AECOM

SHOP DRAWING REVIEW COMMENTS

PROJECT:	Durham Meadows Waterline Remedial Design		
CONTRACT NO:	W912WJ19C0002	**AECOM PROJECT NO.:**	60494812
ENGINEER'S SUBMITTAL NO.:	02160-1	**REVISION IDENTIFIER:**	1
CONTRACTOR'S SUBMITTAL NO.:	02160-1	**REVISION IDENTIFIER:**	1
SUBJECT:	Excavation Support Systems		

REVIEW CODES:

A – Approved as submitted.

B – Approved, except as noted on drawings. Resubmission not required.

C – Approved, except as noted on drawings. Refer to attached comments. Resubmission required.

D – Will be returned by separate correspondence.

E – Disapproved. Refer to attached comments.

F – Receipt Acknowledged.

X – Receipt acknowledged, does not comply with contract requirements, as noted.

G – Other action required.

The Engineer's review is for general conformance with the design concept and Contract Documents. Markings or comments shall not be construed as relieving the Contractor from compliance with the Contract plans and specifications or from departures there from. The Contractor remains responsible for details and accuracy, for confirming and correlating all quantities and dimensions, for selecting fabrication processes, for techniques of assembly, and for performing work in a safe manner. AECOM Technical Services, Inc.

DATE:	3 July 2019	**REVIEWER:**	R. Berlandy

The review is provided to assist the contractor in the management of construction. It should not be considered complete. In order to maintain continuity between submittals, the previous comment numbers have been retained. The shop drawing review comments follow:

COMMENT NUMBER	REFERENCE	CODE	COMMENT
1.	02160 1.03 2	C	*Provide site specific excavation support plans for altitude valve vault, water meter vault, pressure reducing vault, stream crossings, and pipe casing installations in addition to the trench support plans.* Resubmittal indicates this will be provided in future. Submittal reviewed for trench operations only.
2.	02160 1.03 2	B	~~Provide minimum lateral distance from excavation support for vehicles, construction equipment, and stockpiled construction and excavation materials.~~ Distance provided.
3.	02160 1.03 3	B	~~Provide construction contingency plan. Not provided~~ See note 16 on Exhibit A-1
4.	02160 1.05	B	~~Provide maximum width of pipe trench supported. Not provided.~~ See note 13 on Exhibit A-1

TRANSMITTAL OF SHOP DRAWINGS, EQUIPMENT DATA, MATERIAL SAMPLES, OR MANUFACTURER'S CERTIFICATES OF COMPLIANCE

For use of this form, see ER 415-1-0; the proponent agency is CECW-CE

DATE	TRANSMITTAL NO.
7/2/2019	02160-1.2

SECTION I - REQUEST FOR APPROVAL OF THE FOLLOWING ITEMS (This section will be initiated by the contractor)

TO:	FROM:	CONTRACT NO.	THIS IS A:
WESTOVER RESIDENT OFFICE 570 Patriot Avenue Box 70 Chicopee, MA 01022-1634	Ludlow Construction Co., Inc. 19 Carmelina's Circle, Ludlow MA01056	W912WJ19C0002	RESUBMITTAL OF TRANSMITTAL 02160-1.1

SPECIFICATION SEC. NO. (Cover only one section with each transmittal)	PROJECT TITLE AND LOCATION 01	THIS TRANSMITTAL IS FOR: (Check one)
02160-Solidificatn/Stabilizatn-Contam Mat'l	Durham Meadows Waterline Remedial Design,	☐ FIO ☑ GA ☐ DA ☐ CR ☐ DA/CR ☐ DA/GA ☐ S

ITEM NO. (See Note 3) a.	DESCRIPTION OF SUBMITTAL ITEM (Type size, model number/etc) b.	SUBMITTAL TYPE CODE (See Note 8) c.	NO. OF COPIES d.	CONTRACT REFERENCE DOCUMENT		FOR CONTRACTOR USE g.	VARIATION (See Instruction No. 6) h.	FOR CE USE CODE (Note 9) i.
				SPEC. PARA NO. e.	DRAWING SHEET NO. f.			
2	Excavation Support Plan	01 - PRECONSTRUCTION SUBMITTALS	0	1.03.A.2		A	No	

Remarks from Contractor
Revision with contingency plan

I certify that the above submitted items have been reviewed in detail and are correct and in the strict conformance with the contract drawings and specifications except as otherwise stated.

