,min}$ = 0.345 in²/ft |

*PASS - Area of reinforcement provided is greater than minimum area of reinforcement required*

**Rectangular section in shear - Chapter 11**

| | | | |
|---|---|---|---|
| Factored shear force | V = 4599 lb/ft | | |
| Nominal conc.shear strength | $V_c$ = 13092 lb/ft | Strength reduction factor | $\phi_s$ = 0.75 |
| Design conc.shear strength | $\phi V_c$ = 9819 lb/ft | $V / \phi V_c$ = 0.468 | |

*PASS - No shear reinforcement is required*

**Horizontal reinforcement parallel to face of stem**

| | | | |
|---|---|---|---|
| Min.area of reinforcement | $A_{sx,req}$ = 0.288 in²/ft | | |
| Trans.reinforcement provided | No.4 bars @ 8" c/c each face | Trans.reinforcement provided | $A_{sx,prov}$ = 0.589 in²/ft |

*PASS - Area of reinforcement provided is greater than area of reinforcement required*

**Check base design at toe**

Depth of section h = 12 in

**Rectangular section in flexure - Chapter 10**

| | | | |
|---|---|---|---|
| Factored bending moment | M = 2142 lb_ft/ft | | |
| Tens.reinforcement provided | No.4 bars @ 8" c/c | Tens.reinforcement provided | $A_{bb,prov}$ = 0.295 in²/ft |
| Max.reinforcement spacing | $s_{max}$ = 18 in | | |

#5@12" (0.31 in²/ft)

| Tedds<br>IES Engineers<br>Blue Bell, PA 19422 | Project<br>Elcon Recycling | | | | Job Ref.<br>R12 | |
|---|---|---|---|---|---|---|
| | Section<br>Perimeter Wall - Max Height + surcharge, 500 Year Flood | | | | Sheet no./rev.<br>5 | |
| | Calc. by<br>A. Popoli | Date<br>1/24/2019 | Chk'd by | Date | App'd by | Date |

*PASS - Reinforcement is adequately spaced*

Nominal flexural strength $M_n$ = 12567 lb_ft/ft — Strength reduction factor $\phi_f$ = 0.9

Design flexural strength $\phi M_n$ = 11310 lb_ft/ft — M / $\phi M_n$ = 0.189

*PASS - Design flexural strength exceeds factored bending moment*

Reinforcement by analysis $A_{bb.des}$ = 0.055 in²/ft — Min.tension reinforcement $A_{bb.min}$ = 0.259 in²/ft

*PASS - Area of reinforcement provided is greater than minimum area of reinforcement required*

**Rectangular section in shear - Chapter 11**

Factored shear force V = 4089 lb/ft

Nominal conc.shear strength $V_c$ = 13282 lb/ft — Strength reduction factor $\phi_s$ = 0.75

Design conc.shear strength $\phi V_c$ = 9961 lb/ft — V / $\phi V_c$ = 0.411

*PASS - No shear reinforcement is required*

**Rectangular section in flexure - Chapter 10** HEEL

Factored bending moment M = 15123 lb_ft/ft

Tens.reinforcement provided No.4 bars @ 8" c/c — Tens.reinforcement provided $A_{bt.prov}$ = 0.295 in²/ft

Max.reinforcement spacing $s_{max}$ = 18 in

DK-SEE R18 *PASS - Reinforcement is adequately spaced*

Nominal flexural strength $M_n$ = 14039 lb_ft/ft — Strength reduction factor $\phi_f$ = 0.9

Design flexural strength $\phi M_n$ = 12635 lb_ft/ft — M / $\phi M_n$ = 1.197

FAIL - *Design flexural strength is less than factored bending moment*

Reinforcement by analysis $A_{bt.des}$ = 0.354 in²/ft — Min.tension reinforcement $A_{bt.min}$ = 0.259 in²/ft

*PASS - Area of reinforcement provided is greater than minimum area of reinforcement required*

**Rectangular section in shear - Chapter 11**

Factored shear force V = 5517 lb/ft

Nominal conc.shear strength $V_c$ = 14799 lb/ft — Strength reduction factor $\phi_s$ = 0.75

