22320 Foothill Blvd, Suite 600
Hayward, CA 94541
Phone – 415 619 6000
Fax – 415 500 9583
Email – irina@zenithengineers.com
www.zenithengineers.com

PROJECT: 190417-New Railing System Design

PROJECT #: 190417

CLIENT: Nationwide Industries

PREPARED BY: Senthilkumar A G

REVIEWED BY: Senthil Puliyadi, M.S. M.Eng., P.E.

REV: 01

DATE: 10/25/2021

TABLE OF CONTENTS

REGISTERED PROFESSIONAL ENGINEER
SENTHIL PULIYADI
C71630
Exp. 12/31/21
CIVIL
STATE OF CALIFORNIA

54 Pages 10/25/2021

22320 Foothill Blvd, Suite 600
Hayward, CA 94541
Phone – 415 619 6000
Fax – 415 500 9583
Email – irina@zenithengineers.com
www.zenithengineers.com

RFX aluminum guard rail system utilizes aluminum extrusions with wire rope (stainless steel cable) and glass infill to construct building guards and rails for decks, balconies, stairs, fences and similar locations. The system is intended for interior and exterior weather exposed applications and is suitable for use in most natural environments. This system may be used for residential, commercial and industrial applications. It is an engineered system designed for the following criteria:

RFX Rail System Stainless Steel Cable:

The design loading conditions are: (Railing is designed for max speed of 160mph)

On Top Rail:

Concentrated load = 200 lbs any direction, any location

Uniform load = 50 plf, any perpendicular to rail

For installations compliant with the IRC only the 200# top rail load is applicable.

On In-fill Panels:

Concentrated load = 50# on one sf.

Distributed load = 25 psf on area of in-fill, including spaces

Wind load will not control and doesn't impact design.

Refer to IBC Section 1607.7.1 for loading.

Minimum Required Wood Type:

Wood Shall be Douglas-Fir or Better

Anchor Material Specifications:

DIN EN ISO 4042 (For Epoxy Anchors)

Stainless Steel (For Lag Screws)

Railing Post Material Specifications:

Post Shall be Aluminum 6063 – T5 and shall conform to Aluminum Design Manual.

Engineers | Architects
Construction Managers

22320 Foothill Blvd, Suite 600
Hayward, CA 94541
Phone – 415 619 6000
Fax – 415 500 9583
Email – irina@zenithengineers.com
www.zenithengineers.com

RFX Rail System Glass In-fill Panels:

The design loading conditions are: (Railing is designed for max speed of 110mph)

On Top Rail:

Concentrated load = 200 lbs any direction, any location

Uniform load = 50 plf, any perpendicular to rail

For installations compliant with the IRC only the 200# top rail load is applicable.

On In-fill Panels:

Concentrated load = 50# on one sf.

Distributed load = 25 psf on area of in-fill, including spaces

Wind load will apply in glass in-fill system.

Refer to IBC Section 1607.7.1 for loading.

Minimum Required Wood Type:

Wood Shall be Douglas-Fir or Better

Anchor Material Specifications:

DIN EN ISO 4042 (For Epoxy Anchors)

Stainless Steel (For Lag Screws)

Railing Post Material Specifications:

Railing Post Shall be Aluminum 6063 – T5 and shall conform to Aluminum Design Manual.

The RFX system will meet all applicable requirements of the 2006, 2009, 2012, 2015 and 2018 International Building Codes and International Residential Codes, CBC 2019 and state building codes based on these versions of the IBC, and 2005 and 2010 Aluminum Design Manuals. Wood components and anchorage to wood are designed in accordance with the 2018 National Design Specification for Wood Construction.

Zenith Engineers | Architects Construction Managers

22320 Foothill Blvd, Suite 600
Hayward, CA 94541
Phone – 415 619 6000
Fax – 415 500 9583
Email – irina@zenithengineers.com
www.zenithengineers.com

Typical Installations:

Surface mounted with base plates:

Residential Applications:

Rail Height 36” or 42” above finish floor.

Steel Cable: Standard Post spacing 5’ on center maximum all mounting methods (one, or two-story house only) except as noted below.

Glass In-fill Panels: Standard Post spacing 4’ on center maximum all mounting methods (one, or two-story house only) except as noted below.

All top rails

Commercial and Industrial Applications:

Rail Height 42” above finish floor.

Steel Cable: Standard Post spacing 5’ on center maximum with stiffener for all posts.

Glass In-fill Panels: Standard Post spacing 4’ on center maximum with stiffener for all posts.

All top rails

Core pocket /embedded posts:

Residential Applications:

Rail Height 36” or 42” above finish floor.

Steel Cable: Standard Post spacing 5’ on center maximum all mounting methods (one, or two-story house only) except as noted below.

Glass In-fill Panels: Standard Post spacing 4’ on center maximum all mounting methods (one, or two-story house only) except as noted below.

Commercial and Industrial Applications:

Rail Height 42” above finish floor.

Steel Cable: Standard Post spacing 5’ on center maximum with stiffener for all posts.

Glass In-fill Panels: Standard Post spacing 4’ on center maximum with stiffener for all posts.

Note: Post spacing is 4’ on center maximum without using stiffener for posts.

Zenith
Engineers | Architects
Construction Managers

22320 Foothill Blvd, Suite 600
Hayward, CA 94541
Phone – 415 619 6000
Fax – 415 500 9583
Email – irina@zenithengineers.com
www.zenithengineers.com

SIGNATURE & STAMPS

PATRICK E. BIRD
10/29/21
LICENSED PROFESSIONAL ENGINEER
No. PE-12831-S
HAWAII U.S.A.

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION. CONSTRUCTION OF THIS PROJECT WILL BE UNDER MY OBSERVATION.

Signature	Expiration Date of My License
Patrick E. Bird	4/30/22

ALABAMA LICENSED No. 33346 PROFESSIONAL ENGINEER BRIAN JAMES SIELAFF

STATE OF ALASKA 49TH BRIAN J. SIELAFF No. AELC11985 REGISTERED PROFESSIONAL ENGINEER

Registered Professional Engineer (Civil) CERTIFICATE NO. 46035 BRIAN SIELAFF Date Signed ARIZONA U.S.A. Expires March 31, 2022

STATE OF ARKANSAS LICENSED PROFESSIONAL ENGINEER No. 15369 BRIAN JAMES SIELAFF

COLORADO LICENSED BRIAN JAMES SIELAFF PE.0041126 PROFESSIONAL ENGINEER

DISTRICT OF COLUMBIA BRIAN SIELAFF PE907083 CIVIL PROFESSIONAL ENGINEER

STATE OF CONNECTICUT BRIAN J SIELAFF PEN.0028259 LICENSED PROFESSIONAL ENGINEER

BRIAN J SIELAFF LICENSE No. 14574 DELAWARE PROFESSIONAL ENGINEER

BRIAN JAMES SIELAFF LICENSE No 69569 STATE OF FLORIDA PROFESSIONAL ENGINEER

LICENSED PROFESSIONAL ENGINEER BRIAN J SIELAFF 062067451 OF ILLINOIS

GEORGIA REGISTERED No. PE034025 PROFESSIONAL ENGINEER BRIAN J SIELAFF

PROFESSIONAL ENGINEER LICENSED P-10204 STATE OF IDAHO BRIAN J SIELAFF

BRIAN J SIELAFF REGISTERED PE11200371 STATE OF INDIANA PROFESSIONAL ENGINEER

BRIAN J SIELAFF LICENSED PE20525 KANSAS PROFESSIONAL ENGINEER

LICENSED PROFESSIONAL ENGINEER BRIAN J SIELAFF P19649 IOWA

STATE OF KENTUCKY BRIAN J SIELAFF 27420 LICENSED PROFESSIONAL ENGINEER

STATE OF LOUISIANA BRIAN JAMES SIELAFF License No. PE.0035489 PROFESSIONAL ENGINEER IN CIVIL ENGINEERING

STATE OF MAINE BRIAN JAMES SIELAFF PE13148 LICENSED PROFESSIONAL ENGINEER

22320 Foothill Blvd, Suite 600
Hayward, CA 94541
Phone – 415 619 6000
Fax – 415 500 9583
Email – irina@zenithengineers.com
www.zenithengineers.com

ZENITH Engineers | Architects Construction Managers

SIGNATURE & STAMPS (CONTINUOUS)

COMMONWEALTH OF MASSACHUSETTS
BRIAN J SIELAFF
CIVIL
No. 48640
REGISTERED
PROFESSIONAL ENGINEER

STATE OF MICHIGAN
BRIAN J. SIELAFF
ENGINEER
No. 6201057131
LICENSED PROFESSIONAL ENGINEER

STATE OF MARYLAND
BRIAN J SIELAFF
40038
PROFESSIONAL ENGINEER

BRIAN JAMES SIELAFF
LICENSED PROFESSIONAL
ENGINEER
20800
STATE OF MISSISSIPPI

STATE OF MISSOURI
BRIAN JAMES SIELAFF
NUMBER
PE-2008030646
PROFESSIONAL ENGINEER

MONTANA
BRIAN J. SIELAFF
No. 17170 PE
LICENSED
PROFESSIONAL ENGINEER

BRIAN JAMES SIELAFF
LICENSED PROFESSIONAL ENGINEER
50112
STATE OF MINNESOTA

PROFESSIONAL CIVIL ENGINEER
BRIAN J. SIELAFF
E-11918
STATE OF NEBRASKA

PROFESSIONAL ENGINEER-STATE OF NEVADA
BRIAN SIELAFF
Exp. Jun 30, 2022
CIVIL
No. 018961

STATE OF NEW HAMPSHIRE
BRIAN J. SIELAFF
No. 14024
LICENSED
– PROFESSIONAL ENGINEER –

STATE OF NEW JERSEY
BRIAN J. SIELAFF
No.
24GE04583100
LICENSED
PROFESSIONAL ENGINEER

BRIAN J. SIELAFF
NEW MEXICO
17487
PROFESSIONAL ENGINEER

STATE OF OHIO
BRIAN J. SIELAFF
PE-76854
REGISTERED
PROFESSIONAL ENGINEER

STATE OF NEW YORK
BRIAN J. SIELAFF
087979
LICENSED PROFESSIONAL ENGINEER

NORTH CAROLINA
PROFESSIONAL
SEAL
034068
ENGINEER
BRIAN J. SIELAFF

LICENSED PROFESSIONAL ENGINEER
BRIAN J. SIELAFF
26287
OKLAHOMA

REGISTERED PROFESSIONAL ENGINEER
BRIAN J. SIELAFF
PE-10167
DATE ______
NORTH DAKOTA

REGISTERED PROFESSIONAL ENGINEER
79703PE
Exp 6-30-2022
OREGON
JUL 10, 2007
BRIAN J. SIELAFF

COMMONWEALTH OF PENNSYLVANIA
REGISTERED
PROFESSIONAL
BRIAN J. SIELAFF
ENGINEER
PE073758

Brian J. Sielaff

22320 Foothill Blvd, Suite 600
Hayward, CA 94541
Phone – 415 619 6000
Fax – 415 500 9583
Email – irina@zenithengineers.com
www.zenithengineers.com

ZENITH Engineers | Architects Construction Managers

SIGNATURE & STAMPS (CONTINUOUS)

BRIAN J SIELAFF
STATE OF RHODE ISLAND
No. 10151
HOPE
REGISTERED
PROFESSIONAL ENGINEER
CIVIL

SOUTH CAROLINA
LICENSED PROFESSIONAL ENGINEER
No. 30912
BRIAN JAMES SIELAFF

REGISTERED PROFESSIONAL ENGINEER
REG. NO.
11595
BRIAN JAMES
SIELAFF
SOUTH DAKOTA

BRIAN JAMES SIELAFF
REGISTERED ENGINEER
AGRICULTURE
COMMERCE
No. 116834
STATE OF TENNESSEE

STATE OF VERMONT
BRIAN J. SIELAFF
NO. 018.0087552
STRUCTURAL
LICENSED
PROFESSIONAL ENGINEER

STATE OF TEXAS
BRIAN JAMES SIELAFF
94467
LICENSED
PROFESSIONAL ENGINEER

PROFESSIONAL STRUCTURAL ENGINEER
No. 6693708-2203
BRIAN JAMES
SIELAFF
STATE OF UTAH

BRIAN J. SIELAFF
REGISTERED
019321
STATE OF
WEST VIRGINIA
PROFESSIONAL ENGINEER

COMMONWEALTH OF VIRGINIA
BRIAN J. SIELAFF
Lic. No. 0402044037
PROFESSIONAL ENGINEER

BRIAN JAMES SIELAFF
STATE OF WASHINGTON
43821
REGISTERED
PROFESSIONAL ENGINEER
Expires 5-18-2022

Professional Engineer
BRIAN SIELAFF
PE 10600
Date
WYOMING

WISCONSIN
BRIAN J.
SIELAFF
E-41146
BOISE,
ID
PROFESSIONAL ENGINEER

NATIONWIDE INDUSTRIES
50 STATES

SHEET INDEX

SHEET NO.	SHEET TITLE
COVER	COVER
S1.0	RFX 200 / RFX300 / RFX400 W/GLASS INFILL – SURFACE MOUNTED
S2.0	RFX 200 / RFX300 / RFX400 W/GLASS INFIL – OFFSET FASICA MOUNTED
S3.0	RFX 200 / RFX300 / RFX400 W/GLASS INFIL – FLUSH FASICA MOUNTED
S4.0	RFX 200 / RFX300 / RFX400 W/GLASS INFIL – POST CORE MOUNTED
S5.0	RFX 200 / RFX300 W/STAINLESS STEEL CABLE INFILL – SURFACE MOUNTED
S6.0	RFX 200 / RFX300 W/STAINLESS STEEL CABLE INFILL – OFFSET FASICA MOUNTED
S7.0	RFX 200 / RFX300 W/STAINLESS STEEL CABLE INFILL – FLUSH FASICA MOUNTED
S8.0	RFX 200 / RFX300 W/STAINLESS STEEL CABLE INFILLL – POST CORE MOUNTED
S9.0	RFX 100 / RFX250 W/STAINLESS STEEL CABLE INFILL – SURFACE MOUNTED
S10.0	RFX 100 / RFX250 W/STAINLESS STEEL CABLE INFILL – OFFSET FASICA MOUNTED
S11.0	RFX 100 / RFX250 W/STAINLESS STEEL CABLE INFILL – FLUSH FASICA MOUNTED
S12.0	RFX 100 / RFX250 W/STAINLESS STEEL CABLE INFILL – POST CORE

ZENITH ENGINEERS, INC
22320 Foothill Blvd,
Suite 600 Hayward, CA 94541
www.zenithenginers.com

REV: R1 (10.25.21)
REV:

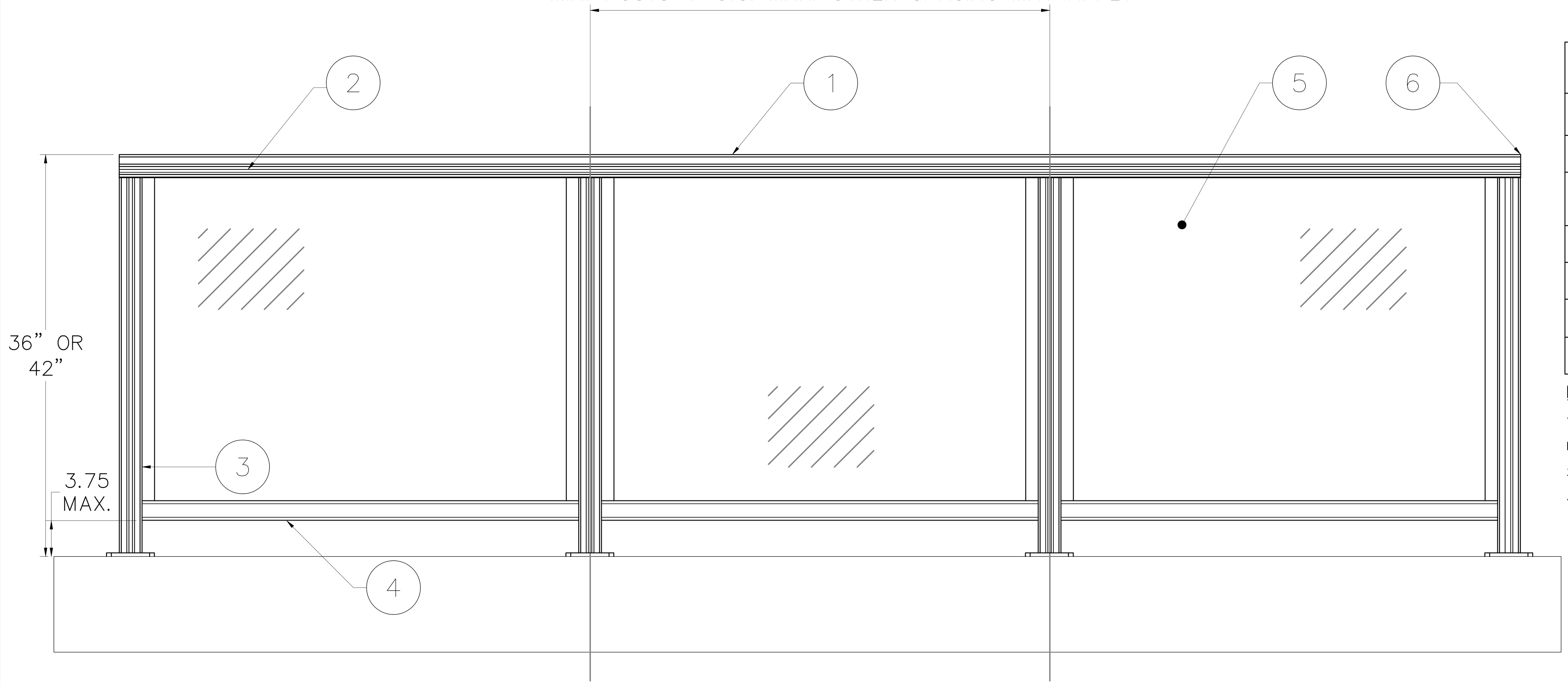
REGISTERED PROFESSIONAL ENGINEER
SENTHIL PULIYADI
C71630
Exp. 12/31/21
CIVIL
STATE OF CALIFORNIA

GENERAL NOTES

NATIONWIDE INDUSTRIES - 50 STATES

DATE: 07.02.2021
SCALE: AS SHOWN
DESIGN BY: SK
DRAWN BY: SK
REVIEWED BY:SP
190417

COVER



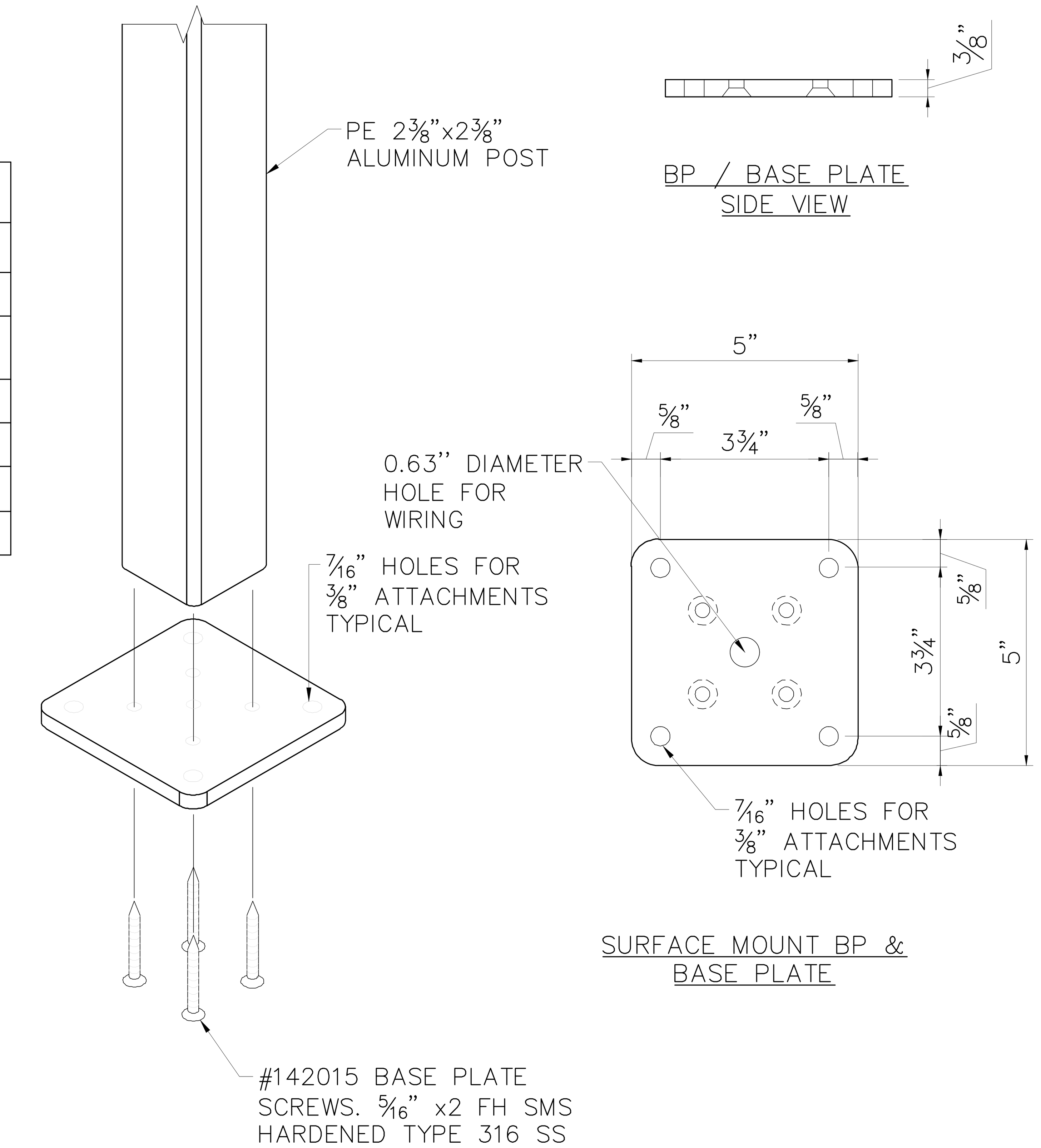
1 RFX 200 / RFX300 ALUMINUM RAIL W/GLASS INFILL SURFACE

Scale: 1" : 1'-0"

RFX200 / RFX300 / RFX400 ALUMINUM RAIL WITH GLASS INFILL SYSTEM	
ITEM	PART NUMBER
1	RFX200/RFX300/RFX400 TOP RAIL
2	INFILL FOR RFX200/RFX300 FOR GLASS AND PICKETS USES RFXUGSK AND RFXLGSK (UPPER AND LOWER GASKETS)
3	2.375"X2.375" SURFACE MOUNTED POST
4	RFXBR–BOTTOM RAIL
5	TEMPERED SAFETY GLASS INFILL 0.25" MIN. THICKNESS
6	RFXEC200/RFXEC300 OR RFXEC200EXP/ RFXEC300EXP END CAP USED WITH SCREWS

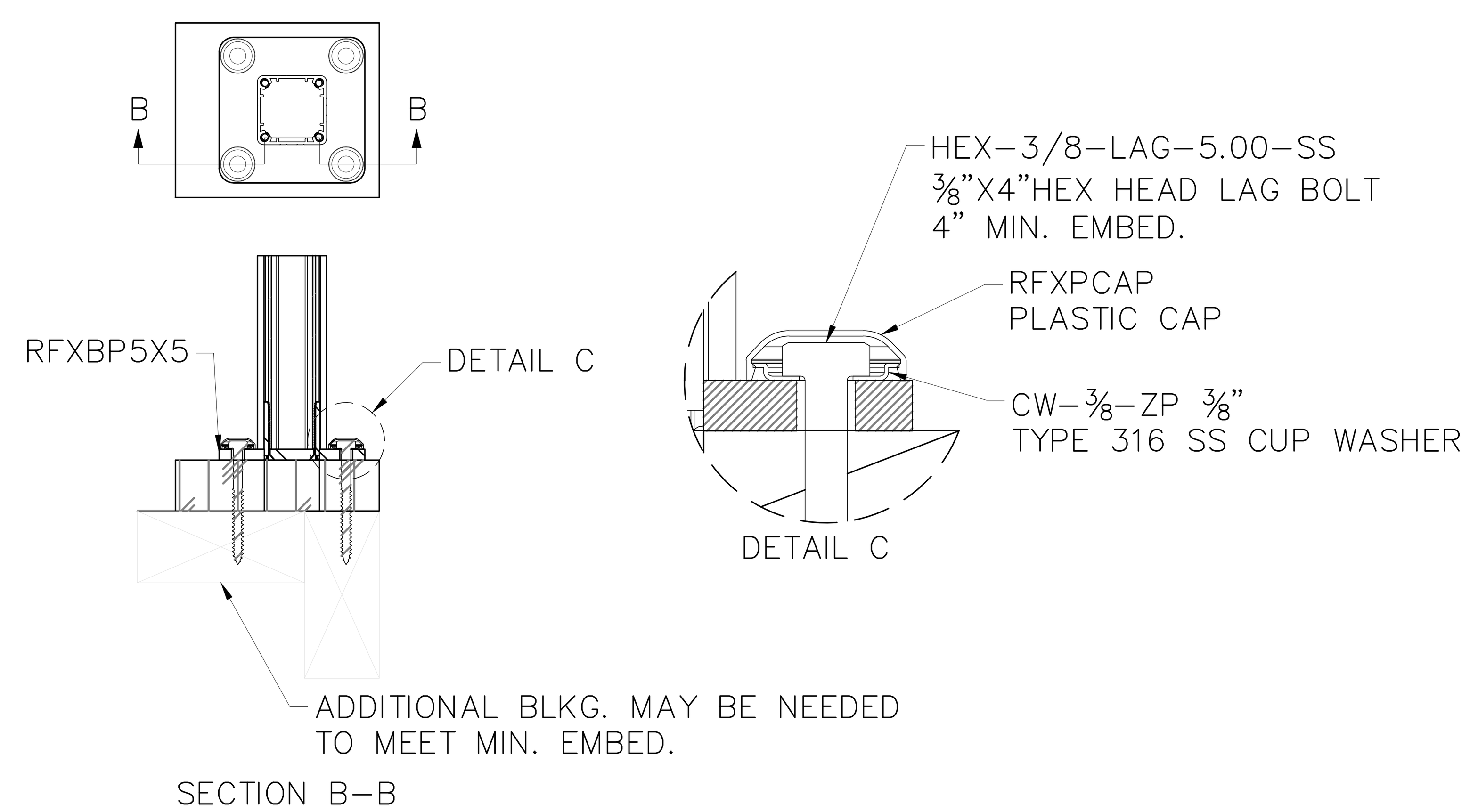
NOTES:

1. DESIGN CAPACITY OF EXISTING STRUCTURE THAT SUPPORTS THE RAILING IS NOT IN ZENITH SCOPE OF WORK.
2. RAILING IS DESIGNED FOR MAX SPEED OF 110MPH.
3. GLASS IN-FILL IS NOT IN ZENITH SCOPE OF WORK.