NAME AND SIGNATURE OF CONTRACTOR

SECTION II - APPROVAL ACTION

ENCLOSURES RETURNED (List by item No.)	NAME, TITLE AND SIGNATURE OF APPROVING AUTHORITY	DATE

Temporary Excavation Support Design

Durham Meadows Waterline Remedial Design

Durham, Middlefield, and Middletown, Connecticut

July 1, 2019

Project No. J2195015

Prepared for:

Ludlow Construction Co., Inc.
Ludlow, Massachusetts

Prepared by:

Terracon Consultants, Inc.
Rocky Hill, Connecticut

July 1, 2019

Ludlow Construction Co., Inc.
19 Carmelina's Circle
Ludlow, MA 01056

Attn: Mr. Michael Pio
P: (413) 583 2522
E: mpio@ludlowconstruction.com

Re: Geotechnical Engineering Design Services
Durham Meadows Waterline Remedial Design – Revision 2
Durham, Middlefield, and Middletown, Connecticut
Terracon Project No. J2195015

Dear Mr. Pio:

Terracon Consultants, Inc. (Terracon) is submitting, herewith, the revised temporary excavation support design for the above-referenced project. The work was performed in general accordance with our proposal dated October 25, 2018.

This submittal includes drawings for the trench shield system, including design calculations for the system, and addresses secondary review comments on Transmittal No. 2160-1.1 dated June 26, 2019.

We appreciate the opportunity to be of service to you on this project. If you have questions concerning this design, or if we may be of further service, please contact us.

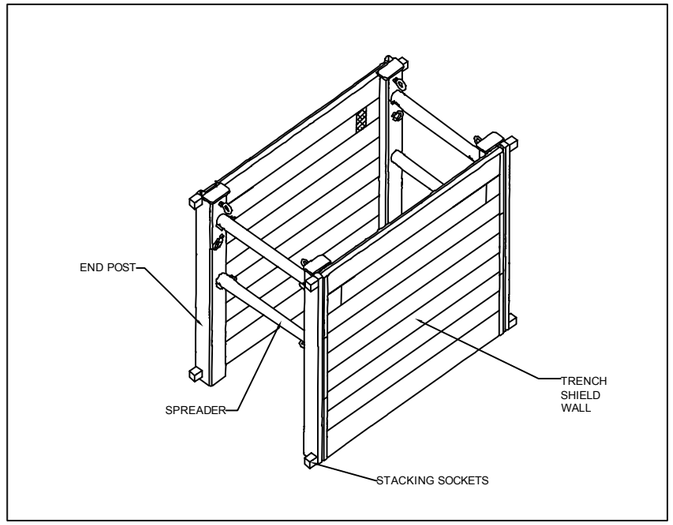
Sincerely,
Terracon Consultants, Inc.

Christian B. Rice, P.E.
Senior Staff Geotechnical Engineer

Stephen C. Lanne, P.E.
Geotechnical Department Manager

/cbr/J2195015

Attachment: Exhibit A-1 Trench Shield Diagram
Exhibit A-2 Trench Shield Details
Exhibit A-3 Trench Shield Calculations



TYPICAL TRENCH SHIELD DIAGRAM

NTS

GENERAL NOTES:

1. TRENCH SHIELD SHORING SYSTEMS ILLUSTRATED ON PLANS ARE TO BE UTILIZED AT VARIOUS LOCATIONS THROUGHOUT THE PROJECT.
2. CONTACT CALL BEFORE YOU DIG (1-800-922-4455) TO MARK OUT EXISTING UTILITIES AT LEAST 72 BUSINESS HOURS PRIOR TO START OF EXCAVATION.
3. ALL EXCAVATIONS SHALL BE IN ACCORDANCE WITH OSHA STANDARDS AND THE PROJECT DOCUMENTS.
4. THE CONTRACTOR SHALL BE SOLELY RESPONSIBLE FOR THE SAFE AND PROPER USE OF THE TRENCH SHIELD SYSTEM, INCLUDING PROVIDING ACCESS AND BARRICADING. TERRACON WILL NOT SUPERVISE, DIRECT, CONTROL, OR HAVE AUTHORITY OVER, OR BE RESPONSIBLE FOR CONTRACTOR'S MEANS, METHODS, TECHNIQUES, OR PROCEDURES OF CONSTRUCTION OR THE SAFETY PRECAUTIONS AND PROGRAMS INCIDENT THERETO, OR FOR ANY FAILURE OF CONTRACTOR TO COMPLY WITH LAWS AND REGULATIONS APPLICABLE TO THE FURNISHING OR PERFORMANCE OF WORK.
5. ALL TRENCH SHIELDS SHALL BE INSPECTED BY CONTRACTOR FOR EXCESS WEAR OR DAMAGE PRIOR TO USE IN ANY TRENCH EXCAVATION. TRENCH SHIELDS SHALL BE UTILIZED IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS. THE CONTRACTOR SHALL FAMILIARIZE HIMSELF WITH MANUFACTURER'S REQUIREMENTS FOR SPREADER CONNECTIONS, TRENCH WIDTH, STACKING CONFIGURATION, AND HOISTING/SLIDING POINTS.
6. TRENCH SHIELDS HAVE BEEN EVALUATED BASED ON A MAXIMUM VERTICAL CONSTRUCTION SURCHARGE OF 250 PSF. TERRACON SHOULD BE NOTIFIED PRIOR TO USE IF CONSTRUCTION SURCHARGE IS EXPECTED TO EXCEED THIS VALUE, SO ADDITIONAL ANALYSIS CAN BE COMPLETED.
7. SUBSURFACE CONDITIONS AT THE PROJECT ARE EXPECTED TO CONSIST OF OSHA TYPE C(60) OR BETTER SOIL TO THE MAXIMUM DEPTH OF EXCAVATION. TERRACON SHOULD BE NOTIFIED IMMEDIATELY IF ACTUAL FIELD CONDITIONS VARY FROM THOSE EXPECTED.
8. THE CONTRACTOR SHALL DEWATER AS REQUIRED TO PREVENT HYDROSTATIC PRESSURE ON THE TRENCH SHIELD AND TO MAINTAIN TRENCH STABILITY. SURFACE WATER SHALL BE PREVENTED FROM ENTERING THE TRENCH EXCAVATION.
9. TRENCH SHIELDS SHALL BE INSTALLED IN A MANNER THAT MINIMIZES GROUND LOSS AROUND THE SHIELD AND IN SHIELD OPENINGS. VOIDS BETWEEN THE EXCAVATION AND TRENCH SHIELD SHALL BE BACKFILLED WITH EXCAVATED SOILS OR SIMILAR MATERIAL PRIOR TO WORKERS ENTERING THE EXCAVATION.
10. TRENCH SHIELDS SHALL MEET THE MINIMUM PRESSURE RATING TABULATED ON THIS PAGE.
11. CAPACITIES TABULATED ABOVE ASSUME SHIELDS ARE IN "GOOD" CONDITION, UTILIZED IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS, UTILIZE STANDARD SPREADERS, AND INSTALLED IN DRY OR DEWATERED CONDITIONS. TRENCH SHIELD SHALL BE INSPECTED PRIOR TO AND AS CONSTRUCTION PROCEEDS.
12. TRENCH SHIELDS MAY BE STACKED TO REACH REQUIRED EXCAVATION DEPTHS PROVIDED THEY ARE CONNECTED PER MANUFACTURER'S RECOMMENDATIONS AND MAXIMUM ALLOWABLE DEPTH NOTED ABOVE IS NOT EXCEEDED.
13. WIDTH OF TRENCHES TO BE SUPPORTED SHALL BE LIMITED TO THE MANUFACTURED TRENCH SHIELD SPREADER LENGTH.
14. CONSTRUCTION EQUIPMENT SHOULD NOT BE LEANED AGAINST OR SUSPENDED FROM TRENCH SHIELD SPREADERS AT ANY TIME.
15. VEHICLES, CONSTRUCTION EQUIPMENT, AND STOCKPILED CONSTRUCTION MATERIALS SHALL MAINTAIN A MINIMUM LATERAL DISTANCE OF 4 FEET FROM THE EDGE OF TRENCH SHIELDS. EXCAVATED MATERIALS SHALL MAINTAIN A MINIMUM LATERAL DISTANCE OF 2 FEET FROM THE EDGE OF TRENCH SHIELDS
16. CONTINGENCY PLAN: IF THE ALLOWABLE MOVEMENT OF THE ADJACENT GROUND OR STRUCTURES ARE EXCEEDED, THE CONTRACTOR WILL BACKFILL THE EXCAVATION IMMEDIATELY AND DEVELOP ANOTHER EXCAVATION SUPPORT PLAN.