Design conc.shear strength $\phi V_c$ = 11100 lb/ft — V / $\phi V_c$ = 0.497

*PASS - No shear reinforcement is required*

**Check key design**

Depth of section h = 12 in

**Rectangular section in flexure - Chapter 10**

Factored bending moment M = 928 lb_ft/ft

Tens.reinforcement provided No.4 bars @ 8" c/c — Tens.reinforcement provided $A_{k.prov}$ = 0.295 in²/ft

Max.reinforcement spacing $s_{max}$ = 18 in

*PASS - Reinforcement is adequately spaced*

Nominal flexural strength $M_n$ = 12567 lb_ft/ft — Strength reduction factor $\phi_f$ = 0.9

Design flexural strength $\phi M_n$ = 11310 lb_ft/ft — M / $\phi M_n$ = 0.082

*PASS - Design flexural strength exceeds factored bending moment*

Reinforcement by analysis $A_{k.des}$ = 0.024 in²/ft — Min.tension reinforcement $A_{k.min}$ = 0.259 in²/ft

*PASS - Area of reinforcement provided is greater than minimum area of reinforcement required*

**Rectangular section in shear - Chapter 11**

Factored shear force V = 1737 lb/ft

Nominal conc.shear strength $V_c$ = 13282 lb/ft — Strength reduction factor $\phi_s$ = 0.75

Design conc.shear strength $\phi V_c$ = 9961 lb/ft — V / $\phi V_c$ = 0.174

*PASS - No shear reinforcement is required*

IES ENGINEERS

SUBJECT ELCON SHEET# OF

BY AFPajak DATE 6/29/2016

PROJECT# REV 1 AFPajak 1/24/2019

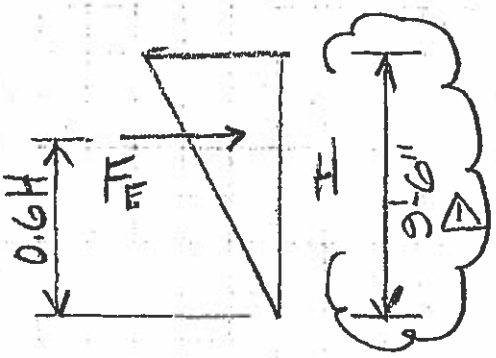
## SEISMIC (LC3)

REF IBC 2009 SECT 1807.2.3

USE 0.7X NOMINAL EARTHQUAKE FORCE, FOS = 1.1

$S_{DS}$ FOR SITE IS 0.30g

SEISMIC LOAD IS INVERTED TRIANGLE:




$F_E = \frac{2}{3} K_{hE} \gamma H^2$

$\gamma = 125$ pcf

$K_{hE} = \frac{S_{DS}}{2.5} = 0.12$ (IBC 1803.5.12)

$F_E = \frac{2}{3}(.12)(125)(9.5^2) = 406$ #/FT ⚠ 508

SEISMIC OTM = (406)(.6)(9.5) = 2071 ft-#/ft. 2894 ⚠

REF LC1 DESIGN: OTM = 11034 ft-#

STABILITY M = 22608 ft-# PG R5

ADD SEISMIC TO LC1 FOR LC4:

OTM FOS = $\frac{22608}{11034 + 0.7(2894)} = \frac{22608}{13060} = 1.73$ ⚠ ~~1.47~~ > 1.1 OK

SLIDING FOS = $\frac{5584}{3408 + 0.7(508)} = \frac{5584}{3764} = 1.48$ ~~1.69~~ > 1.1 OK

(CONSERVATIVE - USES 1.0L INSTEAD OF 0.75L)

IES ENGINEERS

SUBJECT ELCON SHEET# OF

BY APRoyle DATE 6/29/2016

PROJECT# REV 1 APRoyle 1/24/2019

## BEARING PRESSURE

FROM LC1 ANALYSIS: $M = \frac{11034}{7887}$ ft-#

$V = \frac{6900}{6154}$ #

$CG = \frac{11034}{7887} = \frac{6900}{6154} = 1.78$ ft ; 1.4'