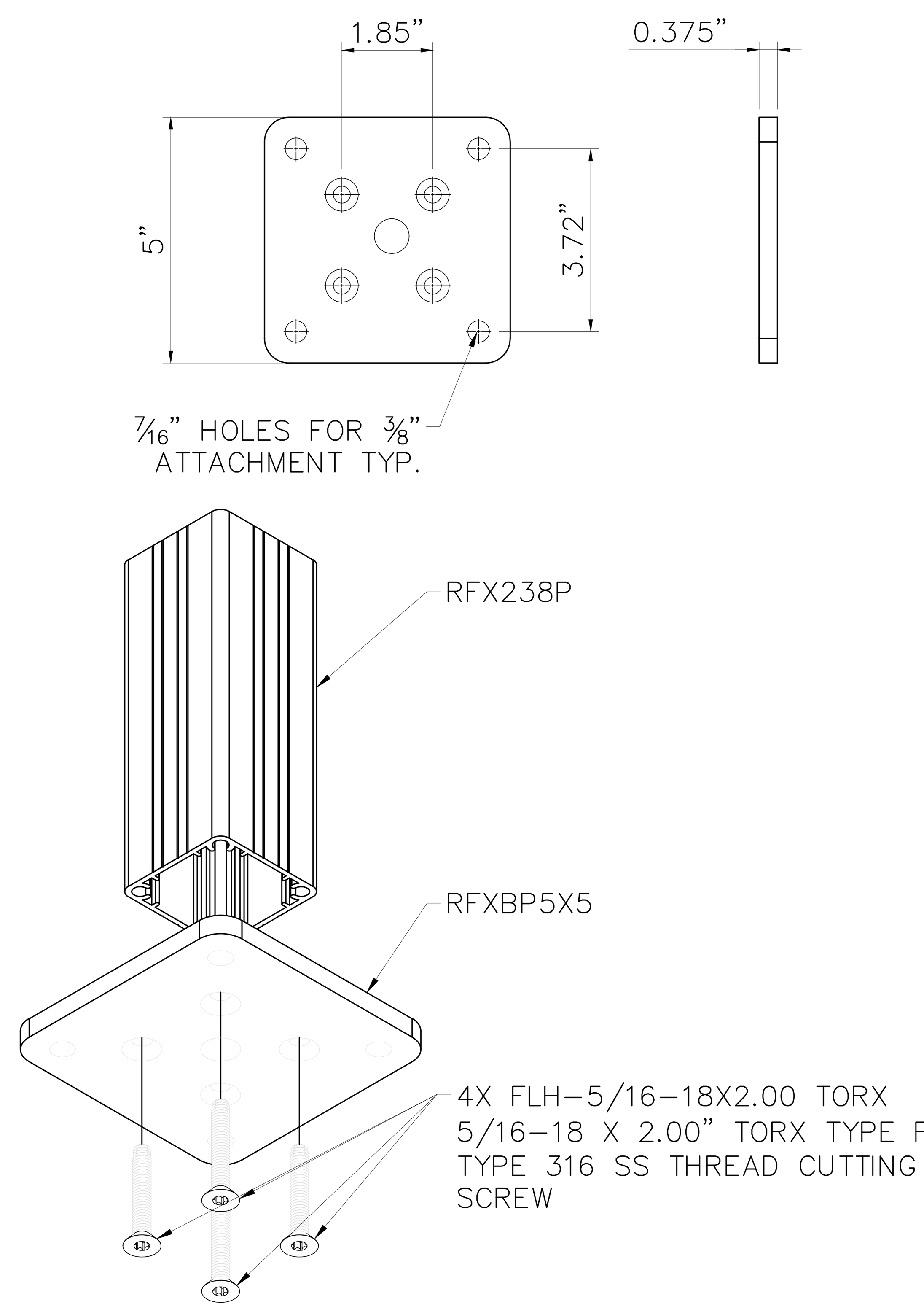
E DETAIL C - SURFACE MOUNT POST & BASE PLATE

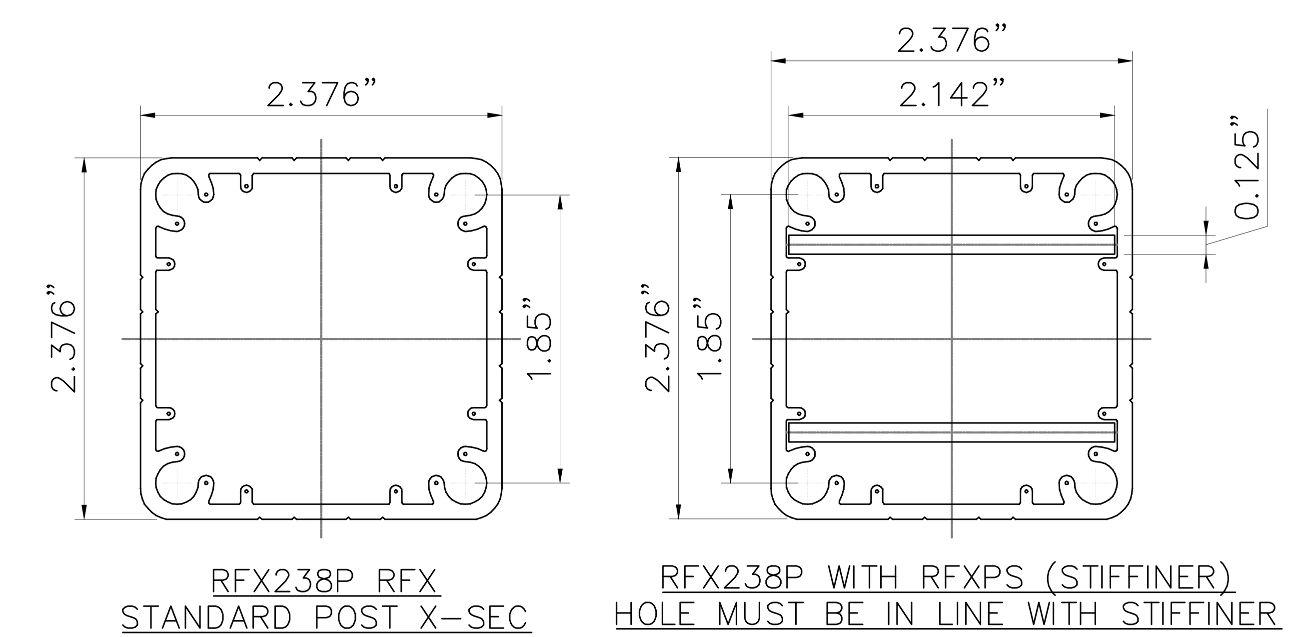
Scale: 5":1'-0"

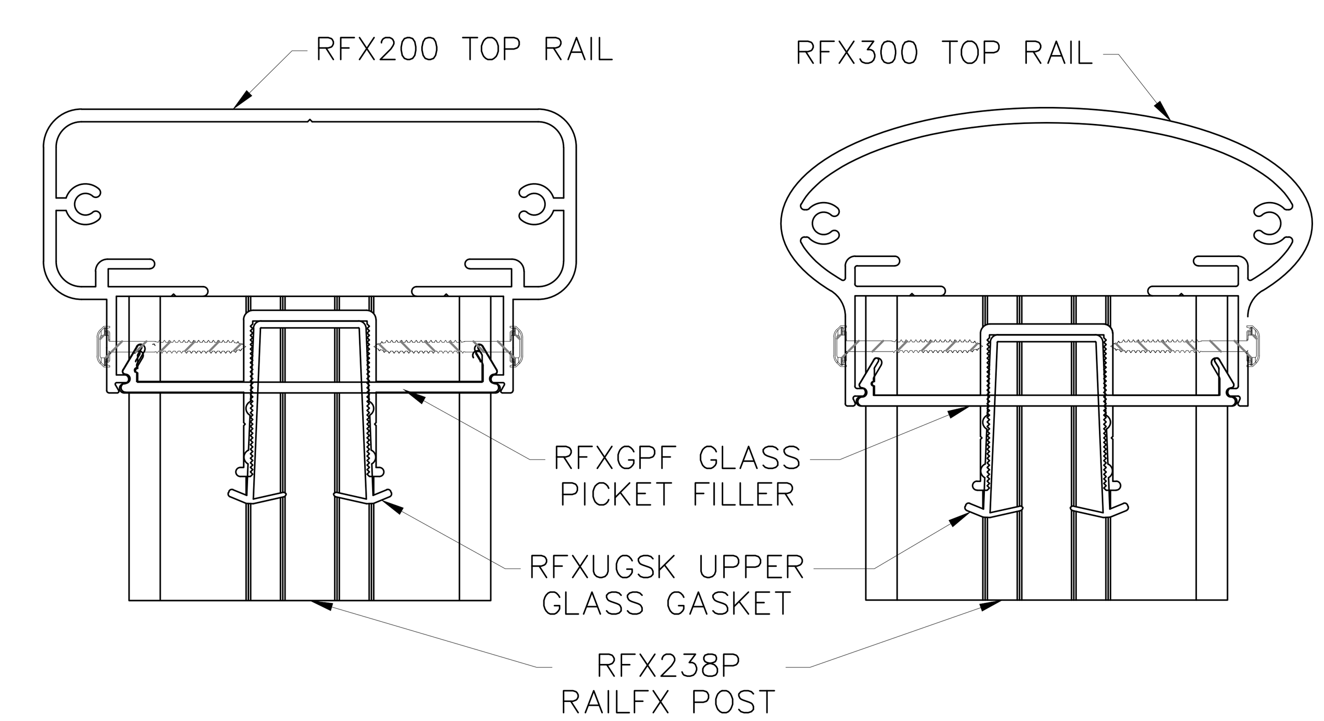


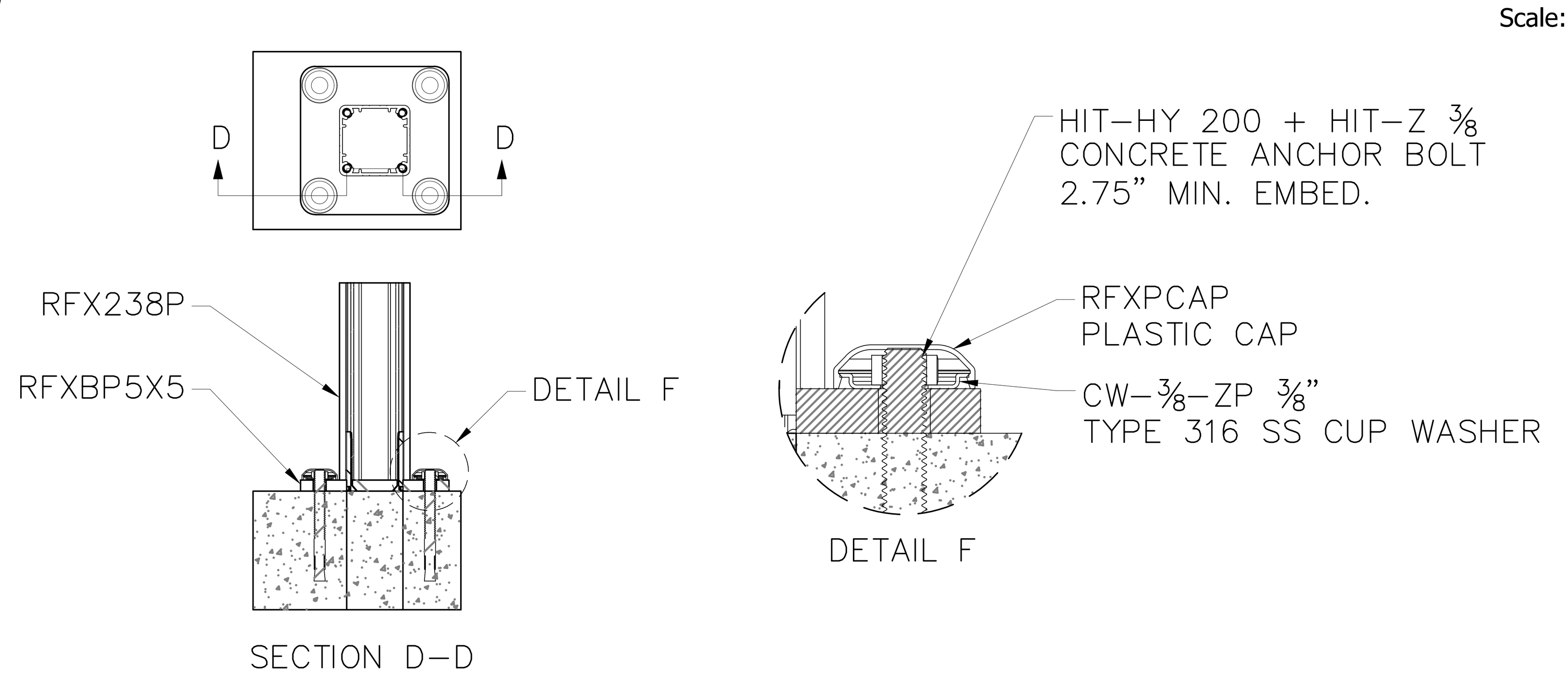
A DETAIL A - SURFACE MOUNT POST WITH BASE PLATE IN WOOD

Scale: 4":1'-0"









B DETAIL B - SURFACE MOUNT POST WITH BASE PLATE IN CONCRETE

Scale: 4":1'-0"

C DETAIL D - RFXBP5X5 DETAILS

Scale: 5'-0":1'-0"

D TOP RAIL PROFILES GLASS INFILL

Scale: 1'-0":1'-0"

ZENITH ENGINEERS, INC
22320 Foothill Blvd,
Suite 600 Hayward, CA 94541
www.zenithengineers.com

REV: R1 (10.25.21)
REV:

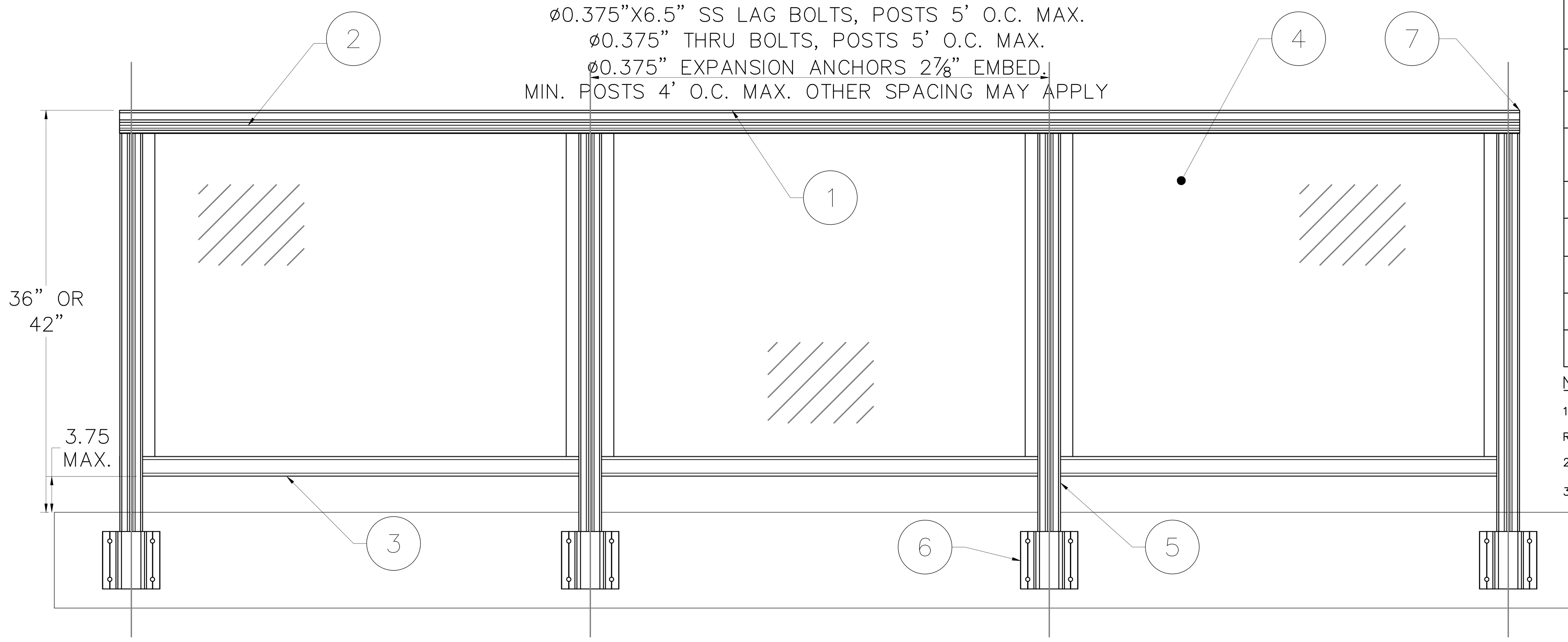
REGISTERED PROFESSIONAL ENGINEER SENTHIL PULIYADI C71630 Exp. 12/31/21 CIVIL STATE OF CALIFORNIA

RFX 200 / RFX300 / RFX400 W/GLASS INFILL SURFACE MOUNTED

NATIONWIDE INDUSTRIES - 50 STATES

DATE: 07.02.2021
SCALE: AS SHOWN
DESIGN BY: SK
DRAWN BY: SK
REVIEWED BY:SP
190417

S1.0



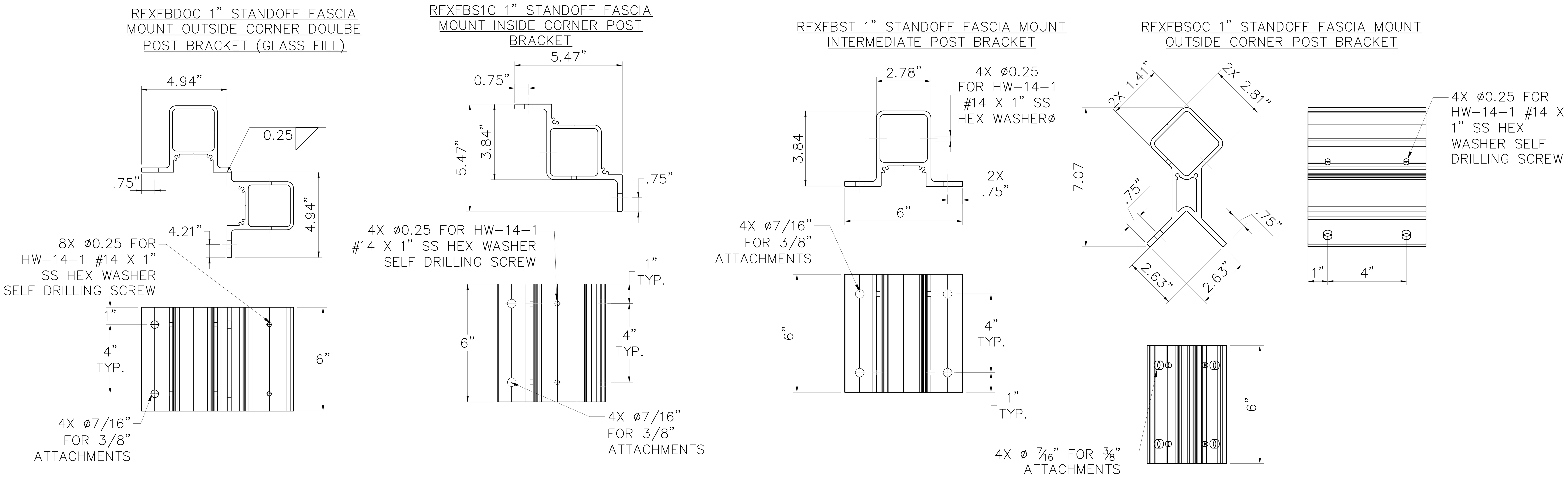
RFX200 / RFX300 / RFX400 ALUMINUM RAIL WITH GLASS INFILL SYSTEM	
ITEM	PART NUMBER
1	RFX200/RFX300/RFX400 TOP RAIL
2	INFILL FOR RFX200/RFX300 FOR GLASS AND PICKETS USES RFXUGSK AND RFXLGSK (UPPER AND LOWER GASKETS)
3	RFXBR-BOTTOM RAIL
4	TEMPERED SAFETY GLASS INFILL 0.25" MIN. THICKNESS
5	RFXRCB-RAIL CONNECTING BLOCK
6	RFXFMINT – 1" OFFSET FASCIA MOUNT BRACKET
7	RFXEC200/RFXEC300 OR RFXEC200EXP/ RFXEC300EXP END CAP USED WITH SCREWS

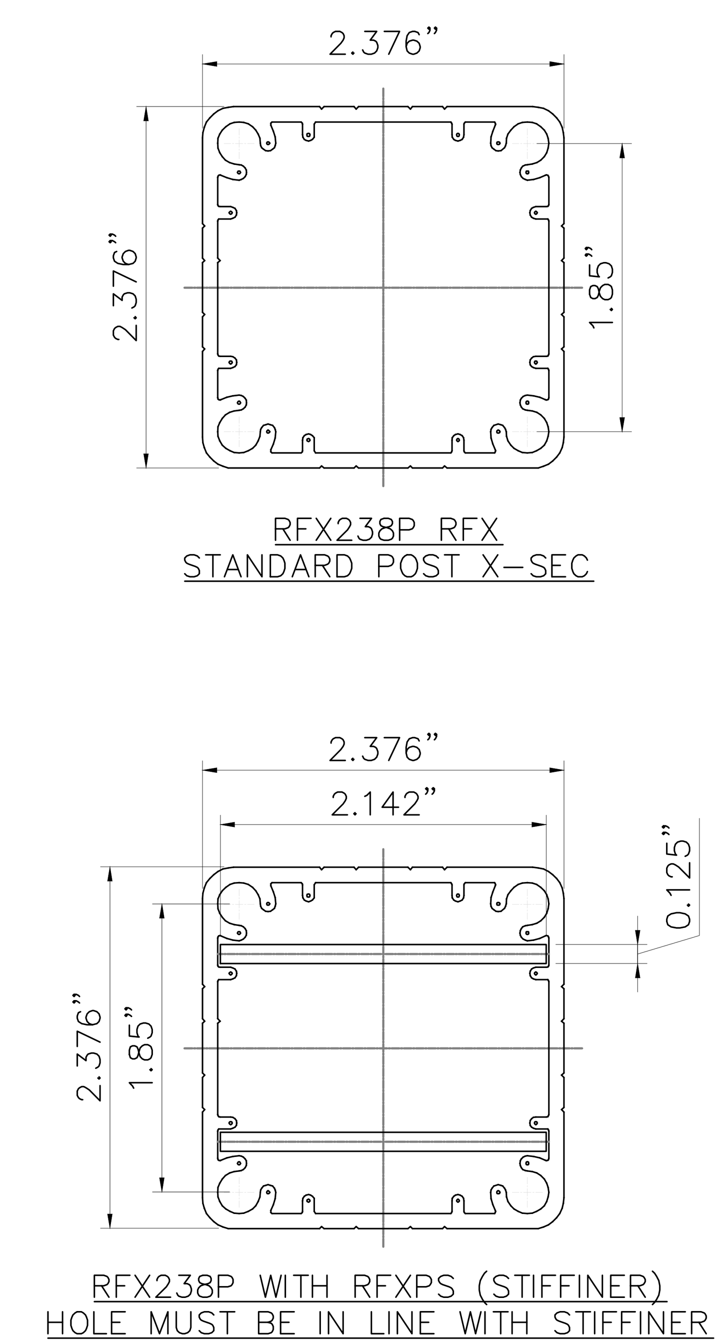
NOTES:

1. DESIGN CAPACITY CHECK OF EXISTING STRUCTURE THAT SUPPORTS THE RAILING IS NOT IN ZENITH SCOPE OF WORK.
2. RAILING IS DESIGNED FOR MAX SPEED OF 110MPH.
3. GLASS IN-FILL & TOP RAIL DESIGN IS NOT IN ZENITH SCOPE OF WORK.