TRENCH SHIELD REQUIREMENTS

EXCAVATION DEPTH (FEET)	MINIMUM TRENCH SHIELD RATING (psf)
4	365
6	485
8	605
10	725
12	845
14	965
16	1,085

CONSTRUCTION SEQUENCE:

1. LOCATE EXISTING UTILITIES WITHIN THE VICINITY OF THE WORK BY CONTACTING CBYD AND REVIEWING AVAILABLE PLANS. THE USE OF PRIVATE UTILITY LOCATORS SHOULD BE CONSIDERED FOR CRITICAL UTILITIES OR WHEN AVAILABLE INFORMATION IS NOT SUFFICIENT TO COMPLETE THE WORK.
2. ASSESS THE REQUIRED DEPTH AND WIDTH OF EXCAVATION BASED ON THE CONTRACT DOCUMENTS.
3. SELECT THE APPROPRIATE TRENCH SHIELD MODEL AND CONFIGURATION TO SAFELY MAINTAIN THE EXCAVATION.
4. EXCAVATE AND INSTALL TRENCH SHIELD(S) IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS, MAINTAINING SECURITY OF TRENCH EXCAVATIONS, EXISTING UTILITIES, AND STRUCTURES AS INSTALLATION PROGRESSES.
5. UPON COMPLETION OF UTILITY INSTALLATION, BACKFILL EXCAVATIONS AND REMOVE TRENCH SHIELDS SEQUENTIALLY AND IN A MANNER THAT MAINTAINS THE SECURITY OF THE TRENCH.

Prepared For:

LUDLOW CONSTRUCTION CO. INC.
19 CARMELINA'S CIRCLE
LUDLOW, MA 01056

Project Mngr:	CBR
Drawn By:	CBR
Checked By:	SCL
Approved By:	SCL

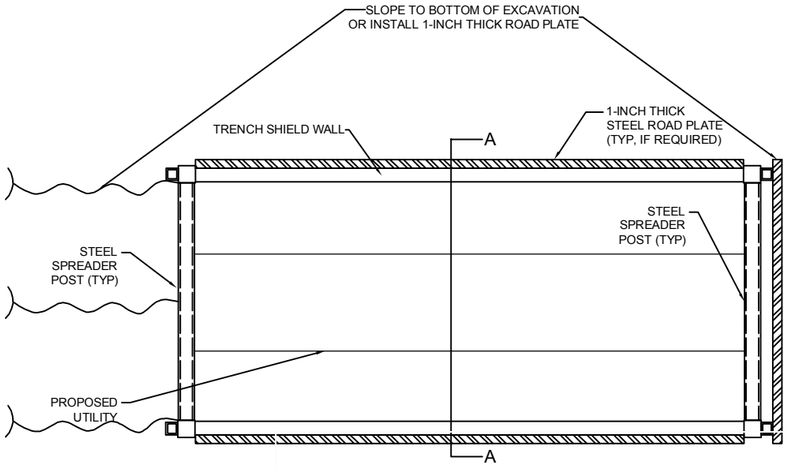
Project No.	J2195015
Scale:	AS SHOWN
File No.	J2195015
Date:	JULY 2019

Terracon
201 Hammer Mill Road Rocky Hill, Connecticut 06067
PH. (860)721-1900 FAX.(860)721-1939