$e = \frac{6}{2} - 1.6 = 1.4'$

$4.67 - 1.78 = 1.05'$

$> b/6 = 1.33'$

REF TENG, "FOUNDATION DESIGN" PRENTICE-HALL 1962

FIG 6-14

$$q_{max} = \frac{Q}{A}\left[\frac{4B}{3B-6e}\right]$$

$$= \frac{6900}{6.0 \times 6.0}\left[\frac{4(6.0)}{3(6.0)-6(1.4)}\right]$$

$$= \frac{1318}{1150}\left[\frac{6.42}{2.5}\right] = \frac{3193}{2875} = 2760 \text{ psf}$$

IN PROGRAM ✓

ADD SEISMIC MOMENT, RECALCULATE

ADJUST OTM FOR 0.75E

SURCHARGE OTM $= \frac{125(9.5/6.7)^2}{2} = \frac{5641}{4516}$ ft-#

$0.25 M_{ll}$ = REDUCTION $\frac{1410}{1129}$ ft-#

SEISMIC OTM $= 0.75(.7)\frac{2834}{2071} = \frac{1520}{1007}$ ft-#

NET INCREASE $42$ ft-#

$+110$ ft-#

NEGLIGIBLE - BEARING PRESSURE OK

$\frac{11034+110}{11034} = 1.01$ I.E. 1% INCREASE - NEGLIGIBLE

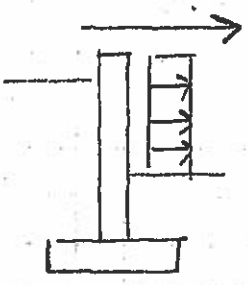
SUBJECT ELCON SHEET# OF

BY AP Pogoli DATE 6/30/2016

PROJECT# (REV 1 AP Pogoli 1/24/2019)

## WIND (LC4)

V = 95 MPH, EXP C



WIND OVER TOP OF WALL CREATES A SUCTION FORCE THAT CONTRIBUTES TO OVERTURNING.

FROM ASCE 7-05, SECTION 6.5.15

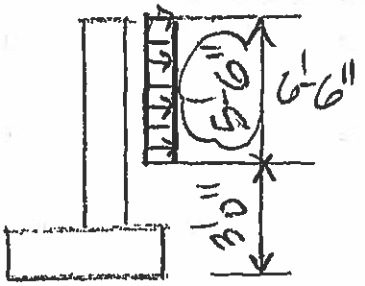
$F = q_z G C_f A_f$ $\quad G = 0.85, C_f = 1.4$

$q_z = 0.00256 K_z K_{zT} K_D V^2 I$

$K_z = 0.57, K_{zT} = 1.0, K_D = 0.85, I = 1.0$

$q_z = 0.00256(.57)(1)(.85)(95)^2(1.0)$

$= 11.2$ say 12 psf.




$F = 12(.85)(1.4) = 14.3$ say 15 psf.

$V_{WIND} = 15(\frac{5.5+6.5}{2}) = 93$ plf

$OTM_{WIND} = 93(3 + \frac{5.5+6.5}{2}/2)$

$= 480$ ft-k/ft. 613

LOAD COMBIN $\quad D + L + 0.75L + 0.75W$

$0.25L = 1129$ kips* (FROM LC5 ANALYSIS) 1410

$> 0.75W$

REDUCTION IN LL OFFSETS WIND OTM. WALL OK

IES ENGINEERS

SUBJECT ELCON SHEET# OF

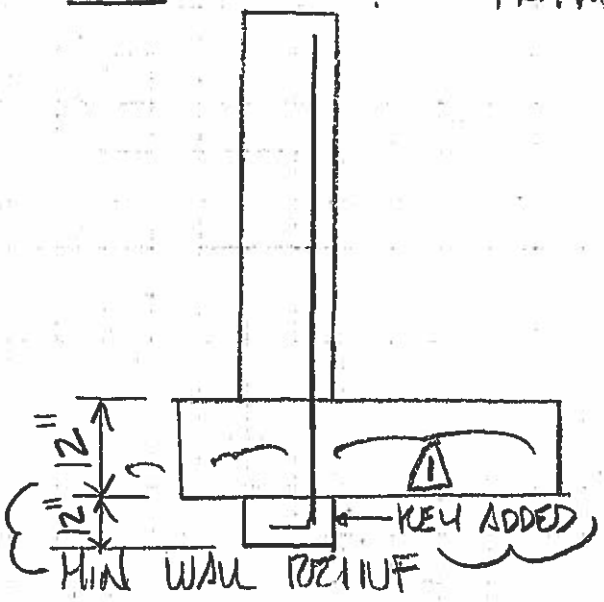
BY AP DATE 6/30/2016

PROJECT# REV 1 AP 1/24/2019

## REINFORCING

MODIFY REINF AS DESIGNED BY PROGRAM / RECHECK ACI CODE.