1 RFX 200 / RFX300 / RXF400 ALUMINUM RAIL W/GLASS INFILL OFFSET FASCIA MOUNT

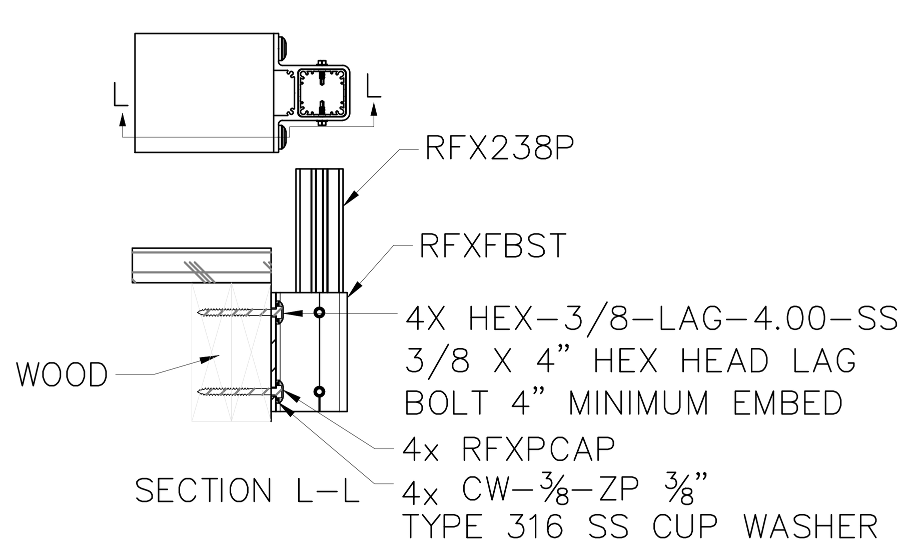
Scale: 1" : 1'-0"





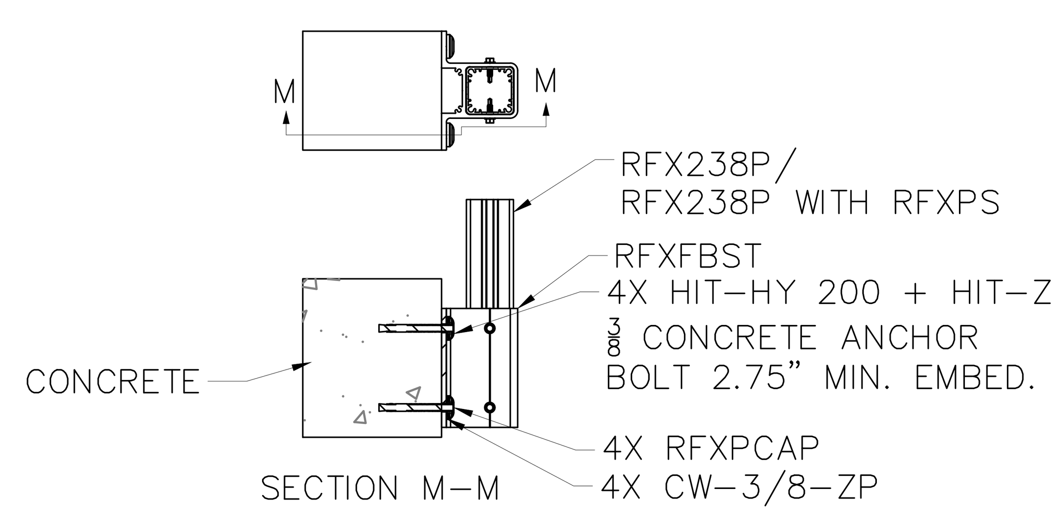
A 1" OFFSET FASCIA MOUNT BRACKET - POST ATTACHMENT OPTIONS AND DETAILS

Scale: 5":1'-0"



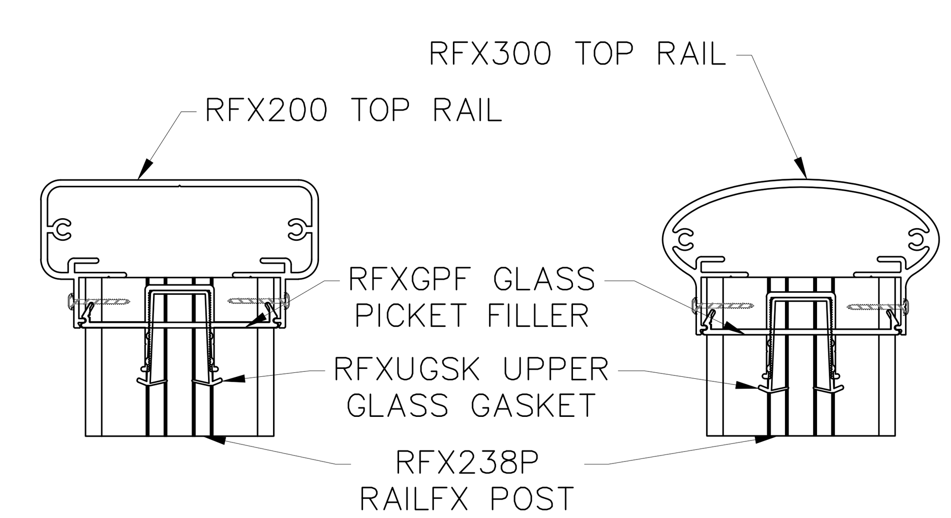
B DETAIL A - RFXMINT MOUNTING IN WOOD

Scale: 5":1'-0"



C DETAIL B - RFXMINT MOUNTING IN CONCRETE

Scale: 5":1'-0"



D DETAIL C - TOP RAIL PROFILES GLASS INFILL

Scale: 5":1'-0"

E DETAIL D

Scale: 1'-0":1'-0"

ZENITH ENGINEERS, INC
22320 Foothill Blvd,
Suite 600 Hayward, CA 94541
www.zenithengineers.com

REV: R1 (10.25.21)
REV:

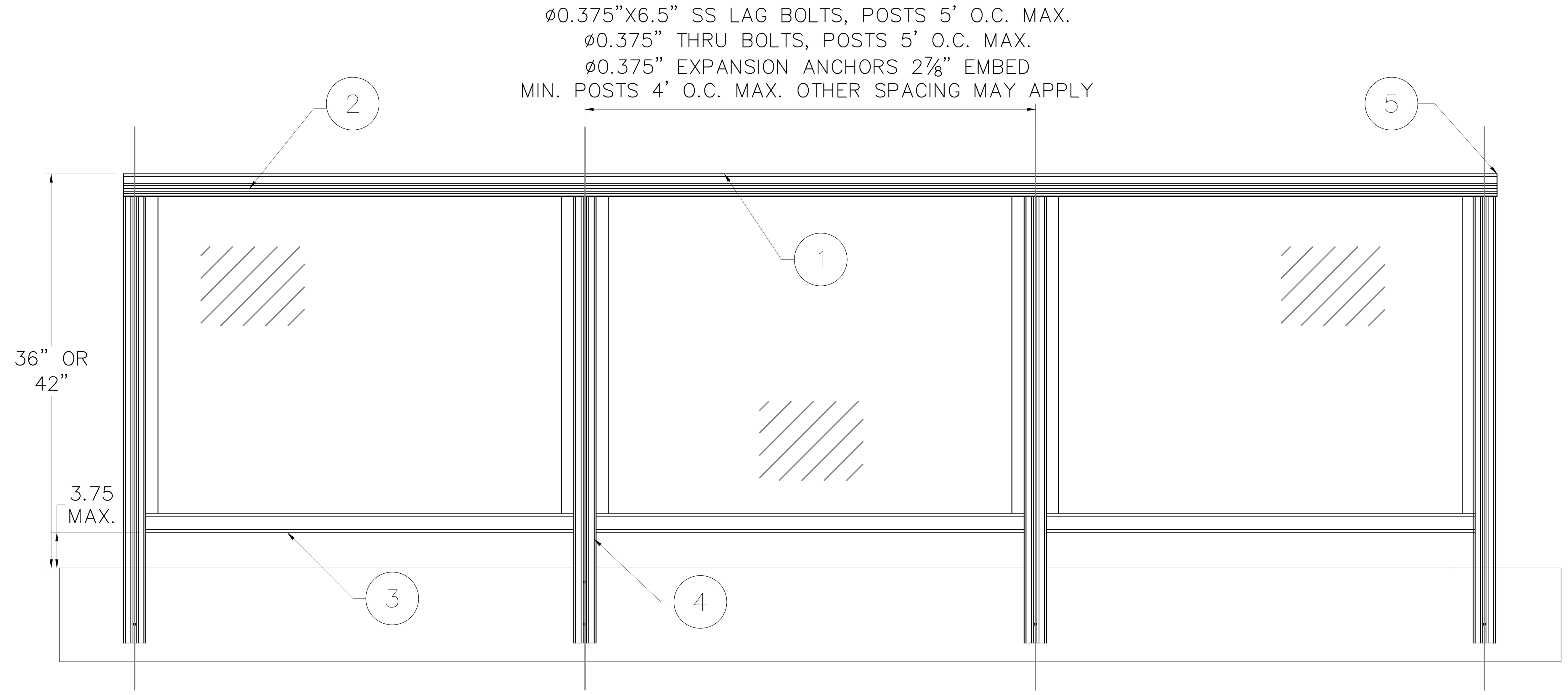
REGISTERED PROFESSIONAL ENGINEER — SENTHIL PULIYADI — C71630 — Exp. 12/31/21 — CIVIL — STATE OF CALIFORNIA

RFX 200 / RFX300 / RFX400 W/GLASS INFILL OFFSET FASCIA MOUNT

NATIONWIDE INDUSTRIES - 50 STATES

DATE: 07.02.2021
SCALE: AS SHOWN
DESIGN BY: SK
DRAWN BY: SK
REVIEWED BY:SP
190417

S2.0



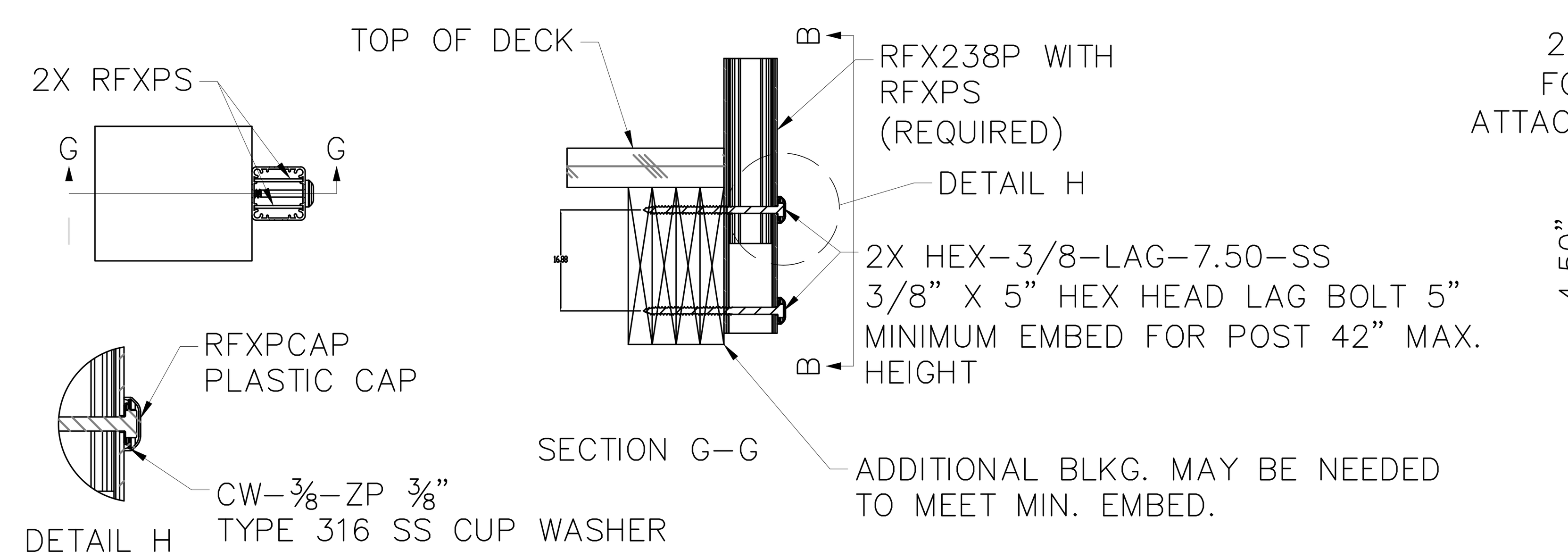
1 RFX 200 / RFX300 ALUMINUM RAIL W/GLASS INFILL FLUSH FASCIA MOUNT

Scale: 1" : 1'-0"

RFX200 / RFX300 / RFX400 ALUMINUM RAIL WITH GLASS INFILL SYSTEM	
ITEM	PART NUMBER
1	RFX200/RFX300/RFX400 TOP RAIL
2	INFILL FOR RFX200/RFX300 FOR GLASS AND PICKETS USES RFXUGSK AND RFXLGSK (UPPER AND LOWER GASKETS)
3	RFXBR–BOTTOM RAIL
4	DIRECT TO FLUSH FASCIA MOUNTED POST
5	RFXEC200/RFXEC300 OR RFXEC200EXP/ RFXEC300EXP END CAP USED WITH SCREWS

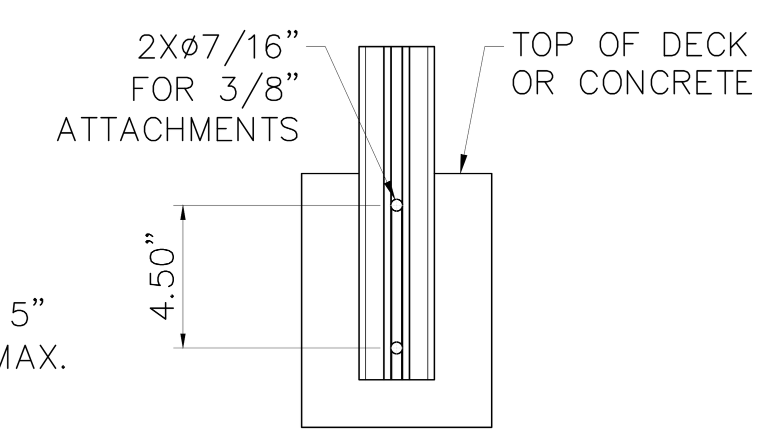
NOTES:

1. DESIGN CAPACITY CHECK OF EXISTING STRUCTURE THAT SUPPORTS THE RAILING IS NOT IN ZENITH SCOPE OF WORK.
2. RAILING IS DESIGNED FOR MAX SPEED OF 110MPH.
3. GLASS IN–FILL & TOP RAIL DESIGN IS NOT IN ZENITH SCOPE OF WORK.
4. FLUSH FASCIA MOUNTED CONNECTION IS NOT RECOMMENDED TO WOODEN MEMBERS



TIMBER FRAME SHOULD BE DOUGLAS–FIR OR BETTER (MIN S.G = 0.5)

RFX238P DIRECT FASCIA FLUSH MOUNT TO WOOD



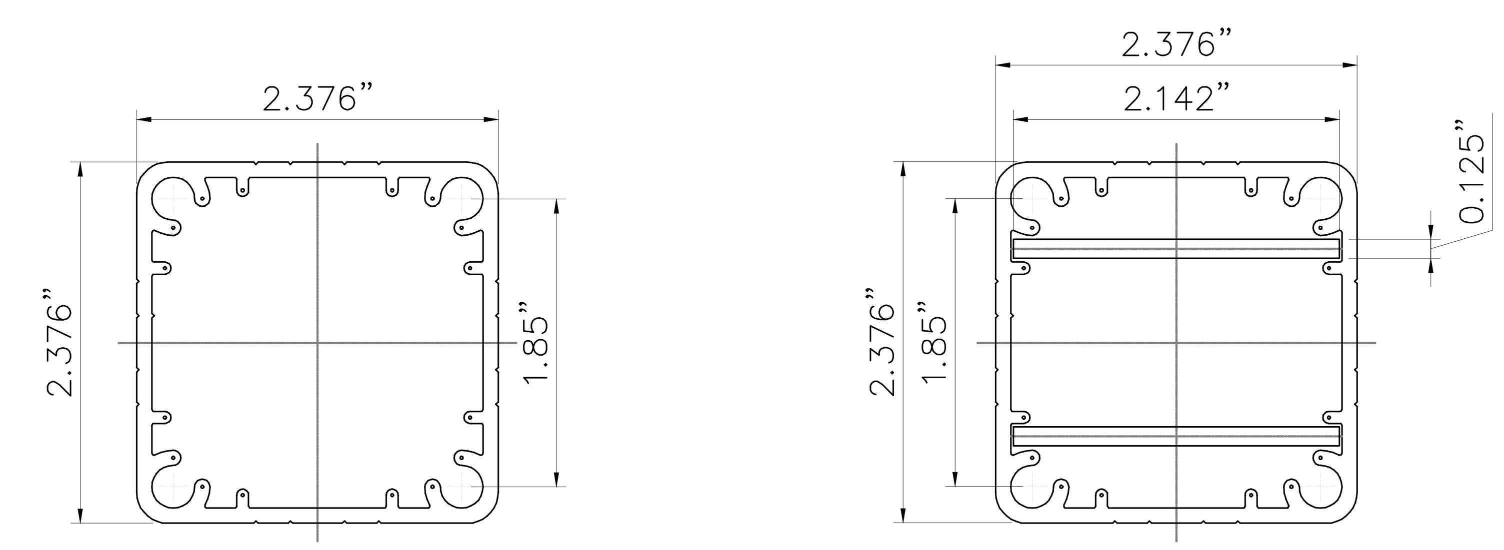
FLUSH MOUNT FASCIA ATTACHMENT (RFXPS REQUIRED FOR ALL DIRECT FASICA MOUNTS)

A DETAIL A

Scale: 4":1'-0"

B DETAIL B

Scale: 4":1'-0"

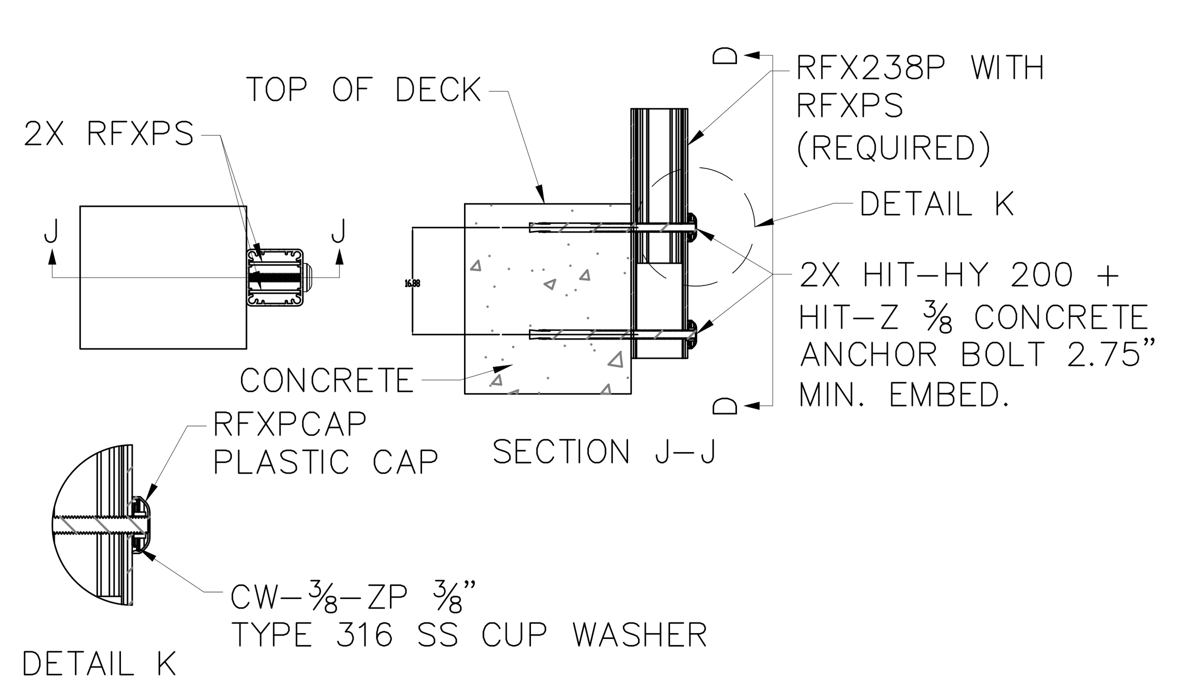


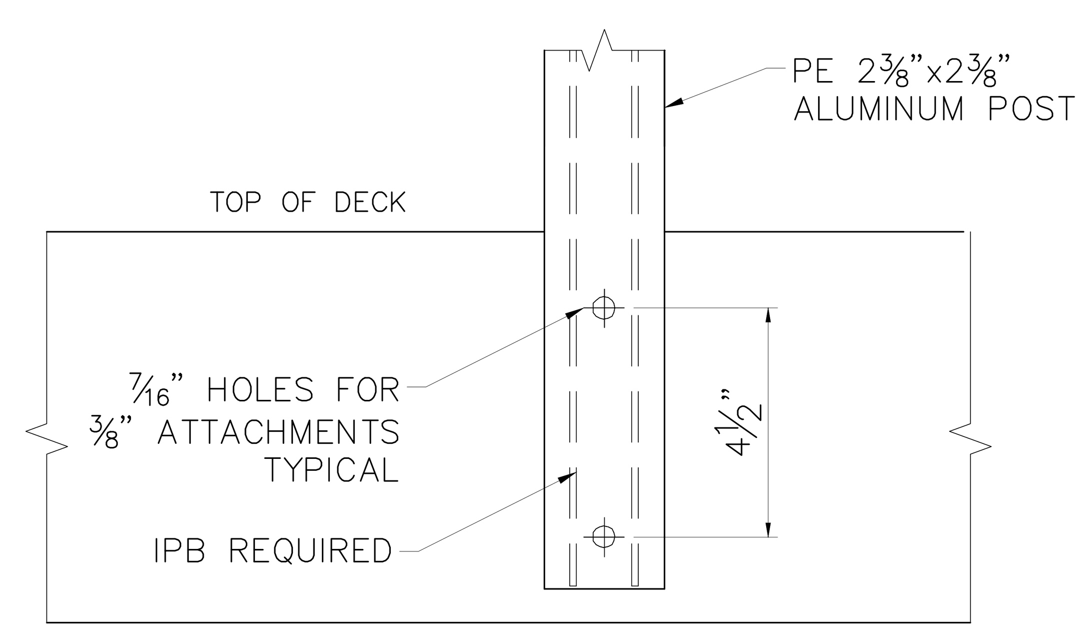
RFX238P RFX STANDARD POST X–SEC

RFX238P WITH RFXPS (STIFFINER) HOLE MUST BE IN LINE WITH STIFFINER

F PE-POST EXTRUSION PROFILE

Scale: 1'-0":1'-0"





FLUSH MOUNT FASCIA ATTACHMENT

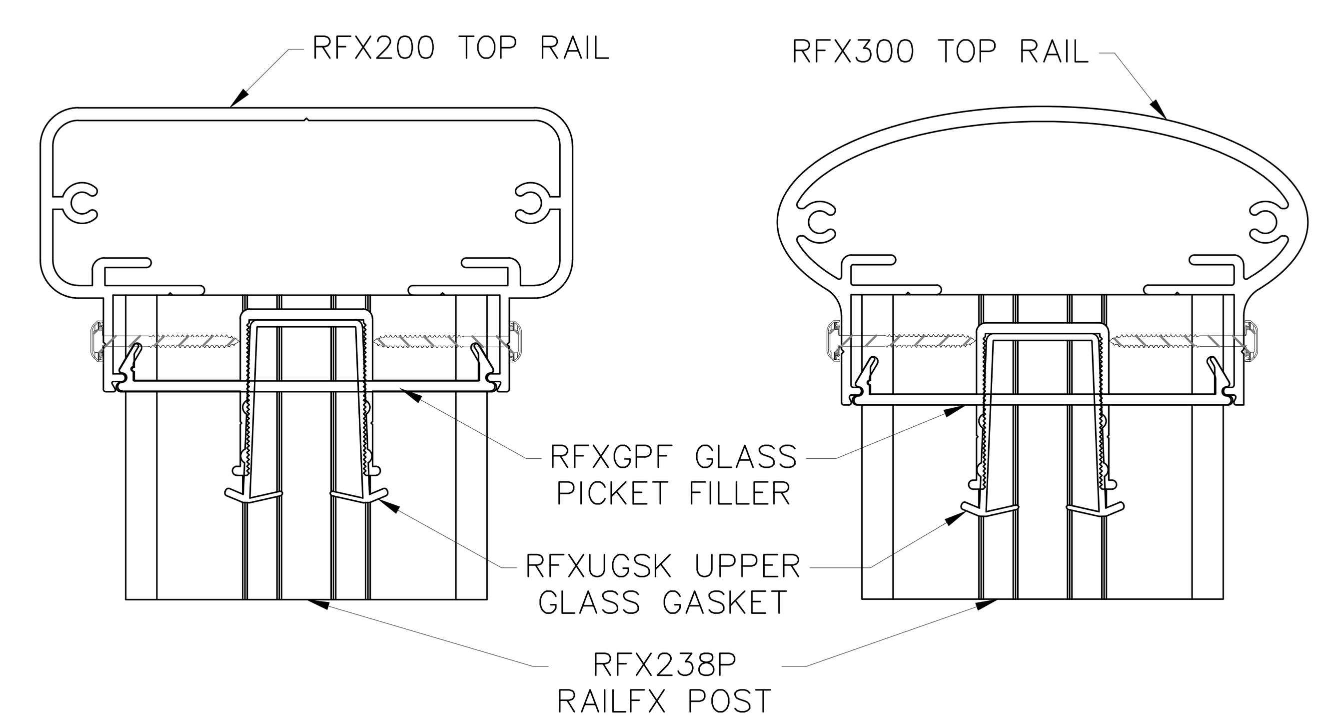
RFX238P DIRECT FASCIA FLUSH MOUNT TO CONCRETE

C DETAIL C

Scale: 4":1'-0"

D DETAIL D

Scale: 4":1'-0"



TOP RAIL PROFILES GLASS INFILL

E DETAIL G

Scale: 1'-0":1'-0"

ZENITH ENGINEERS, INC
22320 Foothill Blvd,
Suite 600 Hayward, CA 94541
www.zenithenginers.com

REV: R1 (10.25.21)

REV:

REGISTERED PROFESSIONAL ENGINEER SENTHIL PULIYADI C71630 Exp. 12/31/21 CIVIL STATE OF CALIFORNIA

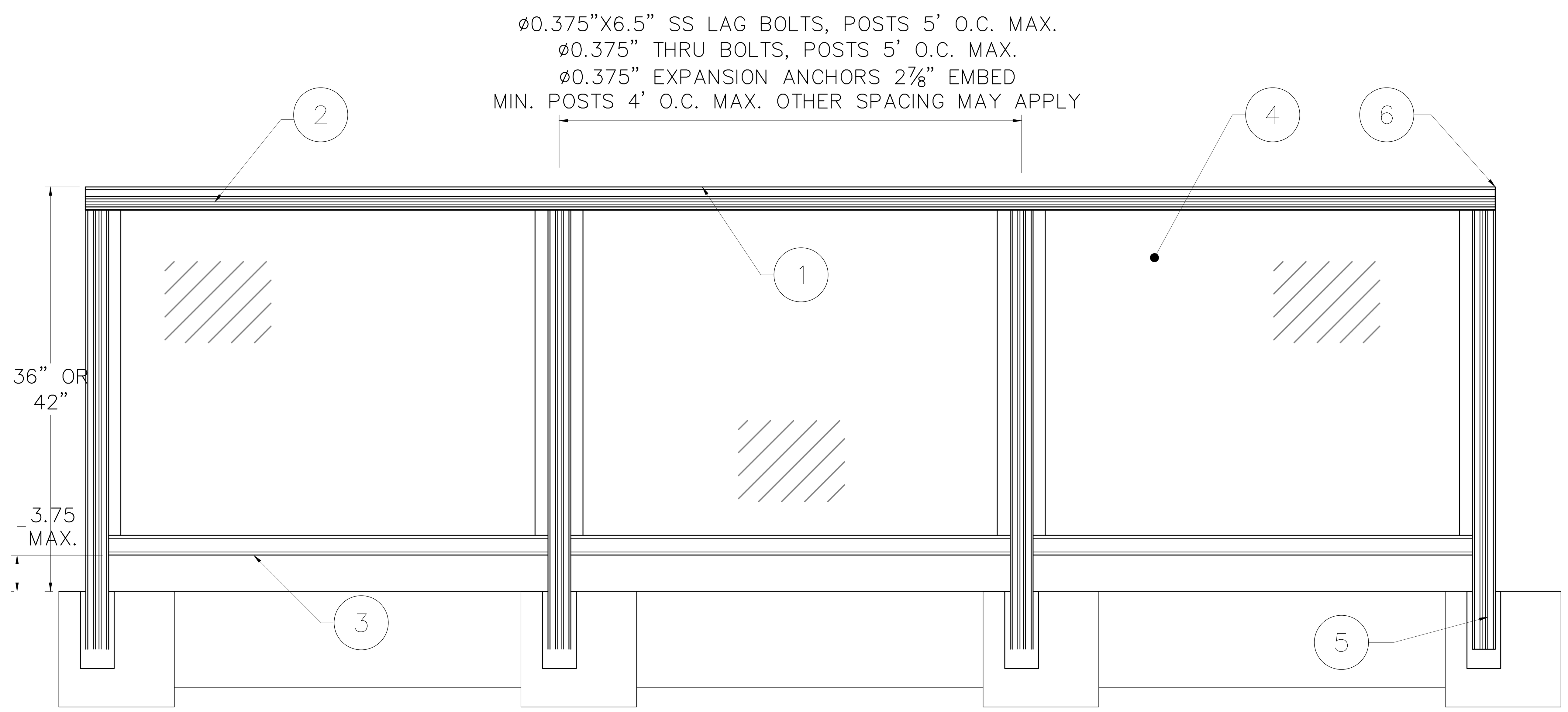
RFX 200 / RFX300 / RFX400 W/GLASS INFILL FLUSH FASCIA MOUNTED