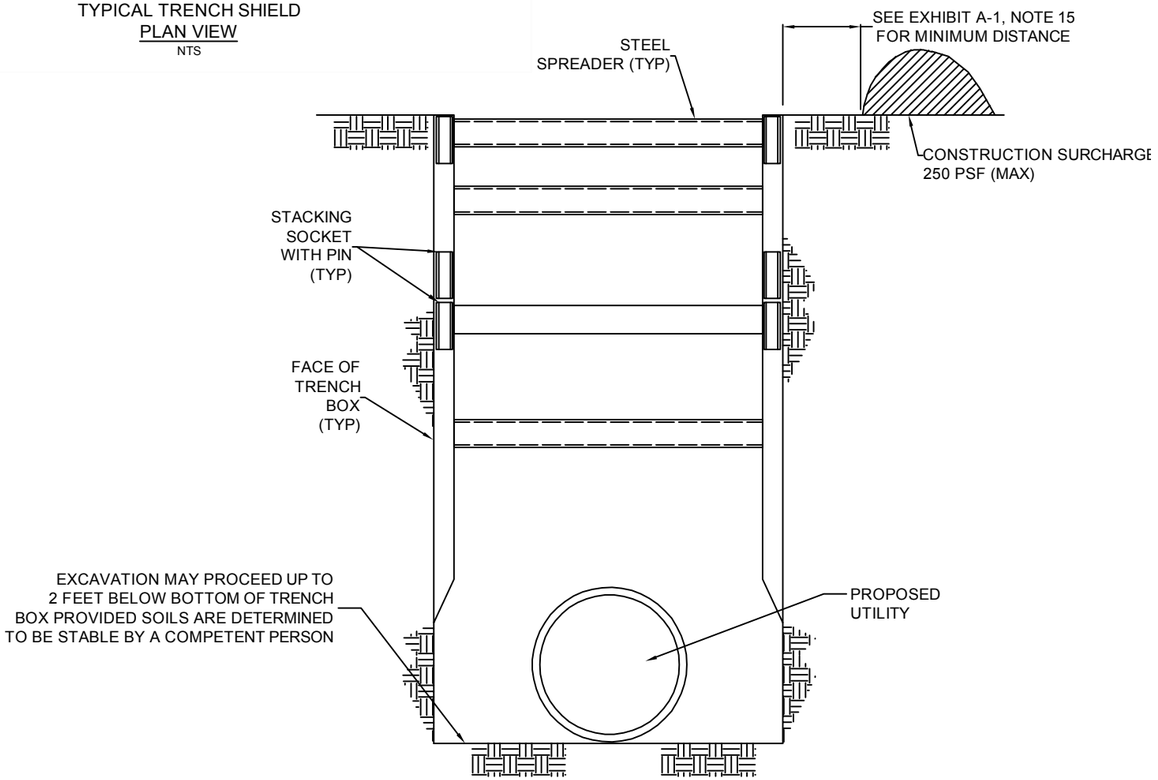
TRENCH SHIELD DIAGRAM

DURHAM MEADOWS WATERLINE REMEDIAL DESIGN
DURHAM, MIDDLEFIELD, AND MIDDLETOWN, CONNECTICUT

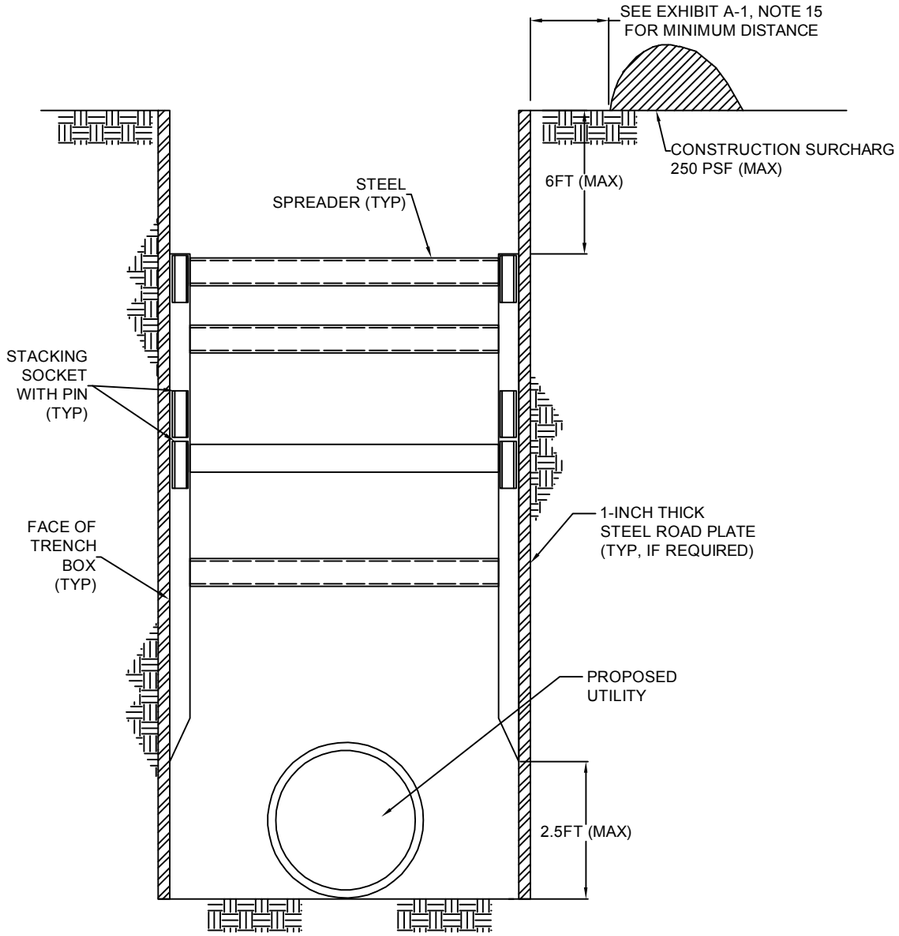
EXHIBIT
A-1



TYPICAL TRENCH SHIELD
PLAN VIEW
NTS



TYPICAL TRENCH SHIELD
SECTION VIEW A
NTS



TYPICAL TRENCH SHIELD WITH STEEL ROAD PLATES
SECTION VIEW A
NTS

Prepared For:

LUDLOW CONSTRUCTION CO. INC.
19 CARMELINA'S CIRCLE
LUDLOW, MA 01056

Project Mngr:	CBR
Drawn By:	CBR
Checked By:	SCL
Approved By:	SCL

Project No.	J2195015
Scale:	AS SHOWN
File No.	J2195015
Date:	JULY 2019

Terracon
201 Hammer Mill Road Rocky Hill, Connecticut 06067
PH. (860)721-1900 FAX.(860)721-1939

TRENCH SHIELD DETAILS

DURHAM MEADOWS WATERLINE REMEDIAL DESIGN
DURHAM, MIDDLEFIELD, AND MIDDLETOWN, CONNECTICUT

EXHIBIT
A-2

Durham Meadows Waterline Remedial Design
Terracon Project No. J2195015
7/1/2019

Exhibit A-3 Trench Shield Calculations

Design Soil Parameters

Granular Fill and Native Soils

Unit Weight (g_f)	120	pcf
Friction Angle (ϕ_f)	30	degrees
At Rest Earth Pressure Coefficient (K_{0f})	0.50	

Note: Hydrostatic pressure is not included as system is considered free-draining or dewatered in the short-term condition

Project Parameters

Maximum depth of excavation (d_m)	16	feet	
Construction surcharge (q_s)	250	psf	(vertical)