WALL




PRIMARY REINF #6 @12" - OK

$\phi M_N$ = 16501 FT-#/FT. (R11)

CHECK BASE DEVELOPMENT

$ld_h = 19 d_b \times 0.7 = 10"$

AVAILABLE EMBED

~~12~~ 24 - 3" - 2(1/2) = ~~8"~~ 20"

∴ 100% DEVELOPED

~~PER ACI 318 08 12.5.3(d)~~

~~FURTHER DEVELOPMENT~~

~~∴ $\phi M_N = \frac{8}{10}(16501)$~~ ⚠

~~= 13,200 FT #/FT.~~

> MAX LOADING

M = ~~10712~~ 14609 FT-#/FT (LC2) OK.

FLEXURAL SIDE

$\rho = .0033$

$d = 12 - 2 - 3/4 - 3/8 = 8\ 3/8"$

Say 9"

$A_{S MIN} = .0033(9)(12)$

$= 0.36\ IN^2/FT.$ OK.

EXPOSED FACE: $A_{S MIN} = .0015(12)(12) = 0.22\ IN^2$ TOTAL

#4 @12" FRONT FACE ADDS 0.20 TO 0.94 OK

HORIZ: $A_{S MIN} = .0020(12)(12) = 0.29\ IN^2/FT.$

#4 @12" HORIZ EF 0.40 $IN^2/FT$ OK

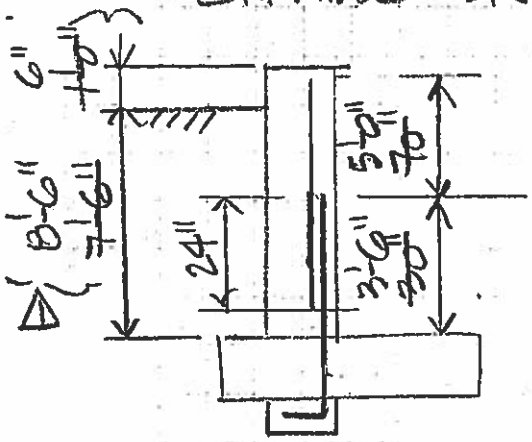
IES ENGINEERS

SUBJECT ELCON SHEET# OF

BY APayoll DATE 6/30/2016

PROJECT# (REV 1 APayoll 1/24/2019)

CONSIDER SPLICING #6 MAIN BAR




#6 $l_d = 38 d_b = 28.5$ IN.

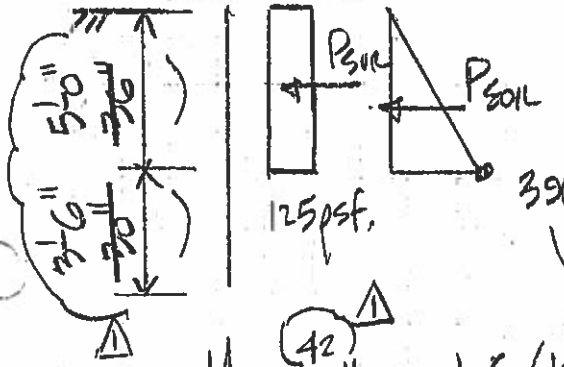
#4 $l_d = 38(.5) = 19$ IN $\times 1.3$ (SPLICE)

$= 24.7$ say 24"

SAVE $\frac{70}{12}(1.502) =$ 8.76 #/FT.