NATIONWIDE INDUSTRIES - 50 STATES

DATE: 07.02.2021
SCALE: AS SHOWN
DESIGN BY: SK
DRAWN BY: SK
REVIEWED BY:SP

190417

S3.0



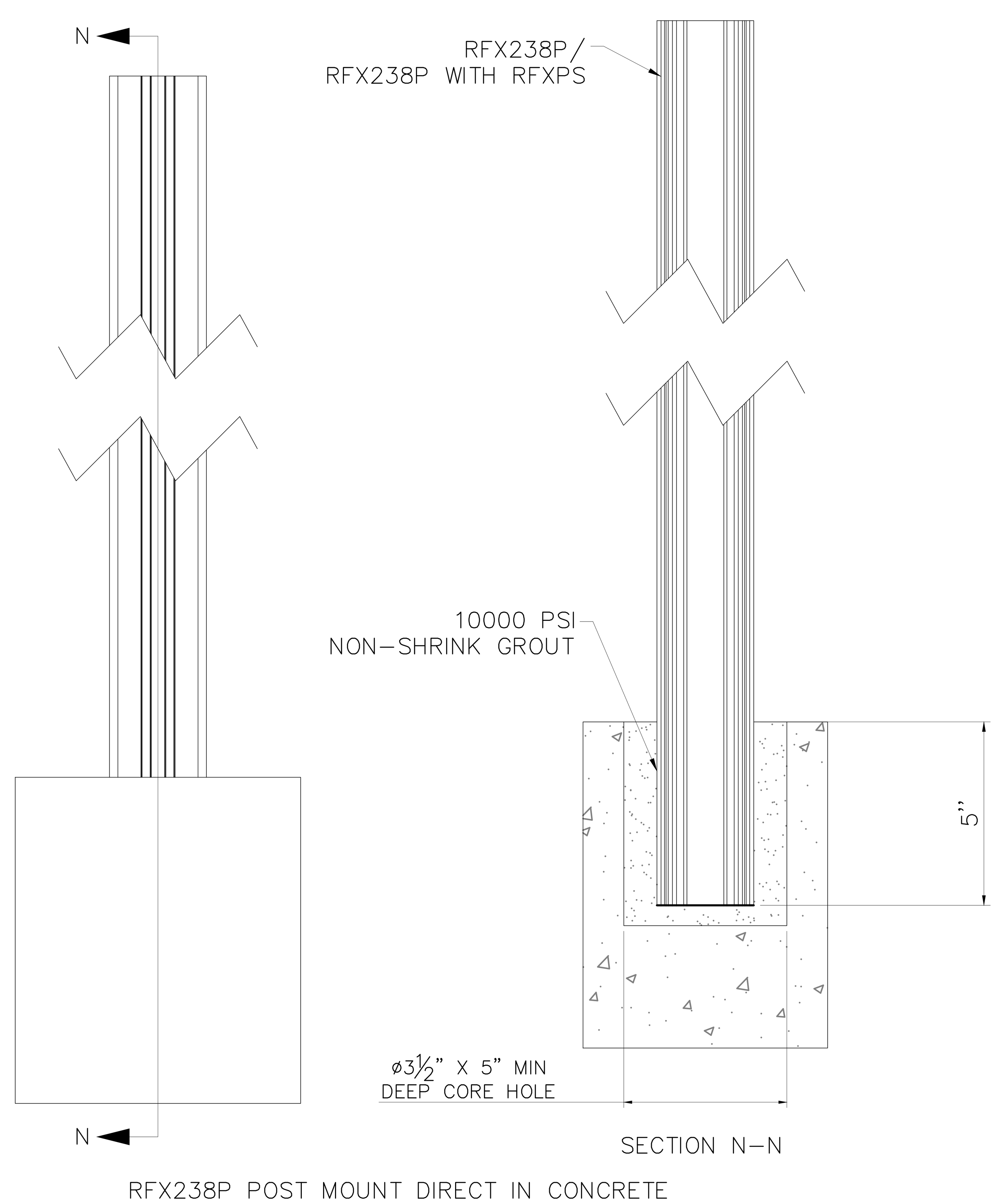
1 RFX 200 / RFX300 ALUMINUM RAIL W/GLASS INFILL POST CORE MOUNT

Scale: 1" : 1'-0"

RFX200 / RFX300 / RFX400 ALUMINUM RAIL WITH GLASS INFILL SYSTEM	
ITEM	PART NUMBER
1	RFX200/RFX300/RFX400 TOP RAIL
2	INFILL FOR RFX200/RFX300 FOR GLASS AND PICKETS USES RFXUGSK AND RFXLGSK (UPPER AND LOWER GASKETS)
3	RFXBR–BOTTOM RAIL
4	TEMPERED SAFETY GLASS INFILL 0.25" MIN. THICKNESS
5	POST WITH CORE MOUNTED IN CONCRETE
6	RFXEC200/RFXEC300 OR RFXEC200EXP/ RFXEC300EXP END CAP USED WITH SCREWS

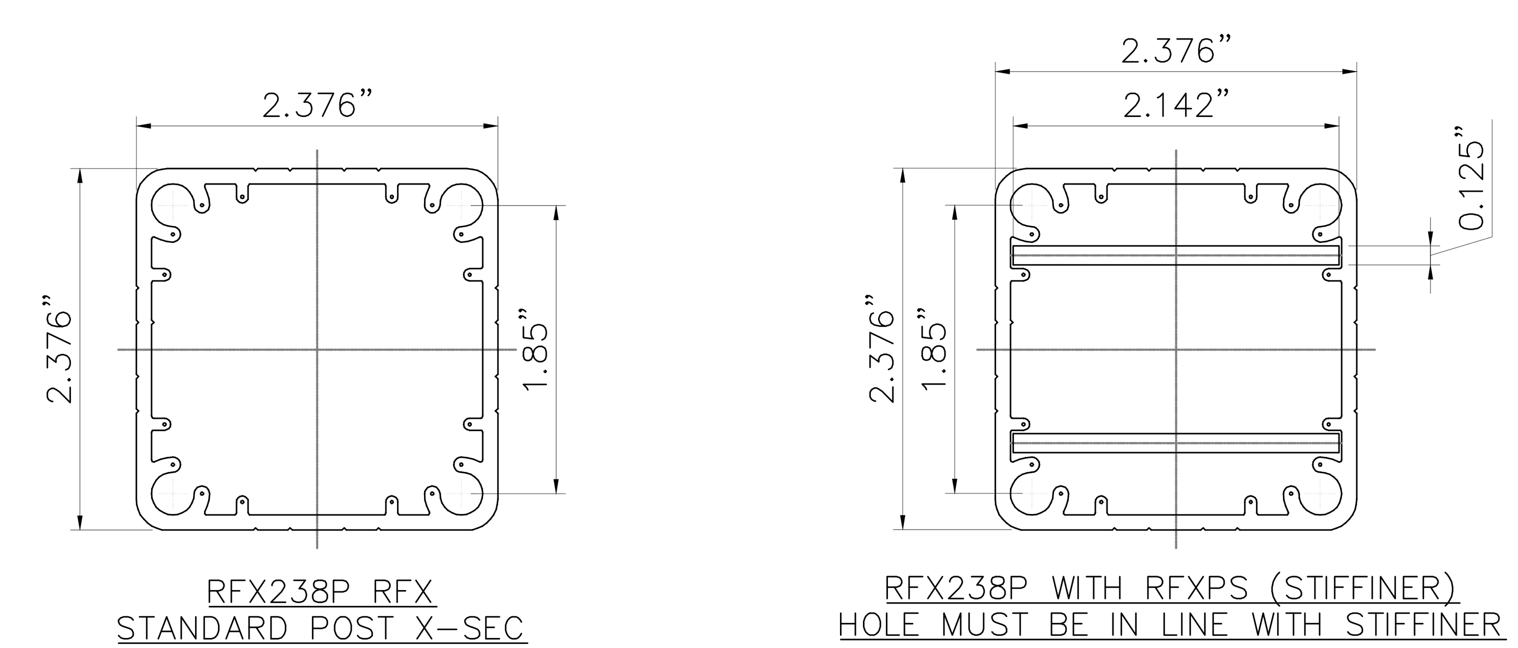
NOTES:

1. DESIGN CAPACITY CHECK OF EXISTING STRUCTURE THAT SUPPORTS THE RAILING IS NOT IN ZENITH SCOPE OF WORK.
2. RAILING IS DESIGNED FOR MAX SPEED OF 110MPH.
3. GLASS IN–FILL & TOP RAIL DESIGN IS NOT IN ZENITH SCOPE OF WORK.



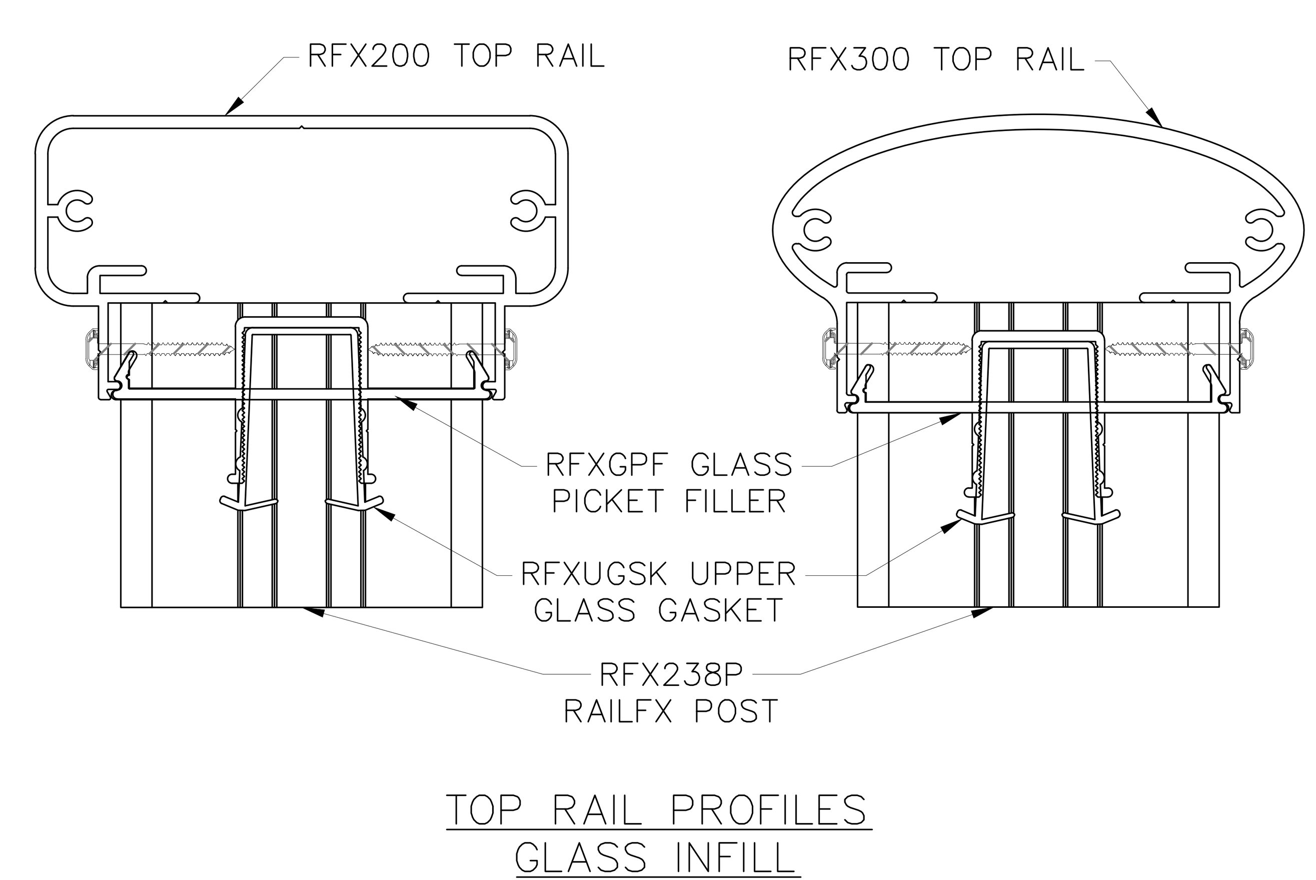
A DETAIL A - POST CORE MOUNTING ATTACHMENT DETAIL

Scale: 6":1'-0"



B PE-POST EXTRUSION PROFILE

Scale: 1'-0":1'-0"



C DETAIL D - TOP RAIL PROFILES (CONTIUOUS TOP RAIL)

Scale: 1'-0":1'-0"

ZENITH ENGINEERS, INC
22320 Foothill Blvd,
Suite 600 Hayward, CA 94541
www.zenithengineers.com

REV: R1 (10.25.21)
REV:

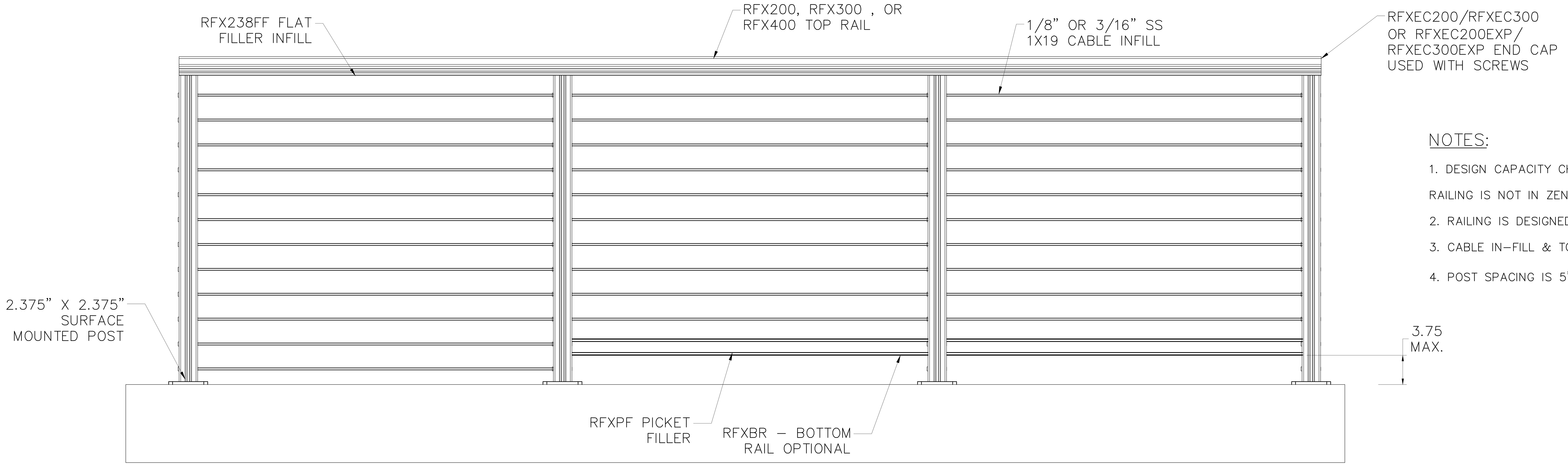
REGISTERED PROFESSIONAL ENGINEER
SENTHIL PULIYADI
C71630
Exp. 12/31/21
CIVIL
STATE OF CALIFORNIA

RFX 200 / RFX300 / RFX400 W/GLASS INFILL POST CORE MOUNT

NATIONWIDE INDUSTRIES - 50 STATES

DATE: 07.02.2021
SCALE: AS SHOWN
DESIGN BY: SK
DRAWN BY: SK
REVIEWED BY:SP
190417

S4.0

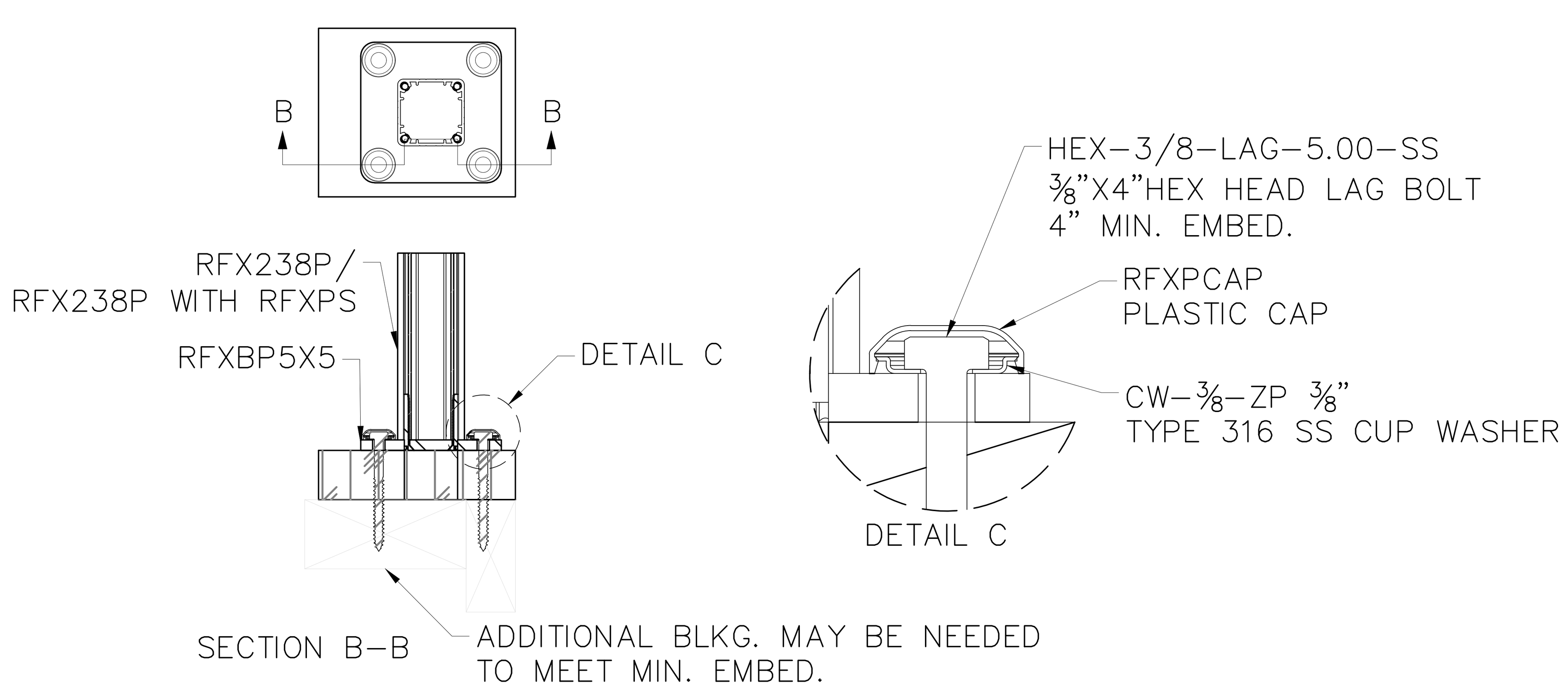


1 RFX 200 / RFX300 ALUMINUM RAIL W/STAINLESS STEEL CABLE INFILL SURFACE MOUNT

Scale: 1-1/2" : 1'-0"

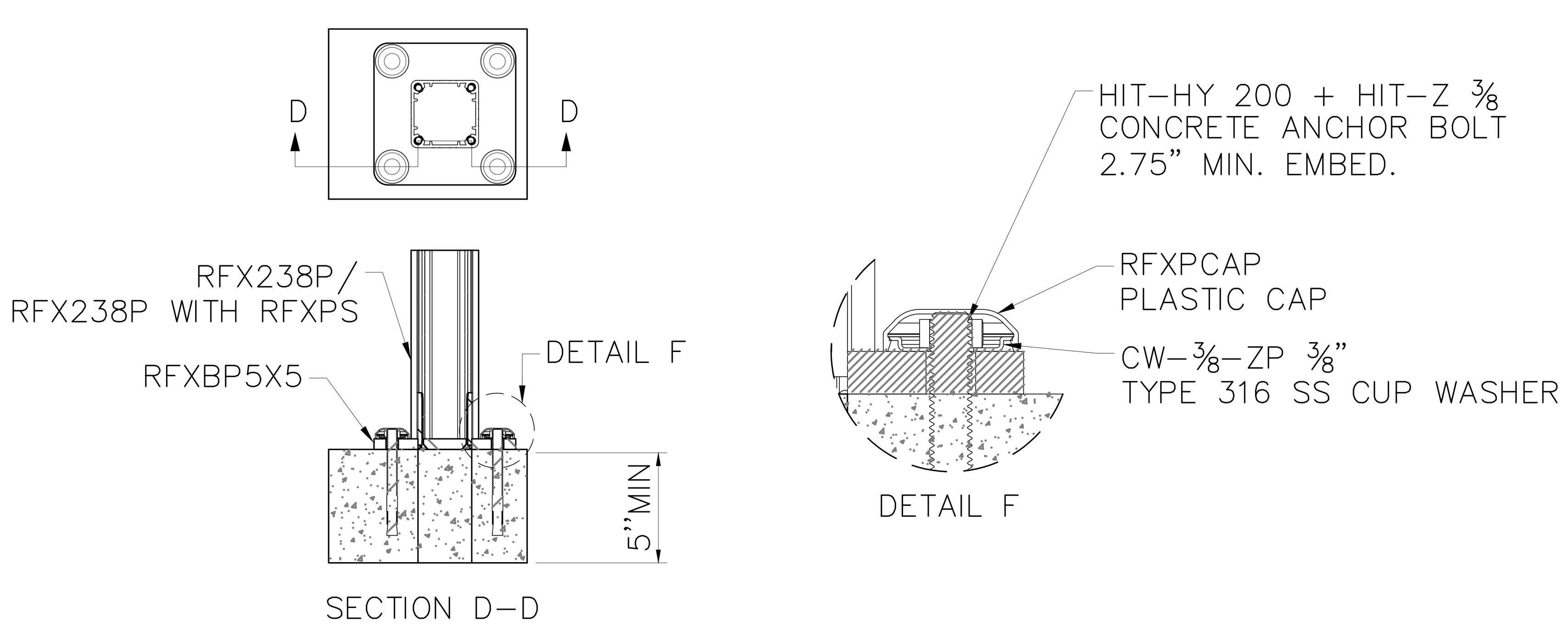
NOTES:

1. DESIGN CAPACITY CHECK OF EXISTING STRUCTURE THAT SUPPORTS THE RAILING IS NOT IN ZENITH SCOPE OF WORK.
2. RAILING IS DESIGNED FOR MAX SPEED OF 110MPH.
3. CABLE IN–FILL & TOP RAIL DESIGN IS NOT IN ZENITH SCOPE OF WORK.
4. POST SPACING IS 5' O.C MAX. OR OTHER SPACING MAY APPLY.



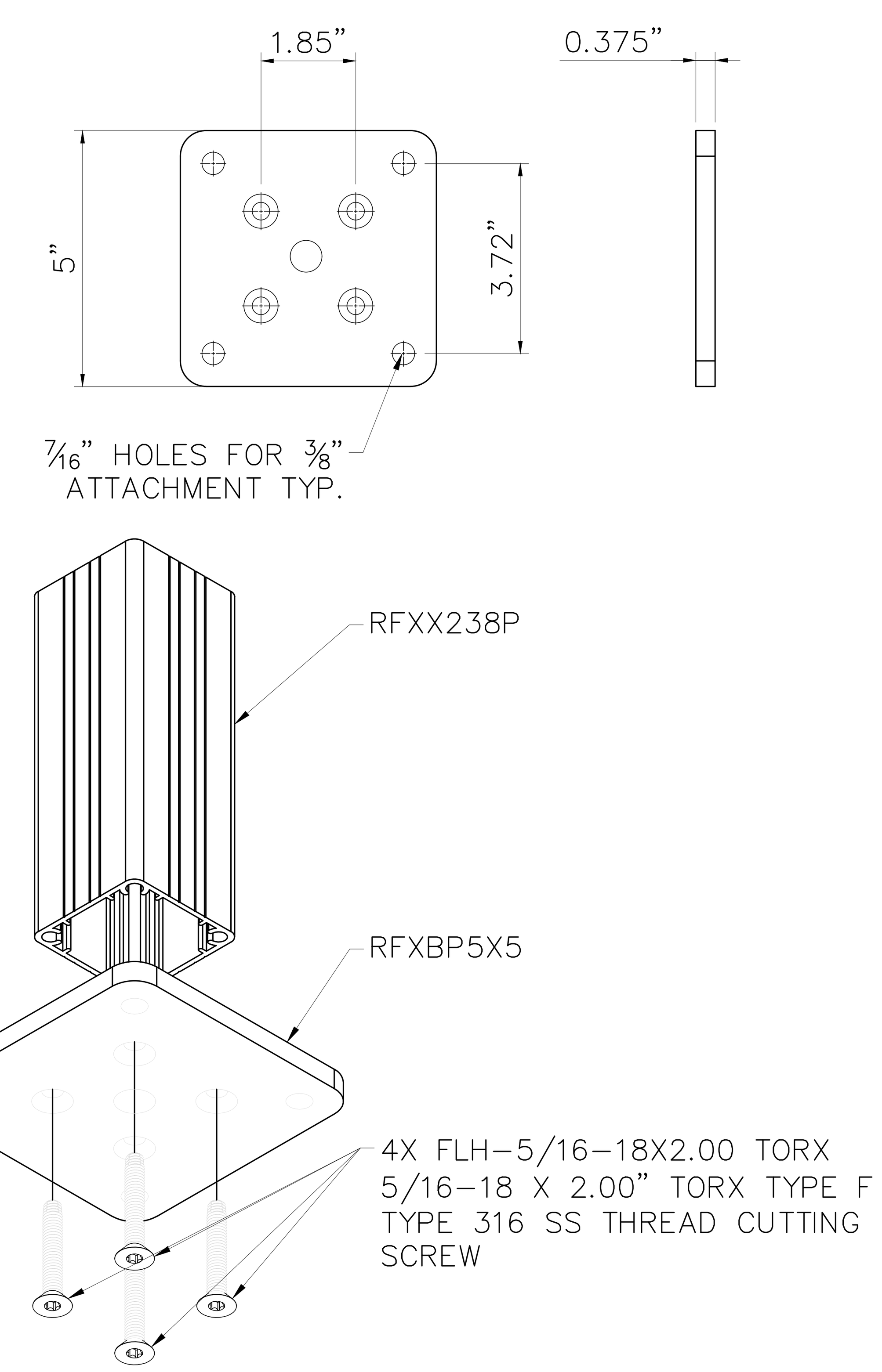
A DETAIL A - SURFACE MOUNT POST WITH BASE PLATE IN WOOD

Scale: 4":1'-0"