Lateral Earth Pressure

$P_e(z) = K_{0f}(g_f*z+q_s)$

Depth of Excavation			Calculated Lateral Earth Pressure	
D1	4	feet	365	psf
D2	6	feet	485	psf
D3	8	feet	605	psf
D4	10	feet	725	psf
D5	12	feet	845	psf
D6	14	feet	965	psf
D7	16	feet	1085	psf

The calculated earth pressure above should be compared to the trench shield rated capacity at its allowable depth

Steel Sheeting Above Trench Shield

Maximum height (h)	6	feet	(represents maximum height extended above top of trench shield)
Moment in sheet			
$M_m=1/2*P_e(h)*h*h/3$	34.9	kip-inch/foot	
Assume 1-inch plate (t_p)	1	inches	
Section Modulus of Plate			
$S_p=t_p^2/6$	2	in^3/ft	

Check allowable steel stress in plate

$\sigma_m=M_m/S_p$	17.5	ksi	Maximum stress in steel
σ_a=0.6*36ksi	21.6	ksi	Allowable stress in steel

Allowable exceeds maximum anticipated stress - OK

Steel Sheeting Below Trench Shield

Maximum height (h)	2.5	feet	(represents maximum depth extended below bottom of trench shield)
Moment in sheet			
$M_m=1/2*P_e(d_m)*h^2$	40.7	kip-inch/foot	
Assume 1-inch plate (t_p)	1	inches	
Section Modulus of Plate			
$S_p=t_p^2/6$	2	in^3/ft	

Check allowable steel stress in plate

$\sigma_m=M_m/S_p$	20.3	ksi	Maximum stress in steel
σ_a=0.6*36ksi	21.6	ksi	Allowable stress in steel

Allowable exceeds maximum anticipated stress - OK