ADD $\frac{(70+24)}{12}(.67) =$ 5.25

3.5 #/FT. SAVINGS




$39(\frac{3}{5}) = \frac{195}{5} = 117$ #/FT ⚠1

$M_{u@2'-10"} = 1.6\frac{(17.5)}{2}(\frac{3}{5})^2 + 1.6(117)\frac{5}{2}(\frac{3}{5})(\frac{5}{3}) = 3000$ FT-#/FT. ⚠1

$F = \frac{(9)^2}{1000} = 0.081$ ; $K_M = \frac{M_u}{F} = 47$ ; $a_M = 4.95$

$A_s = \frac{M_u}{\phi a_M} = \frac{3.8}{9(4.45)} = 0.10$ IN$^2$ ⚠1

# 4 @ 12" OC

(0.2 IN$^2$/FT)

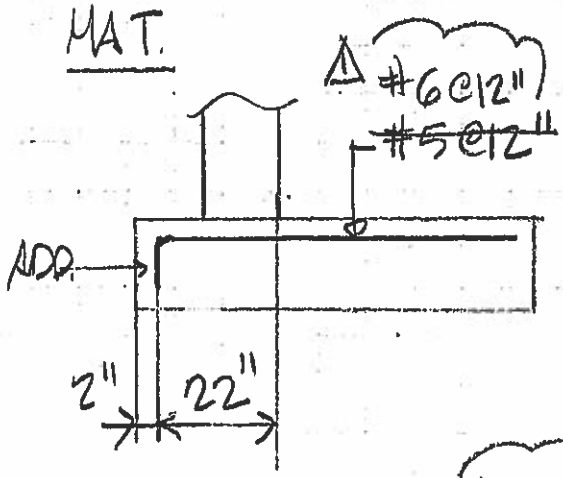
IES ENGINEERS

SUBJECT ELCON SHEET# OF

BY XP DATE 6/30/2016

PROJECT# (REV 1 XP 1/24/2019)

MAT.




PROGRAM DEFAULT VALUE IS #4@8"

$\#\frac{6}{5} l_d = 38(.1025) = 28.5" < 22"$ AVAILABLE

ADD STD HOOK

OTHER HOOKS SHOWN ON PROGRAM NOT REQUIRED - $l_d$ IS ADEQUATE

$A_{S\,MIN} = .003(12)(\frac{d}{0.5}) = 0.31\,IN^2/FT.$ #5@12"

LC1 $M_u = 12189$ ~~8361~~ FT-#/FT.

$\phi M_N = 12635 \times \frac{8}{12} = 8423$ FT-#/FT - OK

LC2 $M_u = 15123$ ~~8994~~ FT-#/FT. > $\phi M_N = 12635$ FT-#

RECHECK $\phi M_N$

$d = 12 - 2 - \frac{1}{2} - \frac{1}{4} = 9\frac{1}{4}"$

$F = \frac{(9.25)^2}{1000} = 0.0855$

$K_u = \frac{M_u}{F} = \frac{15123}{.0855} = 177$ ~~8994 / .0855 = 105~~; $a_u = 4.37$ ~~4.42~~