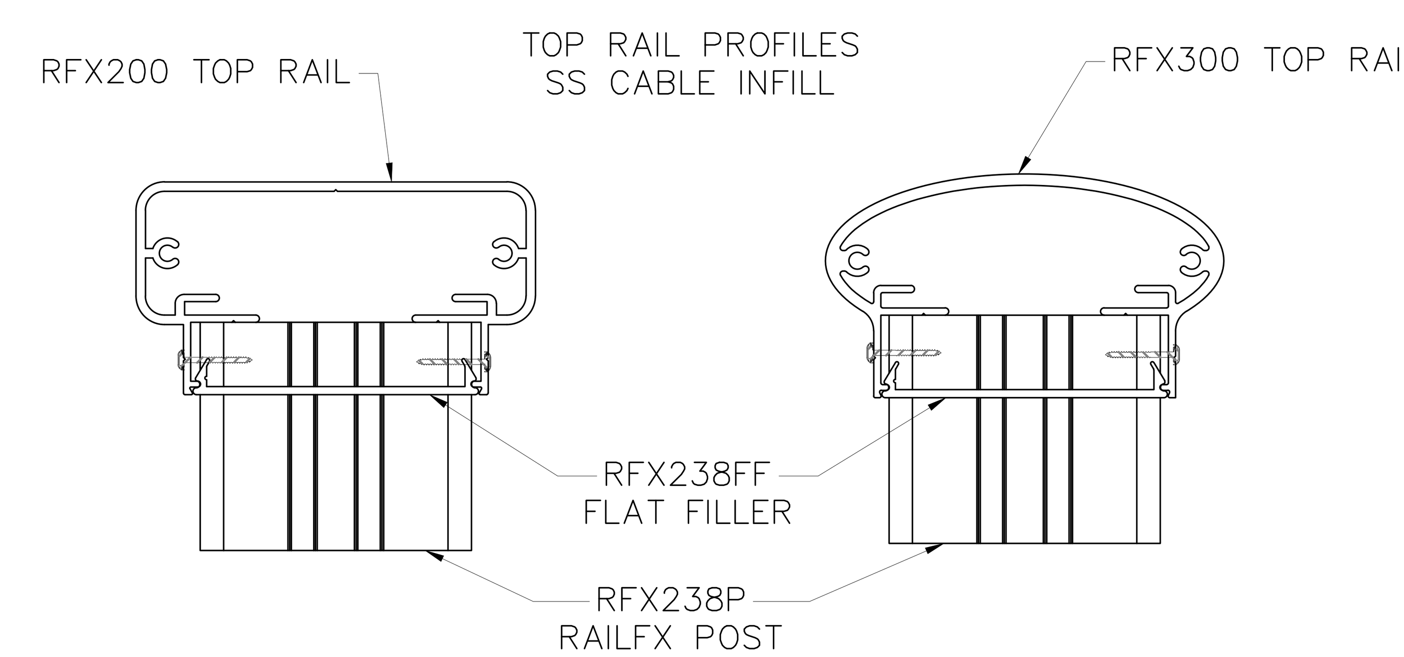
B DETAIL B - SURFACE MOUNT POST WITH BASE PLATE IN CONCRETE

Scale: 4":1'-0"



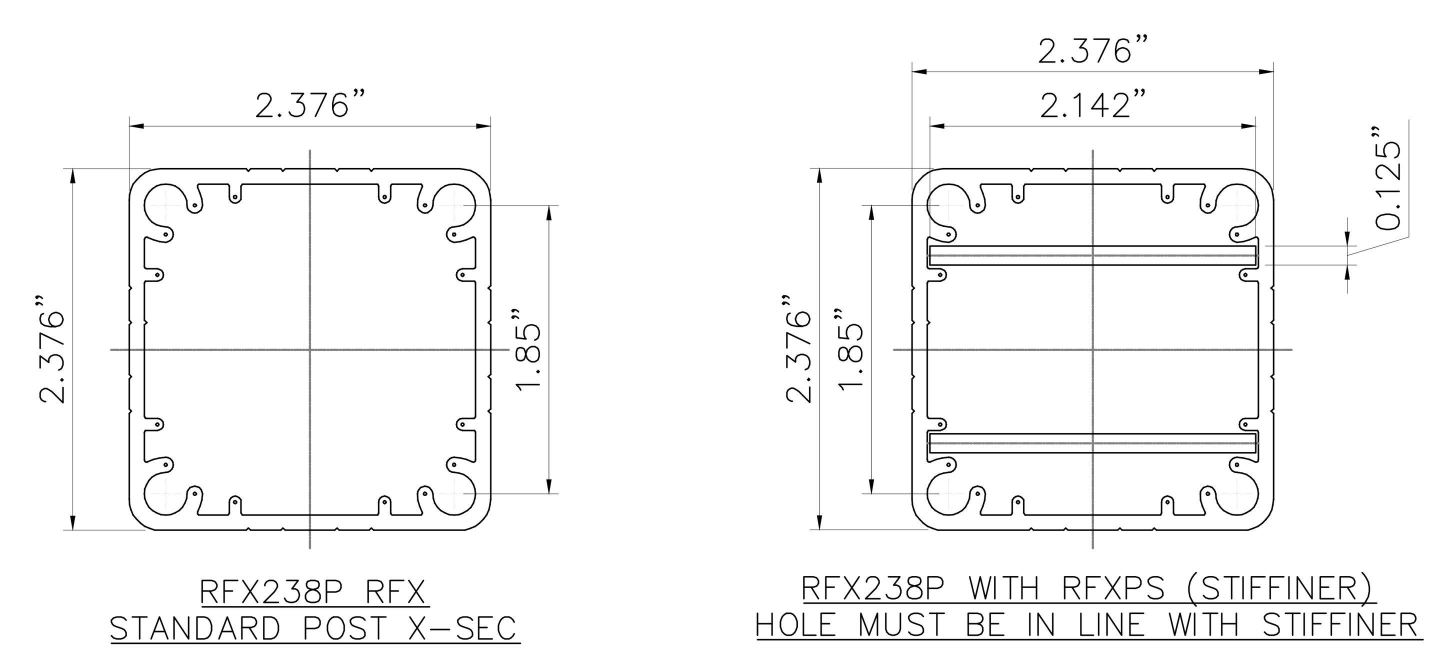
C DETAIL D - RFXBP5X5 DETAILS

Scale: 1'-0":1'-0"



E DETAIL D - TOP RAIL PROFILES (CONTIUOUS TOP RAIL)

Scale: 1'-0":1'-0"



D PE-POST EXTRUSION PROFILE

Scale: 1'-0":1'-0"

ZENITH ENGINEERS, INC
22320 Foothill Blvd,
Suite 600 Hayward, CA 94541
www.zenithengineers.com

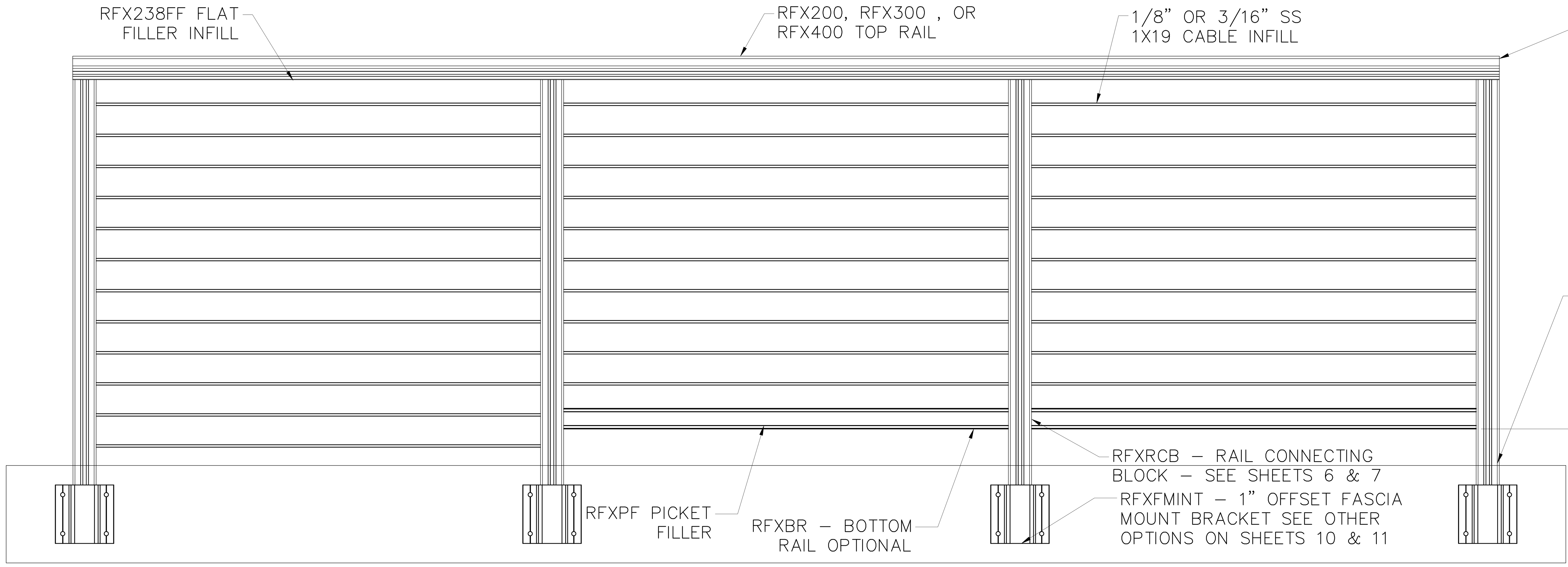
REV: R1 (10.25.21)
REV:

RFX 200 / RFX300 W/STAINLESS STEEL CABLE INFILL SURFACE MOUNTED

NATIONWIDE INDUSTRIES - 50 STATES

DATE: 07.02.2021
SCALE: AS SHOWN
DESIGN BY: SK
DRAWN BY: SK
REVIEWED BY:SP
190417

S5.0

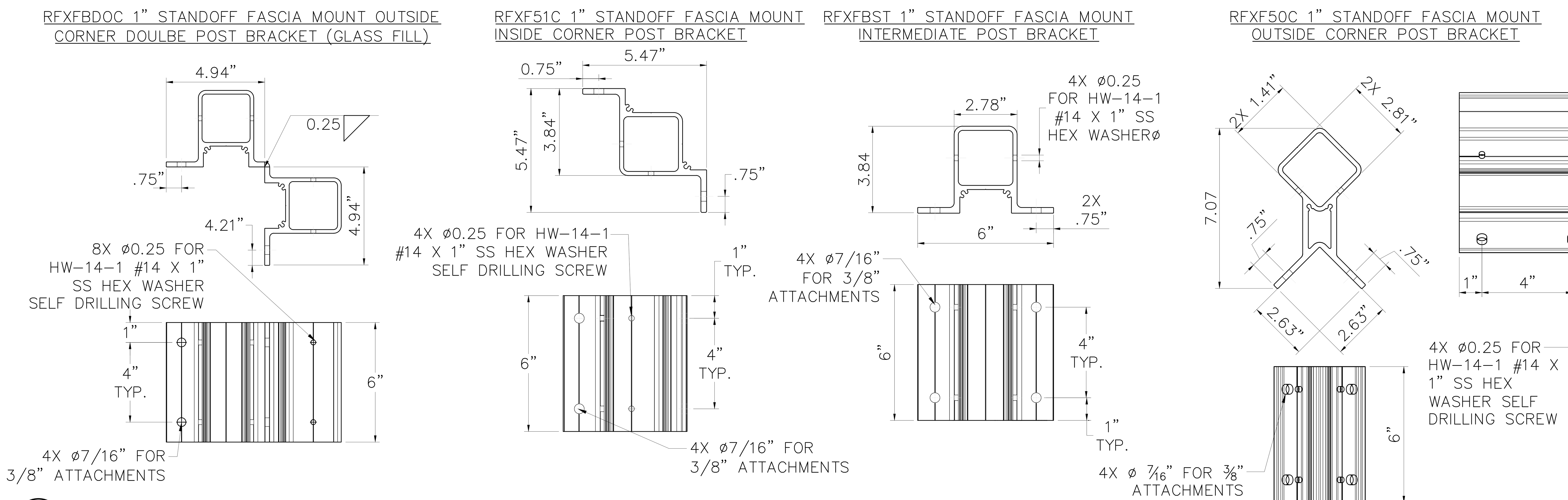


NOTES:

1. DESIGN CAPACITY CHECK OF EXISTING STRUCTURE THAT SUPPORTS THE RAILING IS NOT IN ZENITH SCOPE OF WORK.
2. RAILING IS DESIGNED FOR MAX SPEED OF 110MPH.
3. CABLE IN-FILL & TOP RAIL DESIGN IS NOT IN ZENITH SCOPE OF WORK.
4. POST SPACING IS 5' O.C MAX. OR OTHER SPACING MAY APPLY.

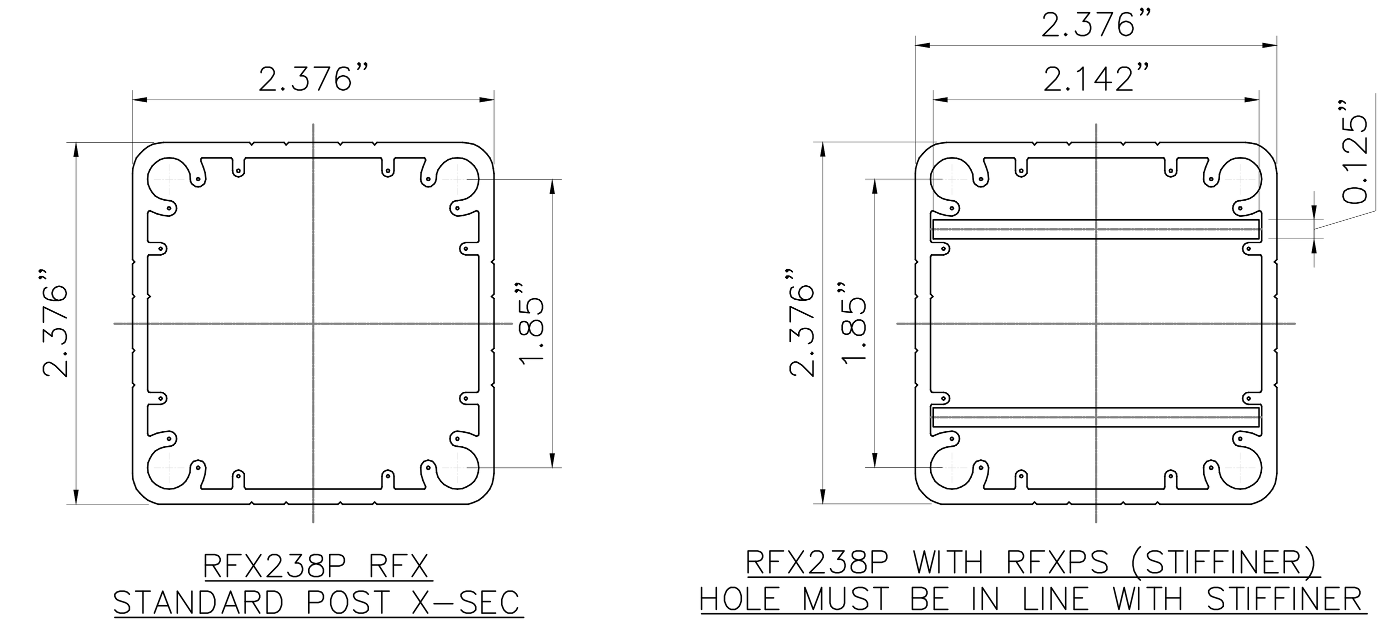
1 RFX 200 / RFX300 ALUMINUM RAIL W/STAINLESS STEEL CABLE INFILL OFFSET FASCIA MOUNT

Scale: 1-1/2" : 1'-0"



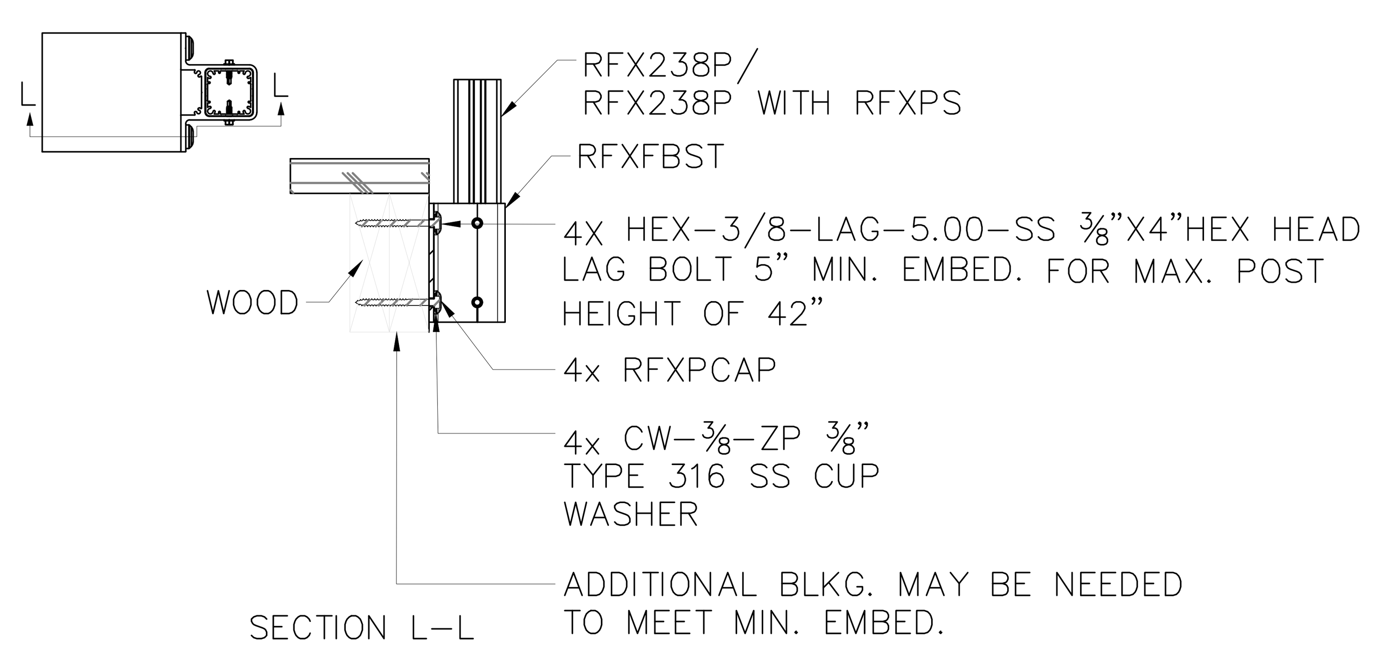
A 1" OFFSET FASCIA MOUNT BRACKET - POST ATTACHMENT OPTIONS AND DETAILS

Scale: 5":1'-0"



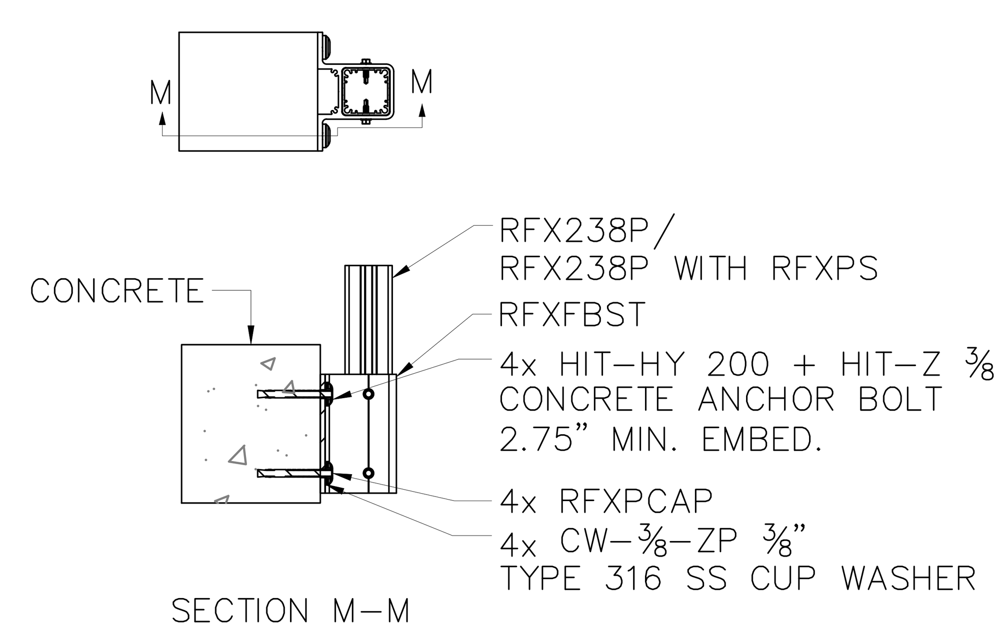
D PE-POST EXTRUSION PROFILE

Scale: 1'-0":1'-0"



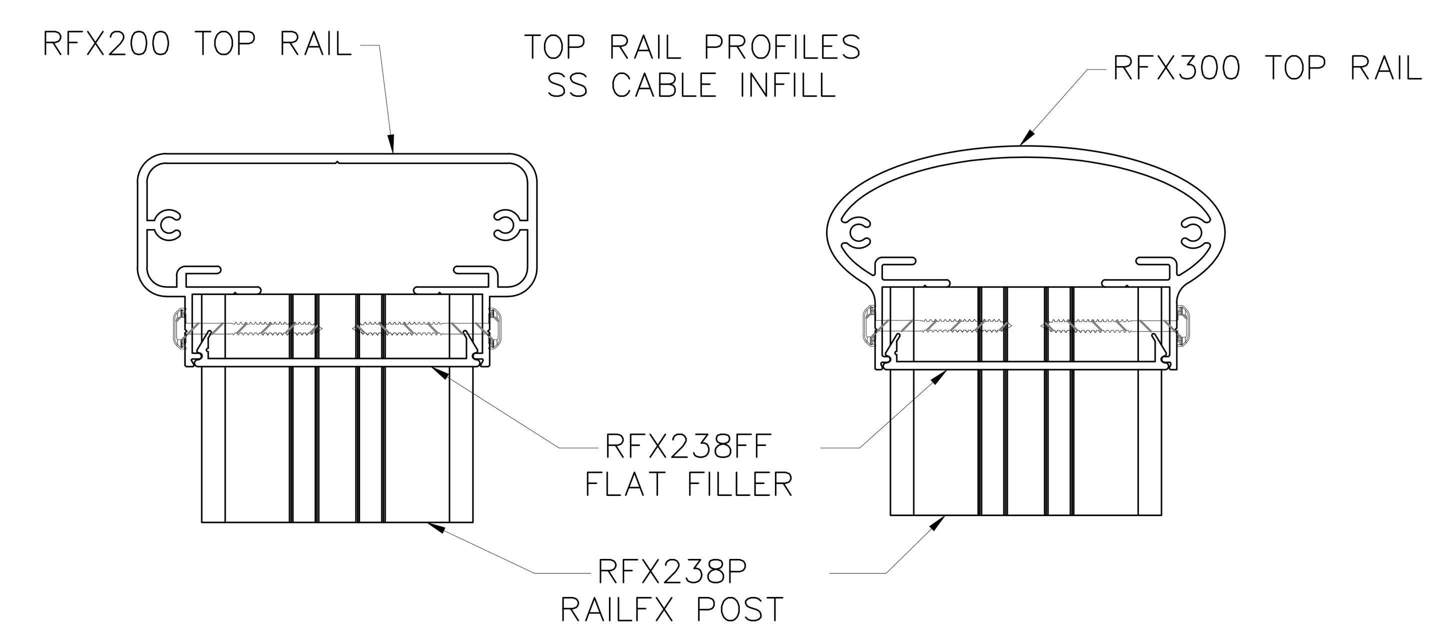
B DETAIL A (TO WOOD)

Scale: 5":1'-0"



C DETAIL B (TO CONCRETE)

Scale: 5":1'-0"



E DETAIL D - TOP RAIL PROFILES (CONTIUOUS TOP RAIL)

Scale: 1'-0":1'-0"

ZENITH ENGINEERS, INC
22320 Foothill Blvd, Suite 600 Hayward, CA 94541
www.zenithenginers.com

REV: R1 (10.25.21)
REV:

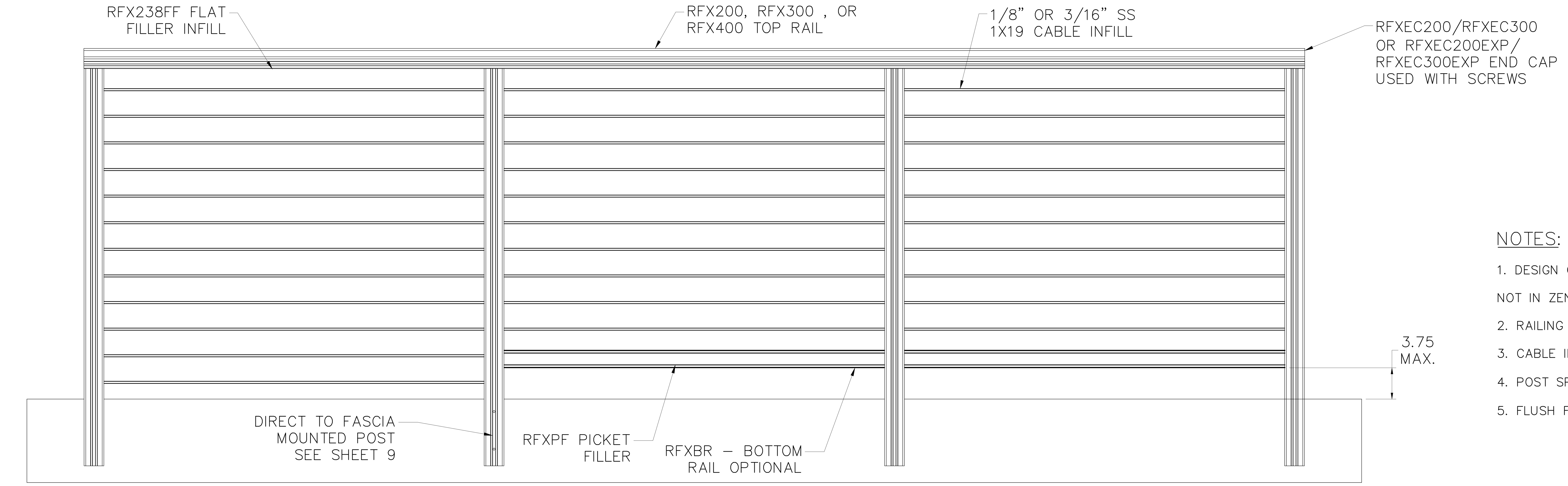
REGISTERED PROFESSIONAL ENGINEER
SENTHIL PULIYADI
C71630
Exp. 12/31/21
CIVIL
STATE OF CALIFORNIA

RFX 200 / RFX300 W/STAINLESS STEEL CABLE INFILL OFFSET FASCIA MOUNTED

NATIONWIDE INDUSTRIES - 50 STATES

DATE: 07.02.2021
SCALE: AS SHOWN
DESIGN BY: SK
DRAWN BY: SK
REVIEWED BY:SP
190417

S6.0

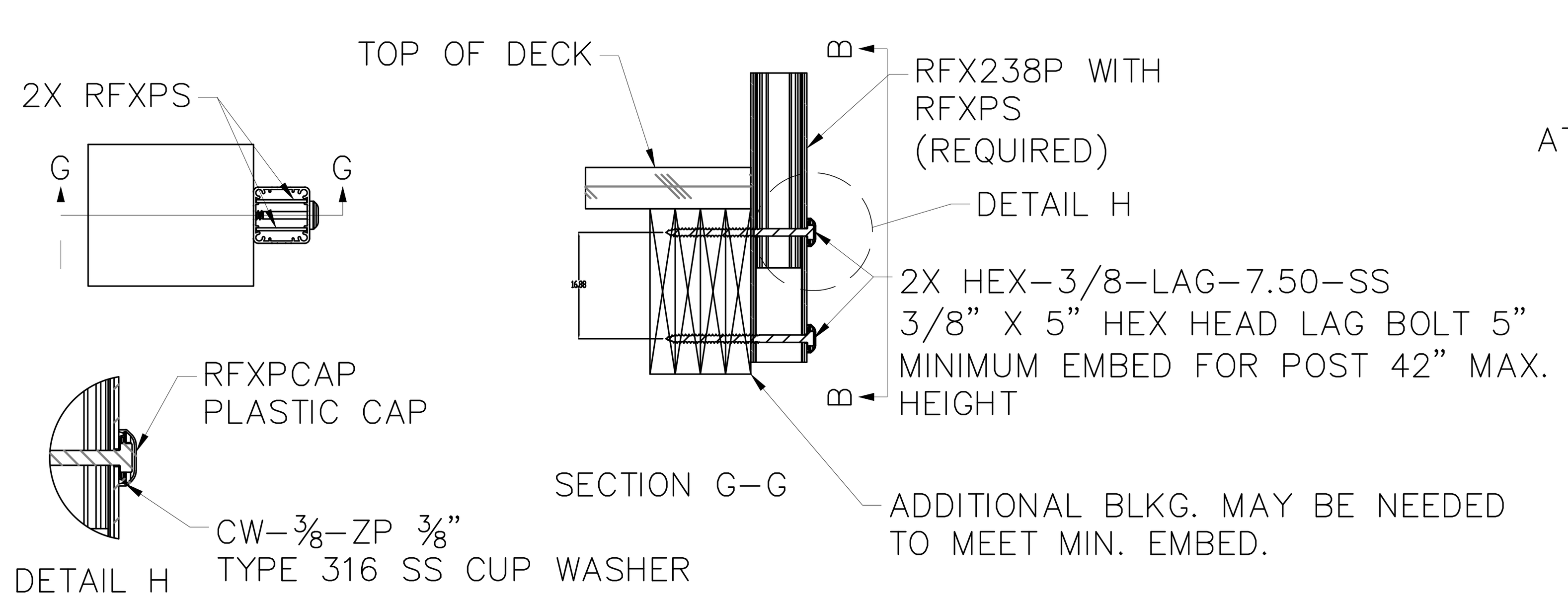


1 RFX 200 / RFX300 ALUMINUM RAIL W/STAINLESS STEEL CABLE INFILL FLUSH FASCIA MOUNT

Scale: 1-1/2" : 1'-0"

NOTES:

1. DESIGN CAPACITY CHECK OF EXISTING STRUCTURE THAT SUPPORTS THE RAILING IS NOT IN ZENITH SCOPE OF WORK.
2. RAILING IS DESIGNED FOR MAX SPEED OF 110MPH.
3. CABLE IN-FILL & TOP RAIL DESIGN IS NOT IN ZENITH SCOPE OF WORK.
4. POST SPACING IS 5' O.C MAX. OR OTHER SPACING MAY APPLY.
5. FLUSH FASCIA MOUNTED CONNECTION IS NOT RECOMMENDED TO WOODEN MEMBERS

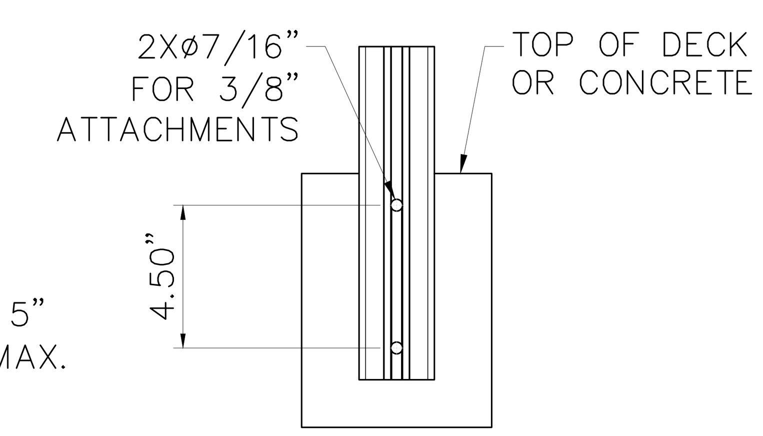


TIMBER FRAME SHOULD BE DOUGLAS-FIR OR BETTER (MIN S.G = 0.5)

RFX238P DIRECT FASCIA FLUSH MOUNT TO WOOD

A DETAIL A

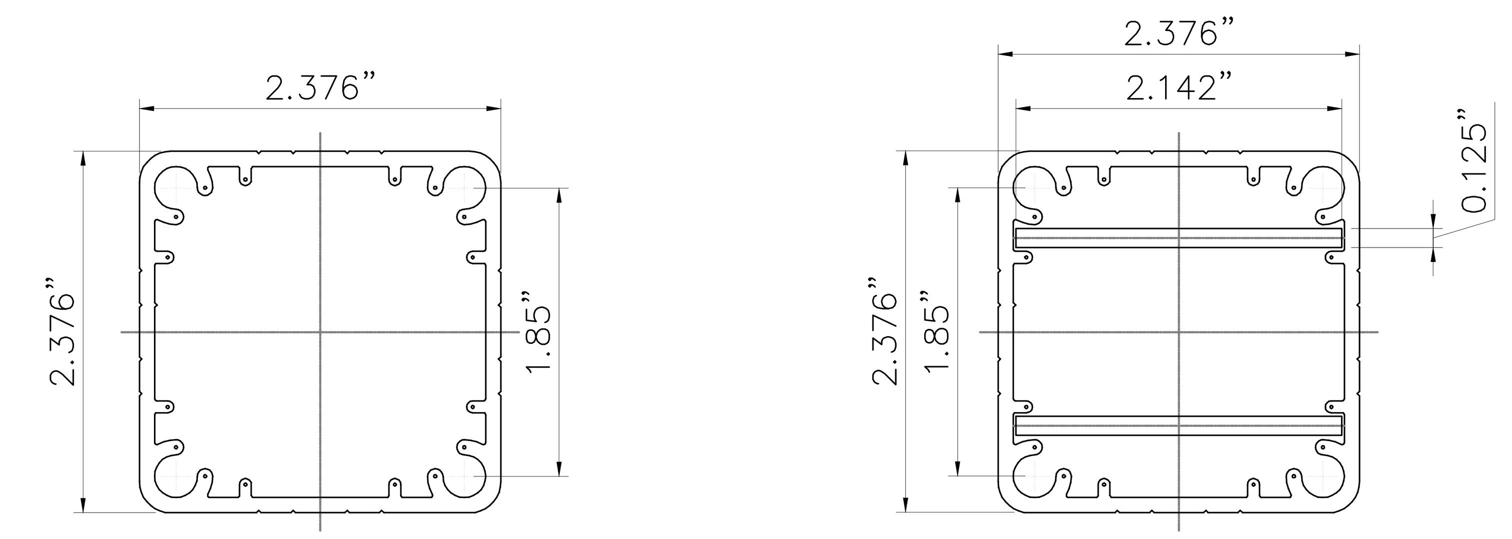
Scale: 4":1'-0"



FLUSH MOUNT FASCIA ATTACHMENT (RFXPS REQUIRED FOR ALL DIRECT FASCIA MOUNTS)

B DETAIL B

Scale: 4":1'-0"

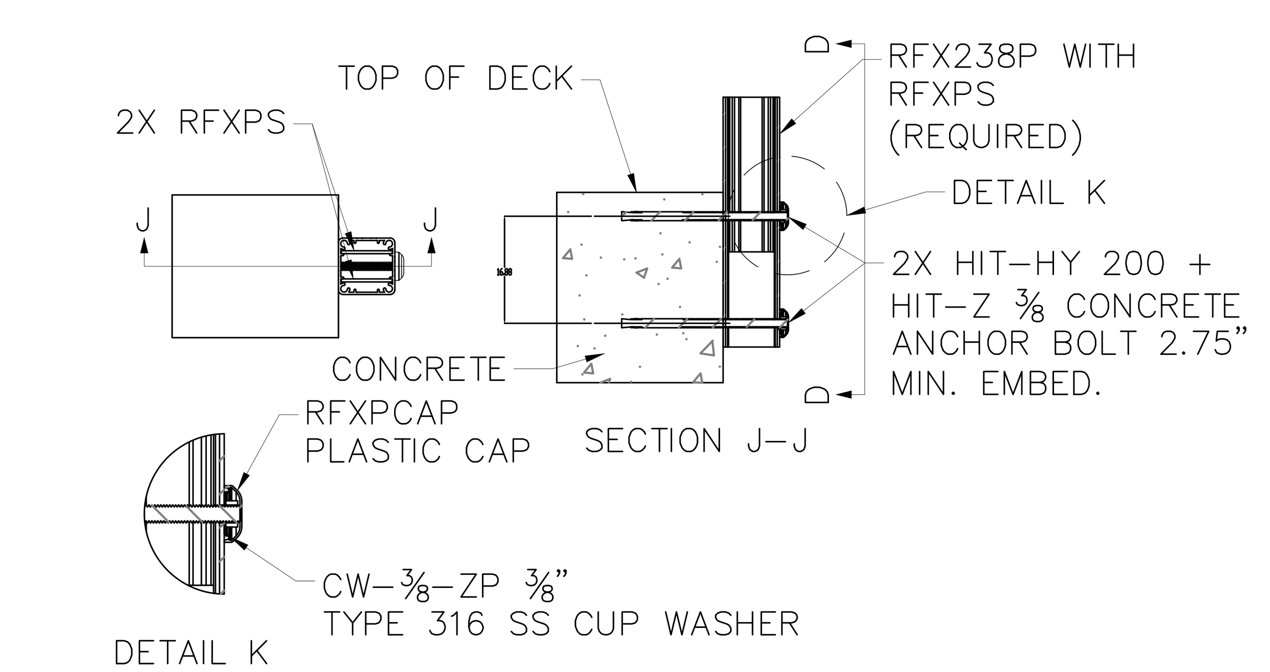


RFX238P RFX STANDARD POST X-SEC

RFX238P WITH RFXPS (STIFFINER) HOLE MUST BE IN LINE WITH STIFFINER

F PE-POST EXTRUSION PROFILE

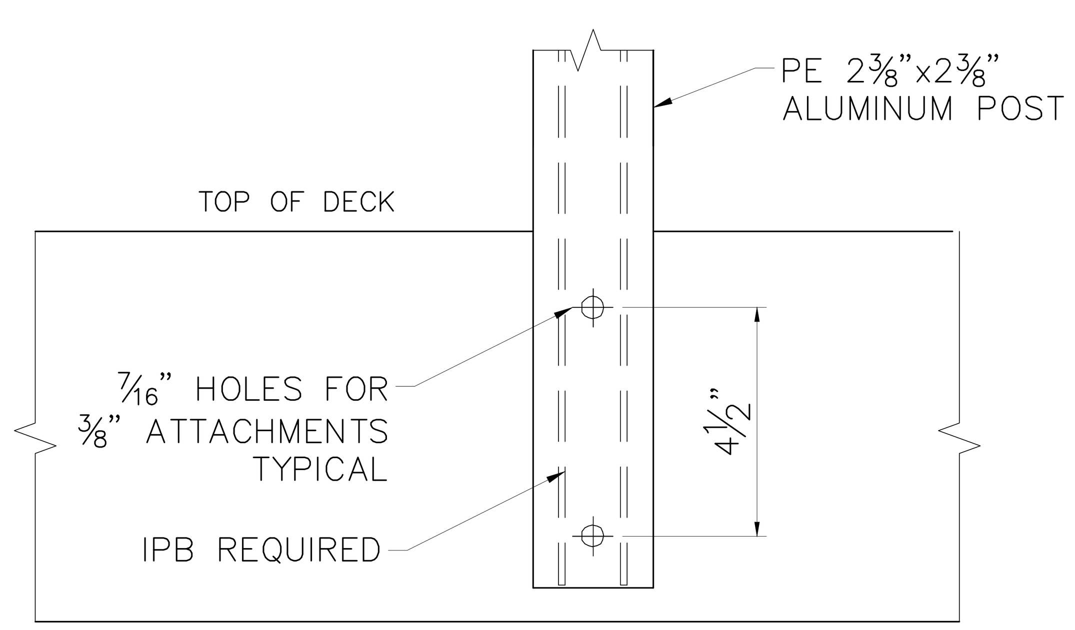
Scale: 1'-0":1'-0"



RFX238P DIRECT FASCIA FLUSH MOUNT TO CONCRETE

C DETAIL C

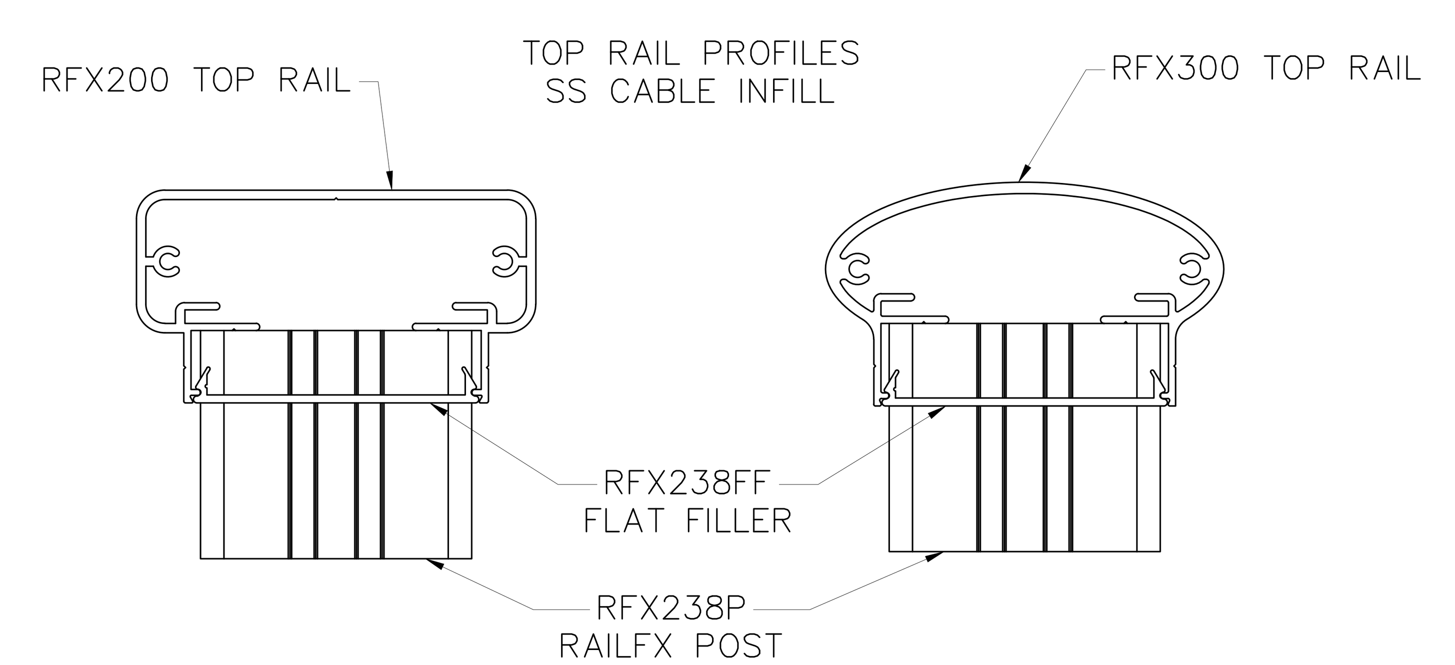
Scale: 4":1'-0"



FLUSH MOUNT FASCIA ATTACHMENT

D DETAIL D

Scale: 4":1'-0"



G DETAIL D

Scale: 1'-0":1'-0"

ZENITH ENGINEERS, INC
22320 Foothill Blvd,
Suite 600 Hayward, CA 94541
www.zenithenginers.com

REV: R1 (10.25.21)
REV:

REGISTERED PROFESSIONAL ENGINEER SENTHIL PULIYADI C71630 Exp. 12/31/21 CIVIL STATE OF CALIFORNIA

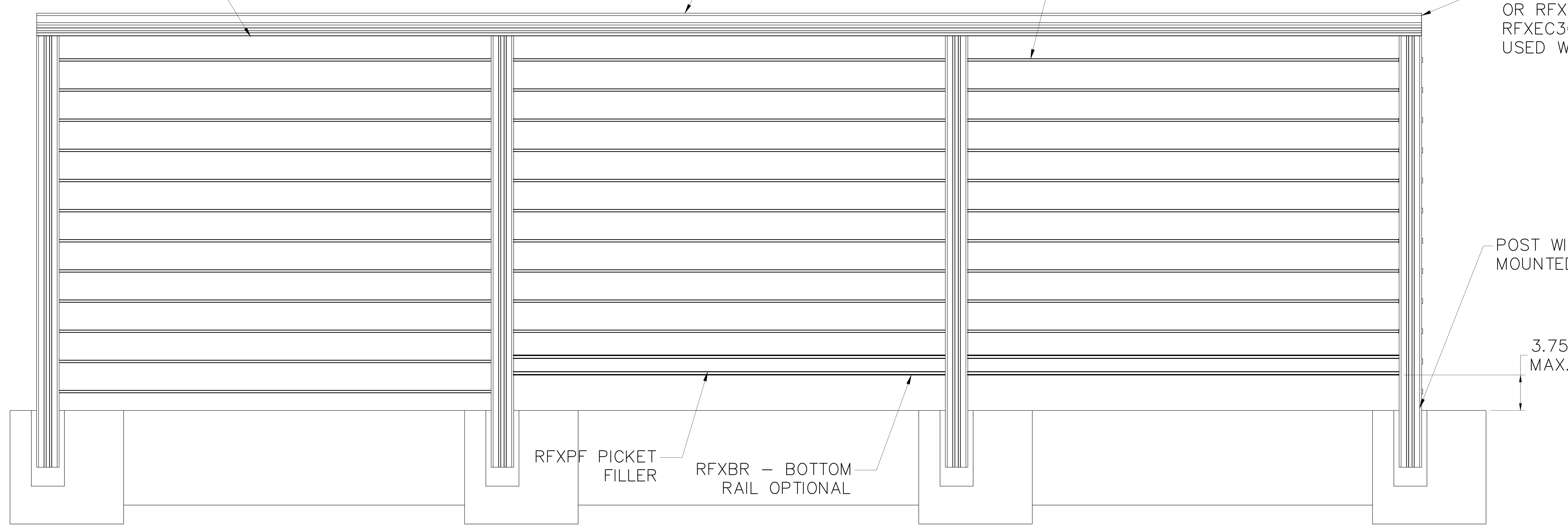
RFX 200 / RFX300 W/STAINLESS STEEL CABLE INFILL FLUSH FASCIA MOUNTED

NATIONWIDE INDUSTRIES - 50 STATES

DATE: 07.02.2021
SCALE: AS SHOWN
DESIGN BY: SK
DRAWN BY: SK
REVIEWED BY:SP

190417

S7.0

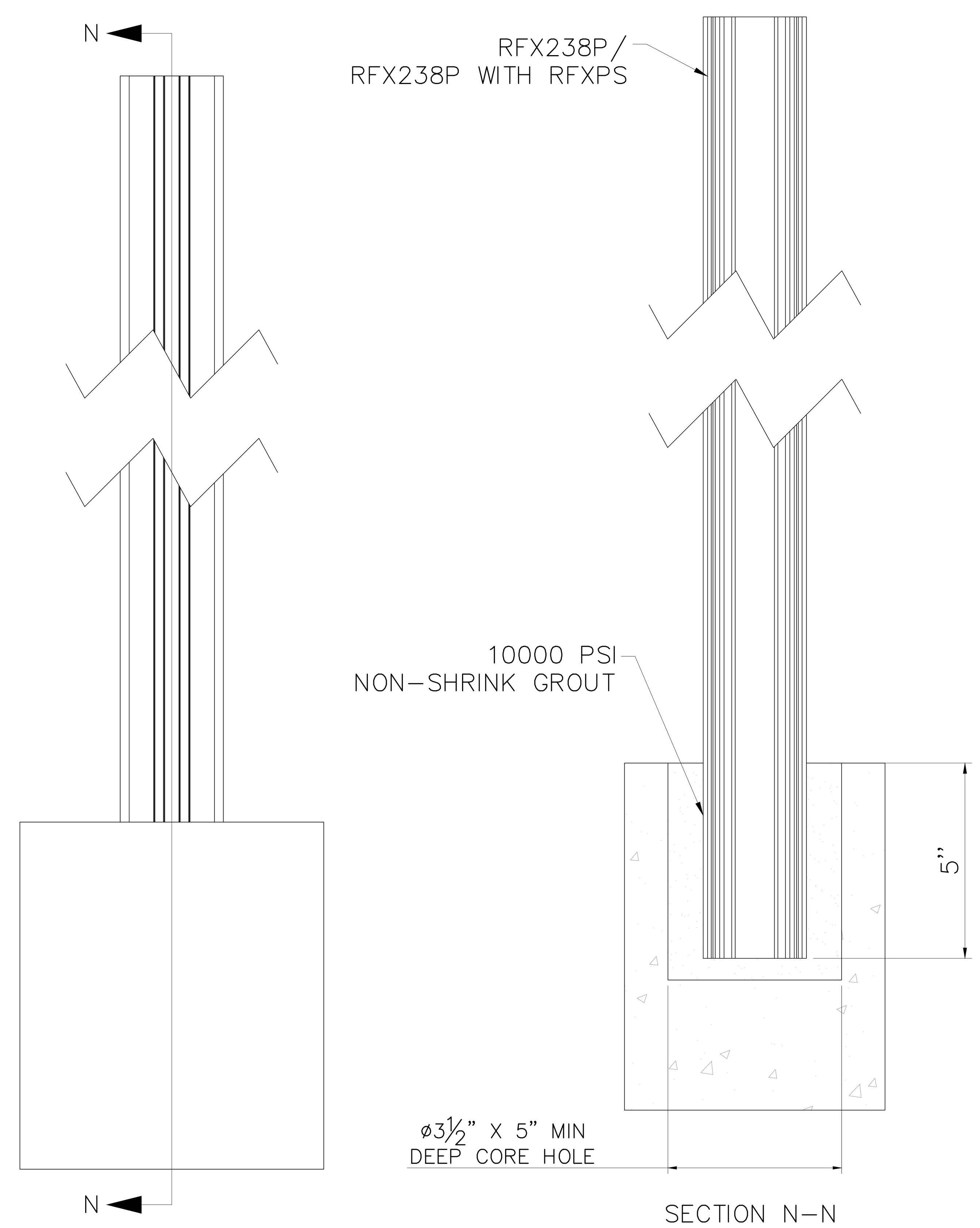


NOTES:

1. DESIGN CAPACITY CHECK OF EXISTING STRUCTURE THAT SUPPORTS THE RAILING IS NOT IN ZENITH SCOPE OF WORK.
2. RAILING IS DESIGNED FOR MAX SPEED OF 110MPH.
3. CABLE IN–FILL & TOP RAIL DESIGN IS NOT IN ZENITH SCOPE OF WORK.
4. POST SPACING IS 5' O.C MAX. OR OTHER SPACING MAY APPLY.