$A_S\,REQ'D = \frac{15.123}{9.25(4.37)} = 0.37\,IN^2/FT$ ~~0.22 IN²/FT.~~

USE $\#\frac{6}{5}$@12" TOP BAR

$A_S = 0.44\,IN^2/FT > 0.35$ REQ'D BY PROGRAM ~~#4@8" (0.30 IN²/FT.)~~

PROVIDE STD HOOK @ TOE ✓ $l_{dh} = 19(.75)(.7) = 10.0" < 22"$ AVAILABLE ~~8.3"~~

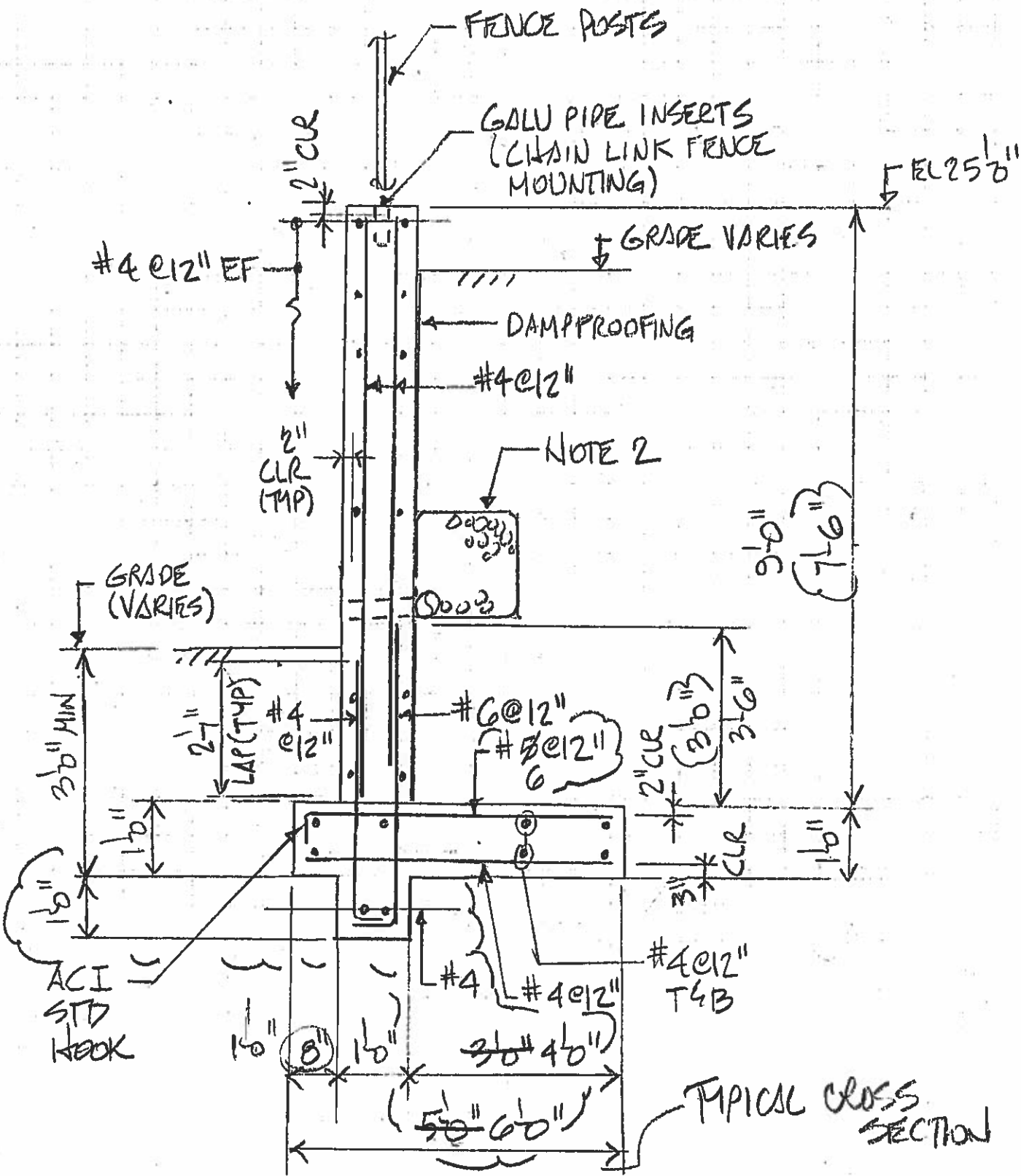
OK.

IES ENGINEERS

SUBJECT ELCON SHEET# OF

BY XPRoyden DATE 6/30/2016

PROJECT# (REV 1 XPRoyden 1/24/2019)



## *BUCKS COUNTY RECORDER OF DEEDS*

55 East Court Street
Doylestown, Pennsylvania 18901
(215) 348-6209

Instrument Number - 2006062298
Recorded On 6/6/2006 At 10:43:25 AM
* Instrument Type - PLANS
Invoice Number - 140829 User - NMS
* Grantor - U S S R E
*
* Customer - U S S REAL ESTATE
* FEES

| | |
|---|---|
| RECORDING FEES | $50.50 |
| TOTAL | $50.50 |

* Total Pages - 3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I hereby CERTIFY that this document is recorded in the Recorder of Deeds Office of Bucks County, Pennsylvania.


Edward R. Gudknecht
Recorder of Deeds

* - Information denoted by an asterisk may change during the verification process and may not be reflected on this page.

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