1 RFX 200 / RFX300 ALUMINUM RAIL W/STAINLESS STEEL CABLE INFILL CORE MOUNT

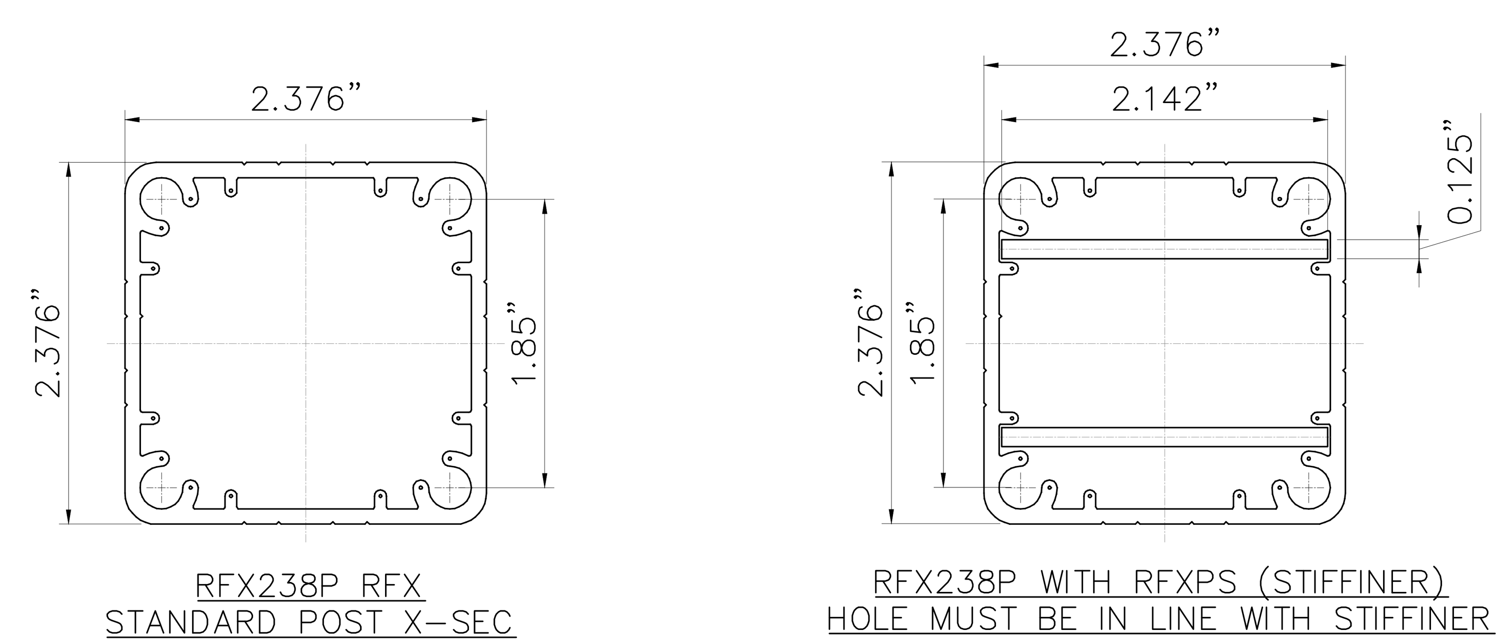
Scale: 1-1/2" : 1'-0"



RFX238P POST MOUNT DIRECT IN CONCRETE

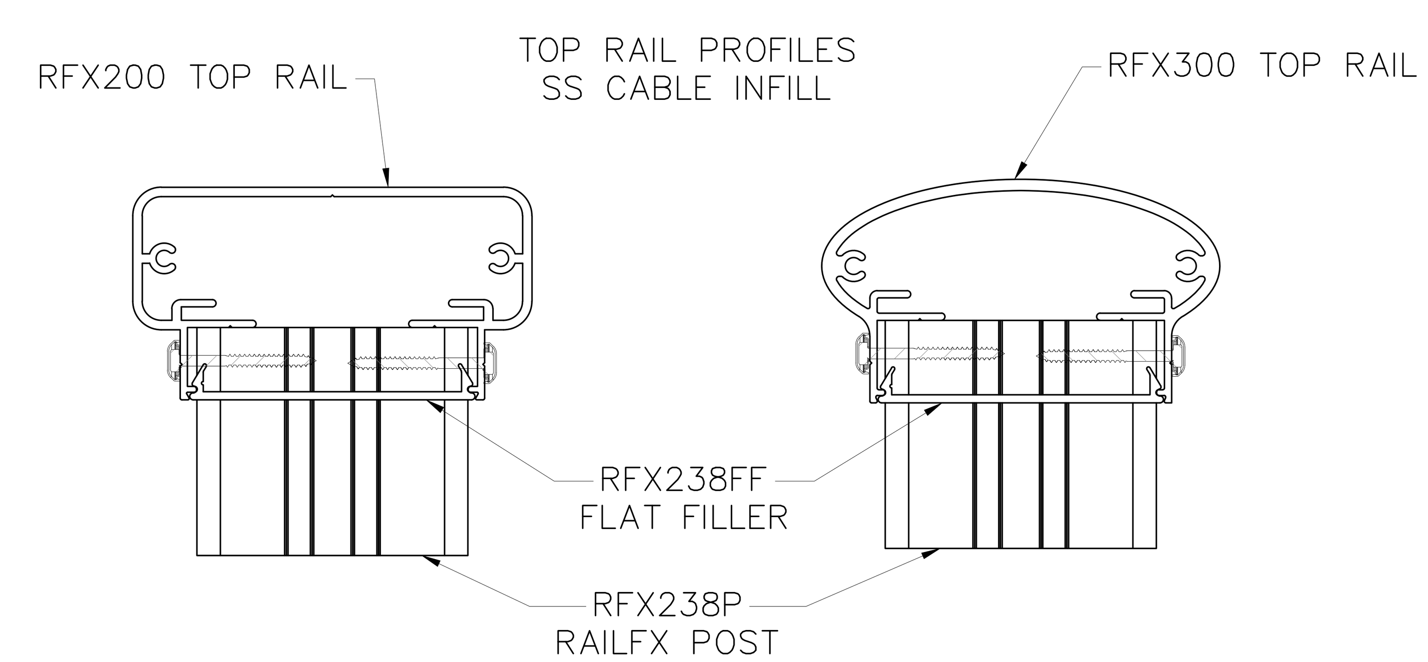
A DETAIL A - POST CORE MOUNTING ATTACHMENT DETAIL

Scale: 5":1'-0"



C PE-POST EXTRUSION PROFILE

Scale: 1'-0":1'-0"



D DETAIL D

Scale: 1'-0":1'-0"

ZENITH ENGINEERS, INC
22320 Foothill Blvd,
Suite 600 Hayward, CA 94541
www.zenithenginers.com

REV: R1 (10.25.21)
REV: R2 (01.07.22)

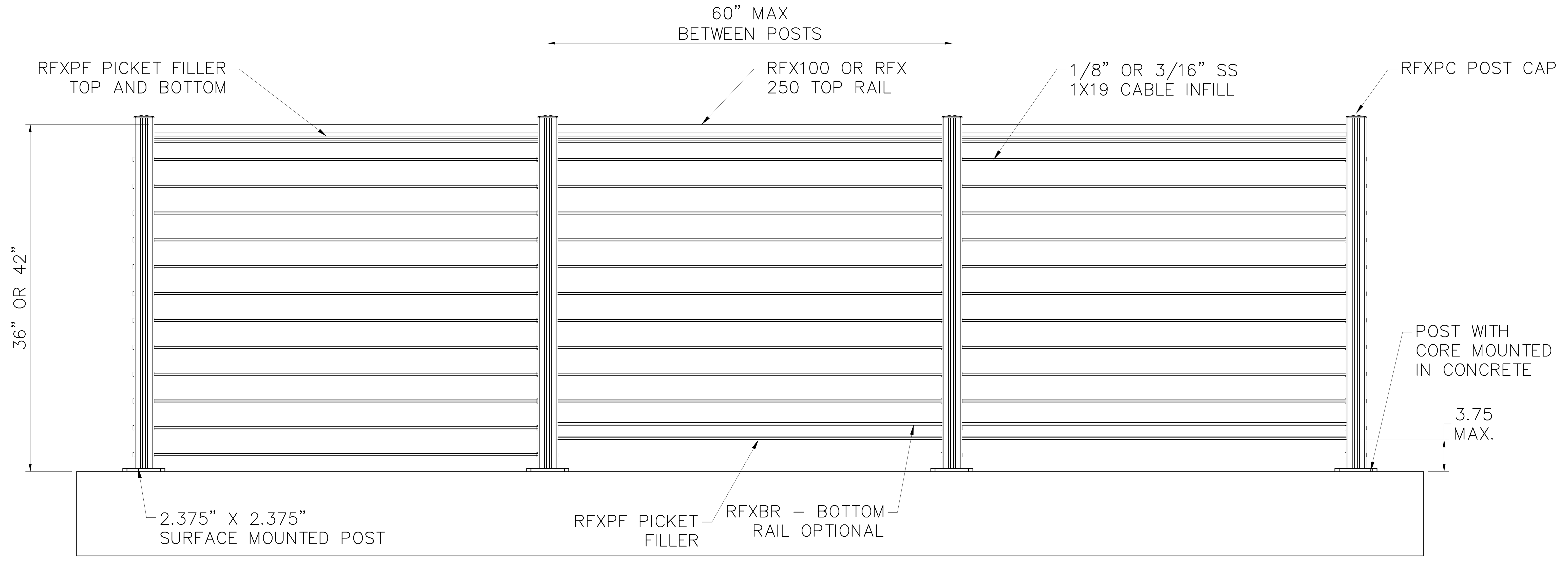
REGISTERED PROFESSIONAL ENGINEER
SENTHIL PULIYADI
C71630
Exp. 12/31/21
CIVIL
STATE OF CALIFORNIA

RFX 200 / RFX300 W/STAINLESS STEEL CABLE INFILL POST CORE MOUNT

NATIONWIDE INDUSTRIES - 50 STATES

DATE: 07.02.2021
SCALE: AS SHOWN
DESIGN BY: SK
DRAWN BY: SK
REVIEWED BY:SP
190417

S8.0

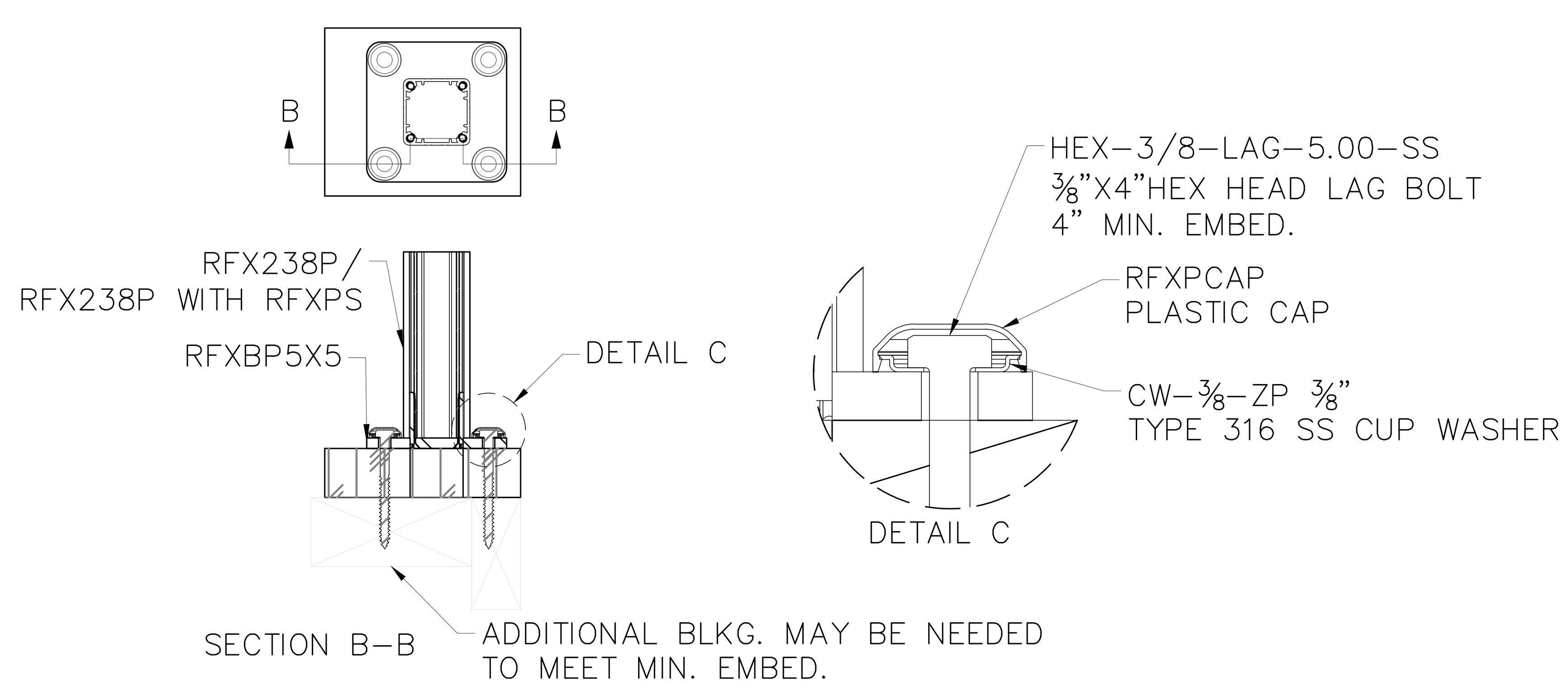


1 RFX 100 / RFX200 ALUMINUM RAIL W/STAINLESS STEEL CABLE INFILL SURFACE MOUNT

Scale: 1-1/2" : 1'-0"

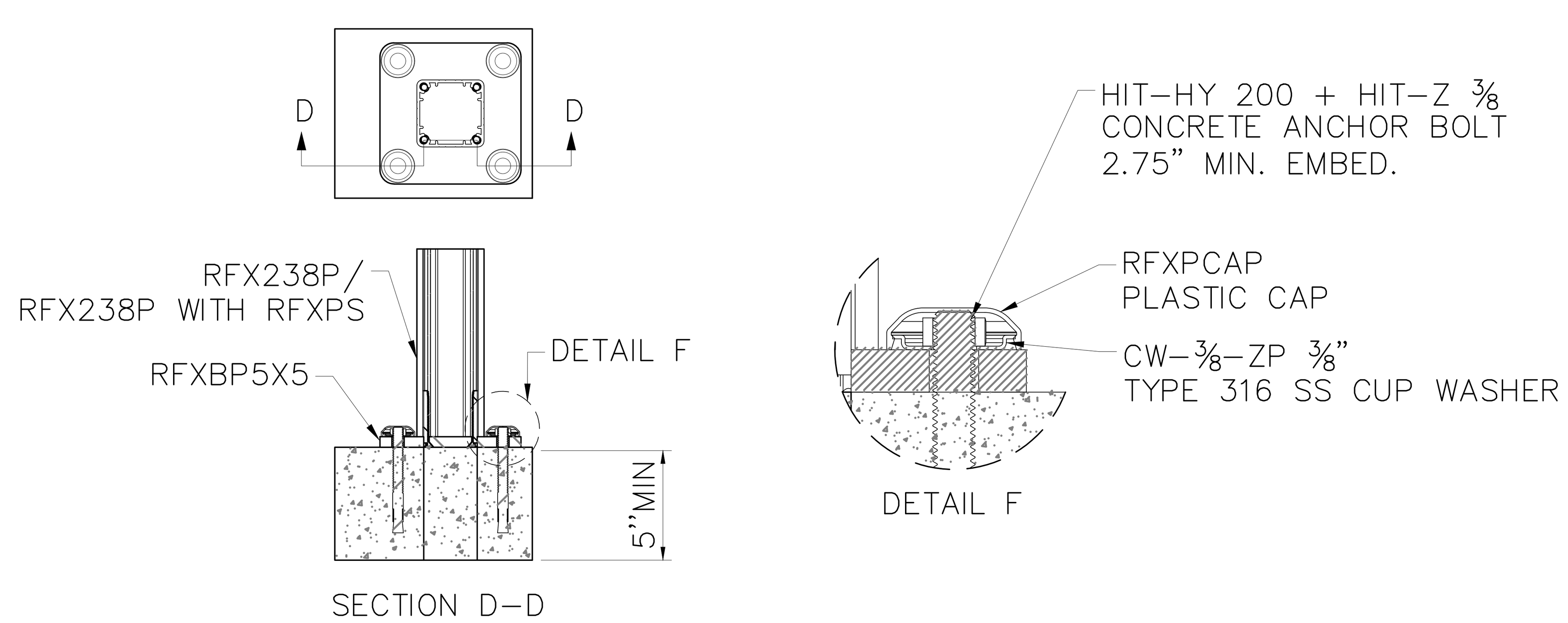
NOTES:

1. DESIGN CAPACITY CHECK OF EXISTING STRUCTURE THAT SUPPORTS THE RAILING IS NOT IN ZENITH SCOPE OF WORK.
2. RAILING IS DESIGNED FOR MAX SPEED OF 110MPH.
3. CABLE IN-FILL & TOP RAIL DESIGN IS NOT IN ZENITH SCOPE OF WORK.
4. POST SPACING IS 5' O.C MAX. OR OTHER SPACING MAY APPLY.



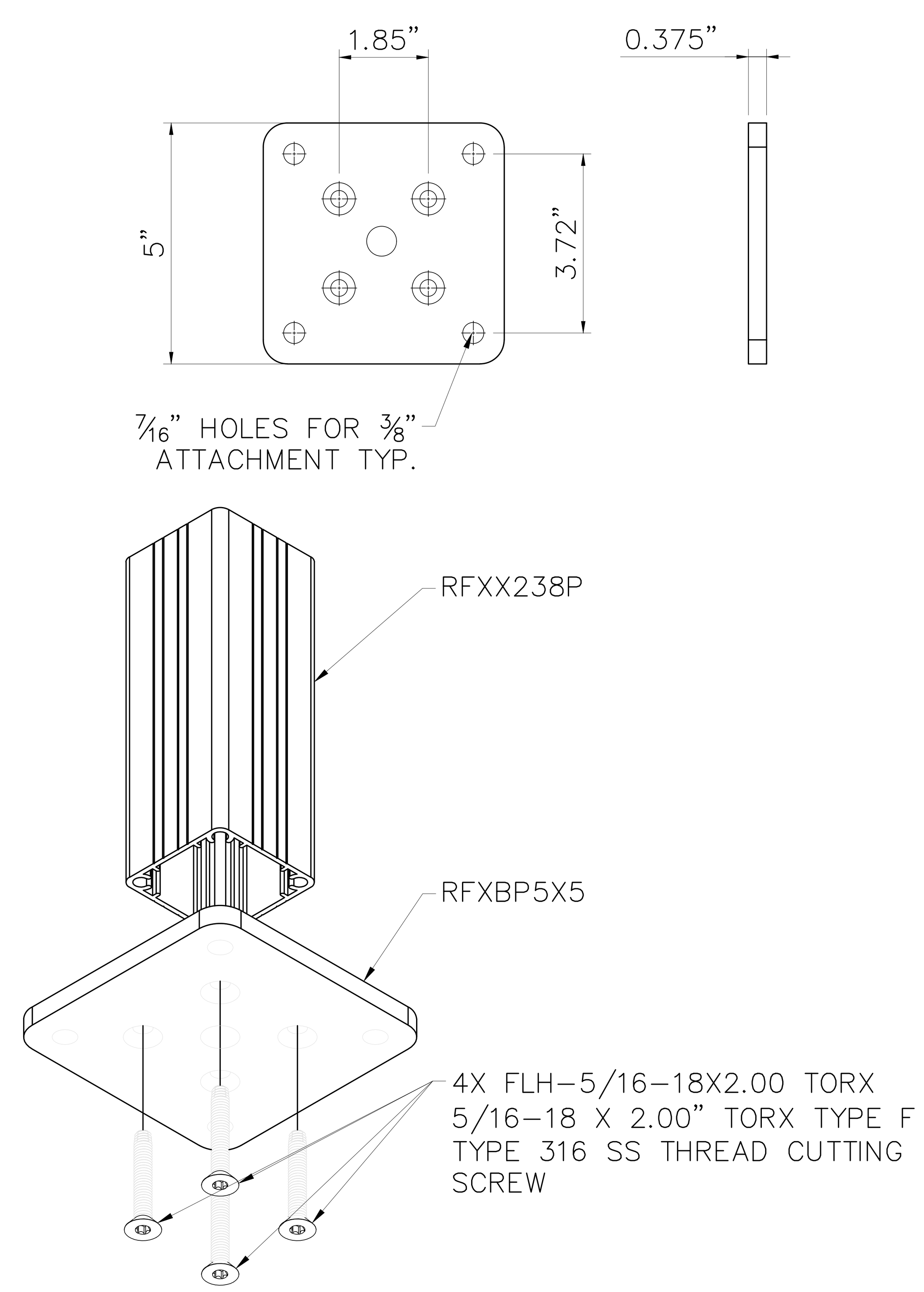
A DETAIL A - SURFACE MOUNT POST WITH BASE PLATE IN WOOD

Scale: 4":1'-0"



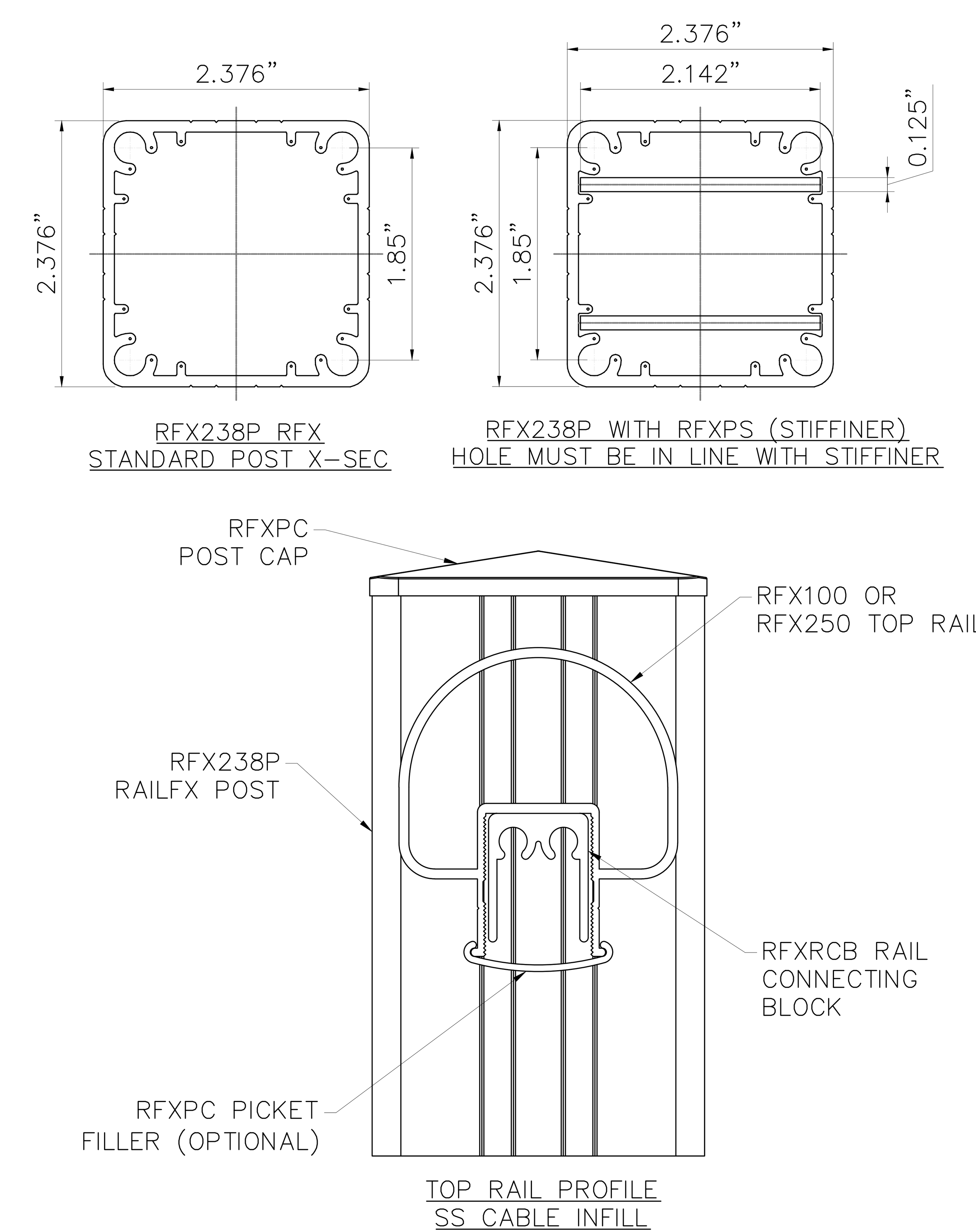
B DETAIL B - SURFACE MOUNT POST WITH BASE PLATE IN CONCRETE

Scale: 4":1'-0"



C DETAIL D - RFXBP5X5 DETAILS

Scale: 1'-0":1'-0"



D DETAIL D

Scale: 1'-0":1'-0"

ZENITH ENGINEERS, INC
22320 Foothill Blvd,
Suite 600 Hayward, CA 94541
www.zenithenginers.com

REV: R1 (10.25.21)

REV:

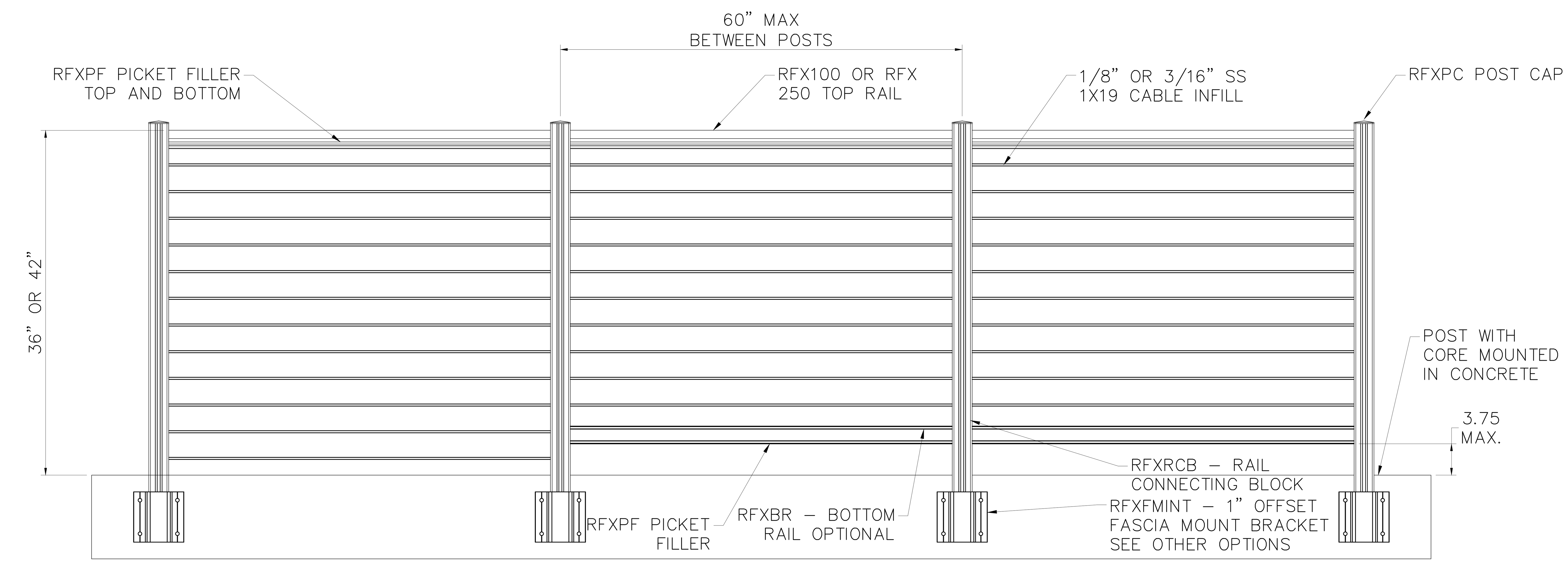
REGISTERED PROFESSIONAL ENGINEER
SENTHIL PULIYADI
C71630
Exp. 12/31/21
CIVIL
STATE OF CALIFORNIA

RFX 100 / RFX250 W/STAINLESS STEEL CABLE INFILL SURFACE MOUNTED

NATIONWIDE INDUSTRIES - 50 STATES

DATE: 07.02.2021
SCALE: AS SHOWN
DESIGN BY: SK
DRAWN BY: SK
REVIEWED BY:SP
190417

S9.0

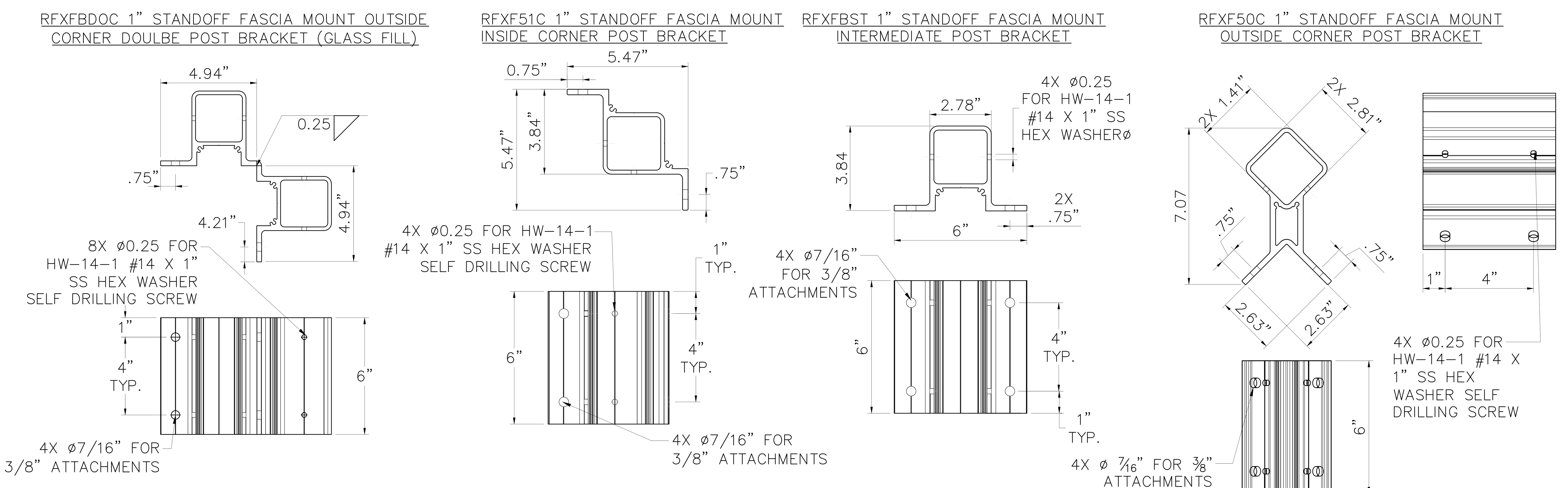


NOTES:

1. DESIGN CAPACITY CHECK OF EXISTING STRUCTURE THAT SUPPORTS THE RAILING IS NOT IN ZENITH SCOPE OF WORK.
2. RAILING IS DESIGNED FOR MAX SPEED OF 110MPH.
3. CABLE IN-FILL & TOP RAIL DESIGN IS NOT IN ZENITH SCOPE OF WORK.
4. POST SPACING IS 5' O.C MAX. OR OTHER SPACING MAY APPLY.

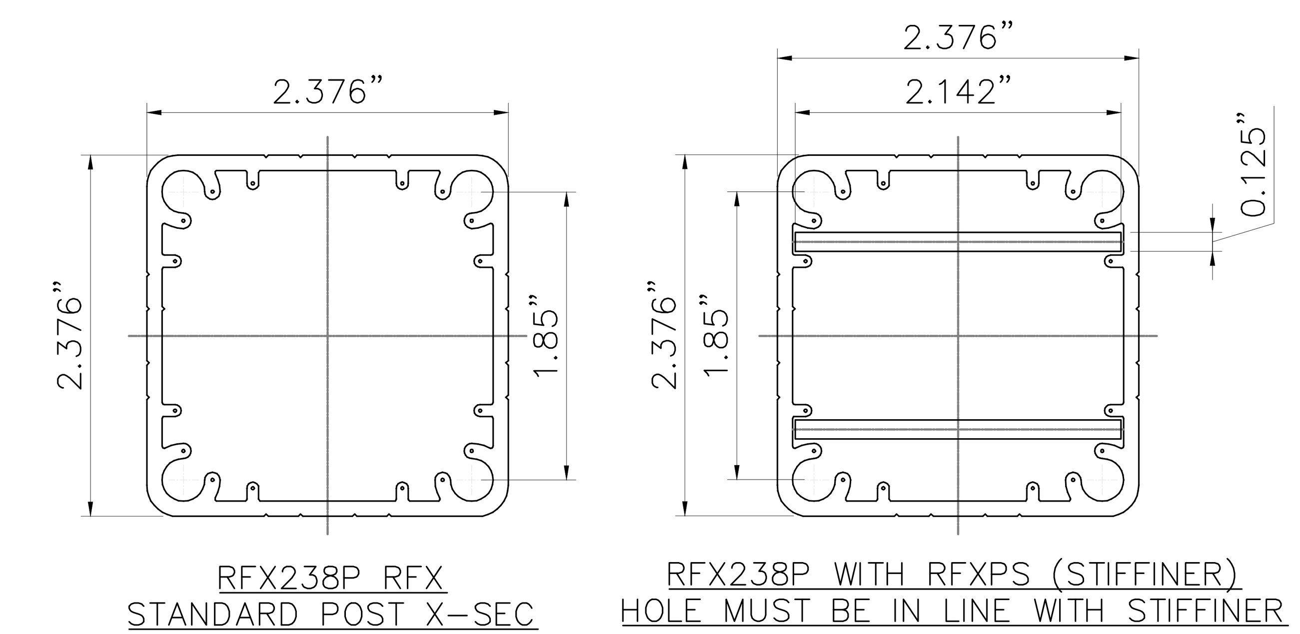
1 RFX 100 / RFX250 ALUMINUM RAIL W/STAINLESS STEEL CABLE INFILL OFFSET FASCIA MOUNT

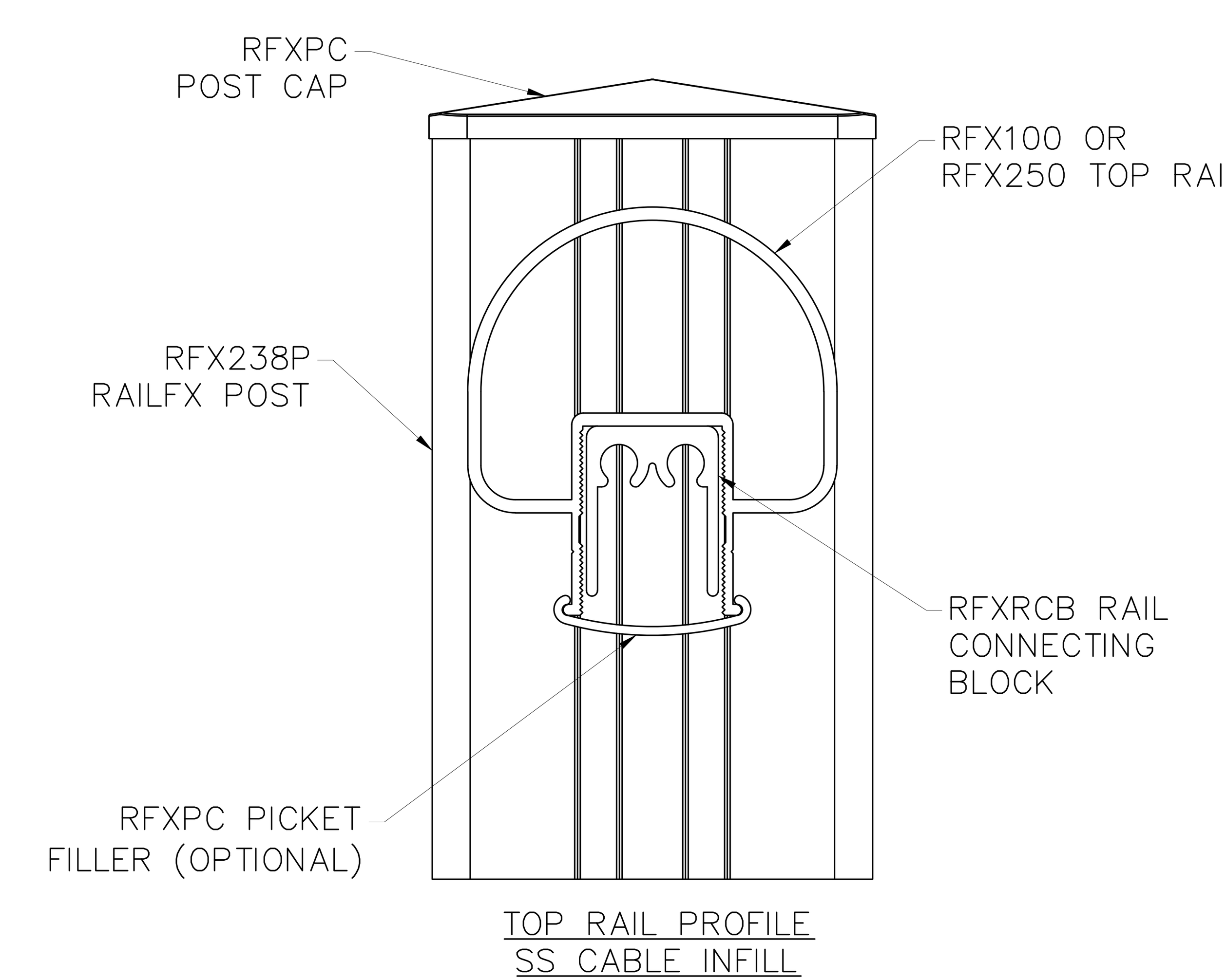
Scale: 1-1/2" : 1'-0"

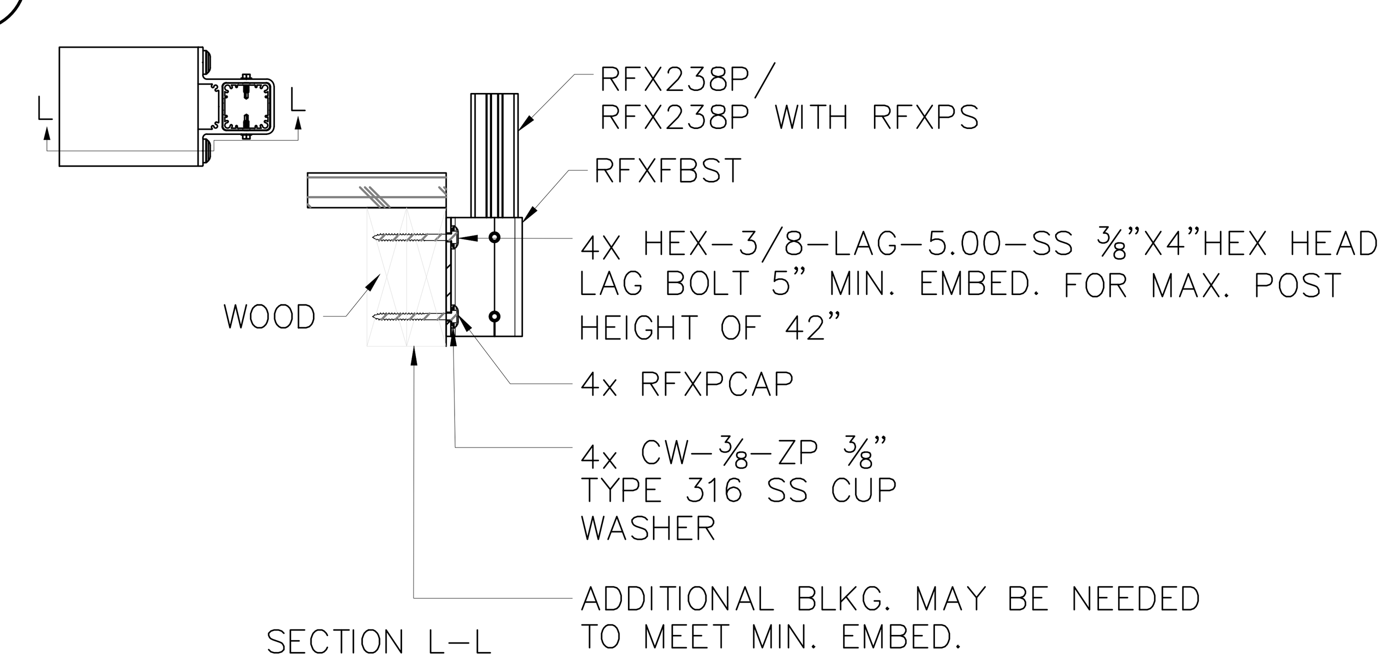


A 1" OFFSET FASCIA MOUNT BRACKET - POST ATTACHMENT OPTIONS AND DETAILS

Scale: 5":1'-0"

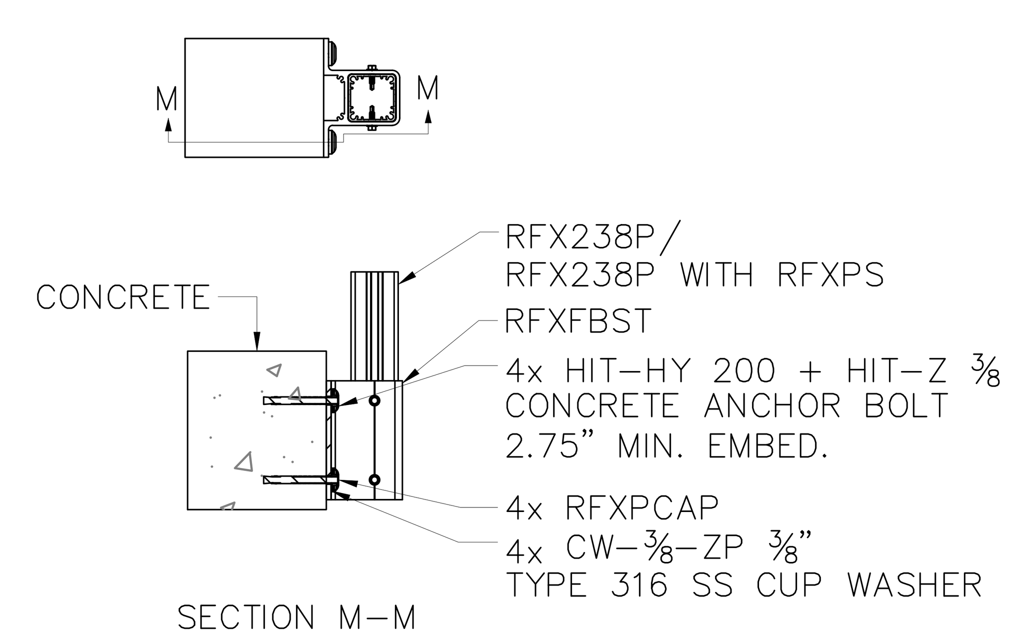






B DETAIL A (TO WOOD)

Scale: 5":1'-0"



C DETAIL B (TO CONCRETE)

Scale: 5":1'-0"

D DETAIL D

Scale: 1'-0":1'-0"

ZENITH ENGINEERS, INC
22320 Foothill Blvd,
Suite 600 Hayward, CA 94541
www.zenithengineers.com

REV: R1 (10.25.21)
REV:

REGISTERED PROFESSIONAL ENGINEER
SENTHIL PULIYADI
C71630
Exp. 12/31/21
CIVIL
STATE OF CALIFORNIA

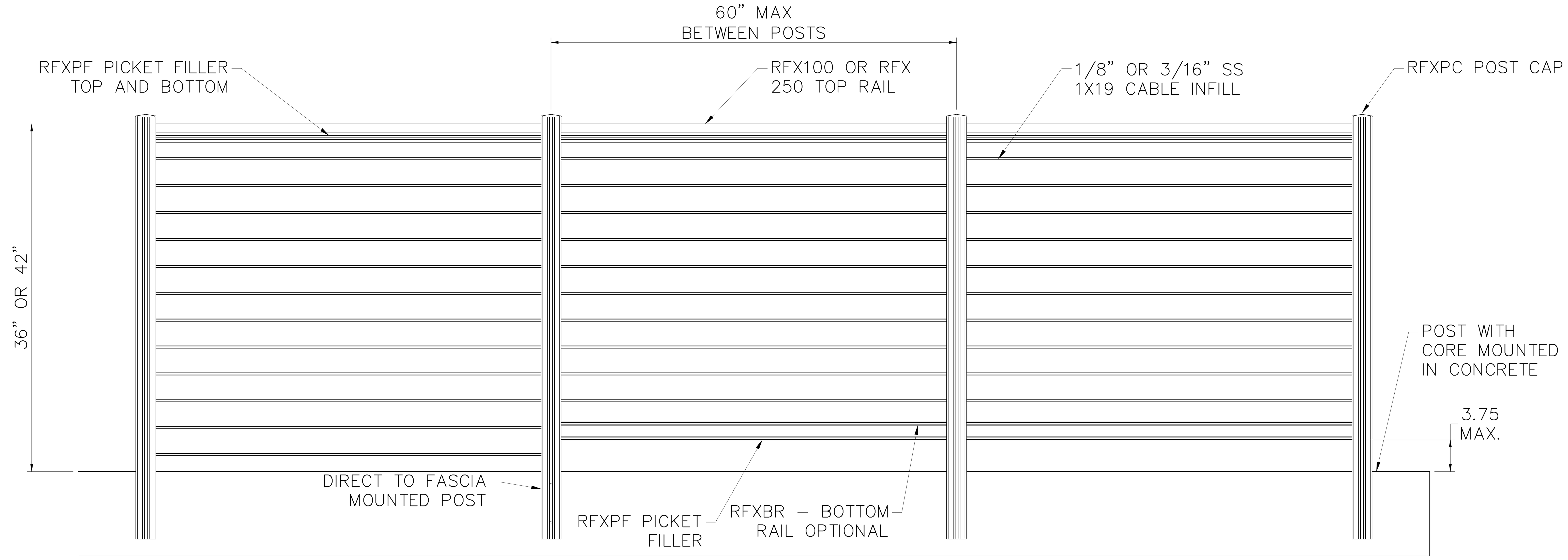
RFX 100 / RFX250 W/STAINLESS STEEL CABLE INFILL OFFSET FASCIA MOUNT

NATIONWIDE INDUSTRIES - 50 STATES

DATE: 07.02.2021
SCALE: AS SHOWN
DESIGN BY: SK
DRAWN BY: SK
REVIEWED BY:SP
190417

S10.0

PAGE 12 of 14

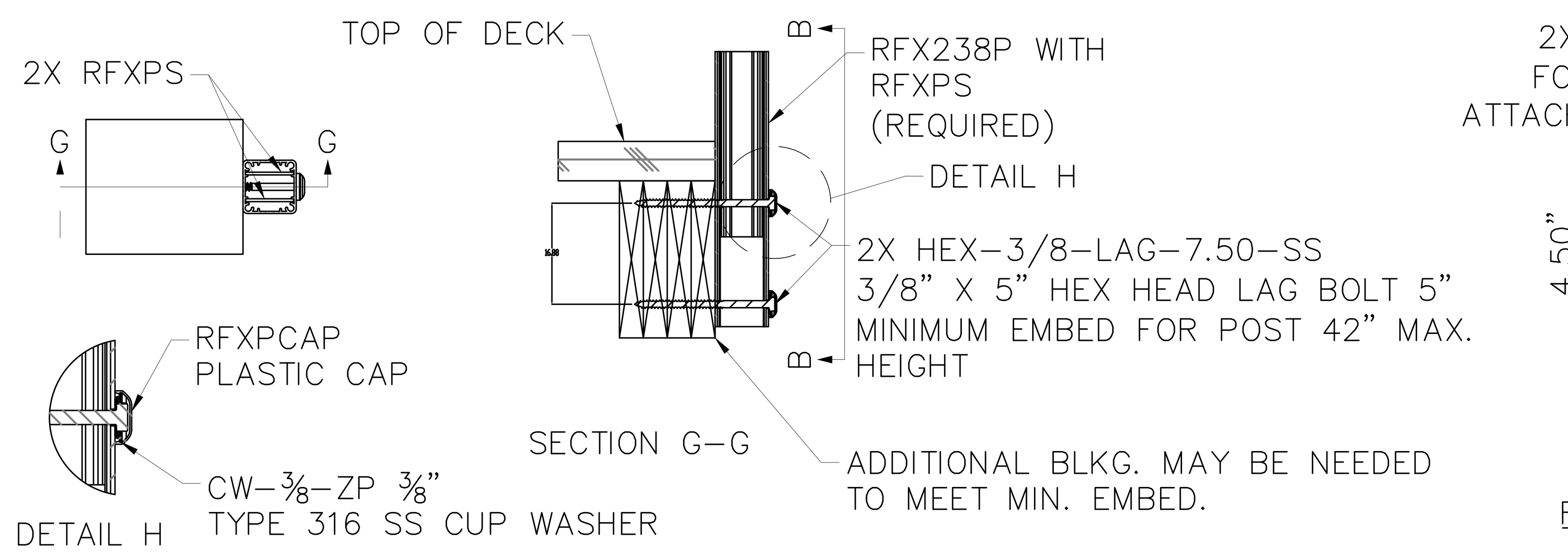


1 RFX 100 / RFX250 ALUMINUM RAIL W/STAINLESS STEEL CABLE INFILL OFFSET FASCIA MOUNT

Scale: 1-1/2" : 1'-0"

NOTES:

1. DESIGN CAPACITY CHECK OF EXISTING STRUCTURE THAT SUPPORTS THE RAILING IS NOT IN ZENITH SCOPE OF WORK.
2. RAILING IS DESIGNED FOR MAX SPEED OF 110MPH.
3. CABLE IN-FILL & TOP RAIL DESIGN IS NOT IN ZENITH SCOPE OF WORK.
4. POST SPACING IS 5' O.C MAX. OR OTHER SPACING MAY APPLY.
5. FLUSH FASCIA MOUNTED CONNECTION IS NOT RECOMMENDED TO WOODEN MEMBERS

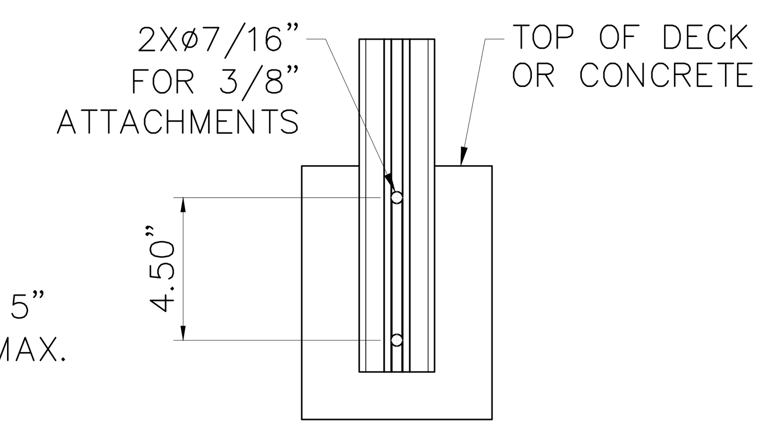


TIMBER FRAME SHOULD BE DOUGLAS-FIR OR BETTER (MIN S.G = 0.5)

RFX238P DIRECT FASCIA FLUSH MOUNT TO WOOD

A DETAIL A

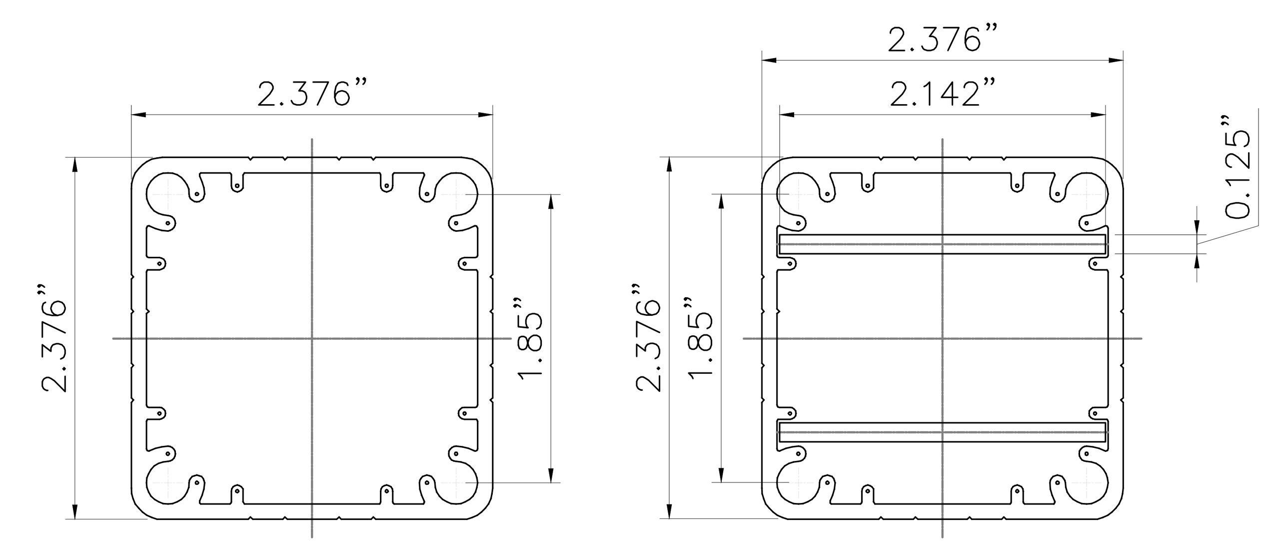
Scale: 4":1'-0"



FLUSH MOUNT FASCIA ATTACHMENT (RFXPS REQUIRED FOR ALL DIRECT FASICA MOUNTS)

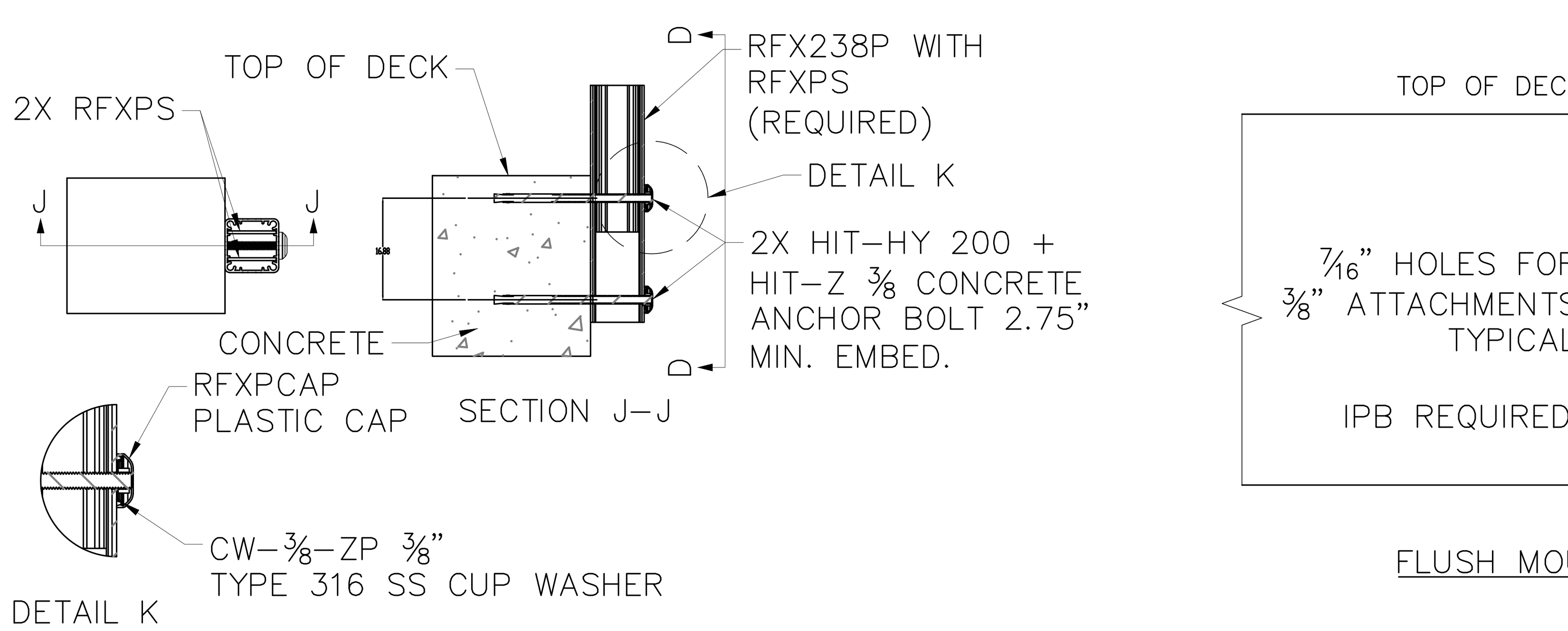
B DETAIL B

Scale: 4":1'-0"



RFX238P RFX STANDARD POST X-SEC

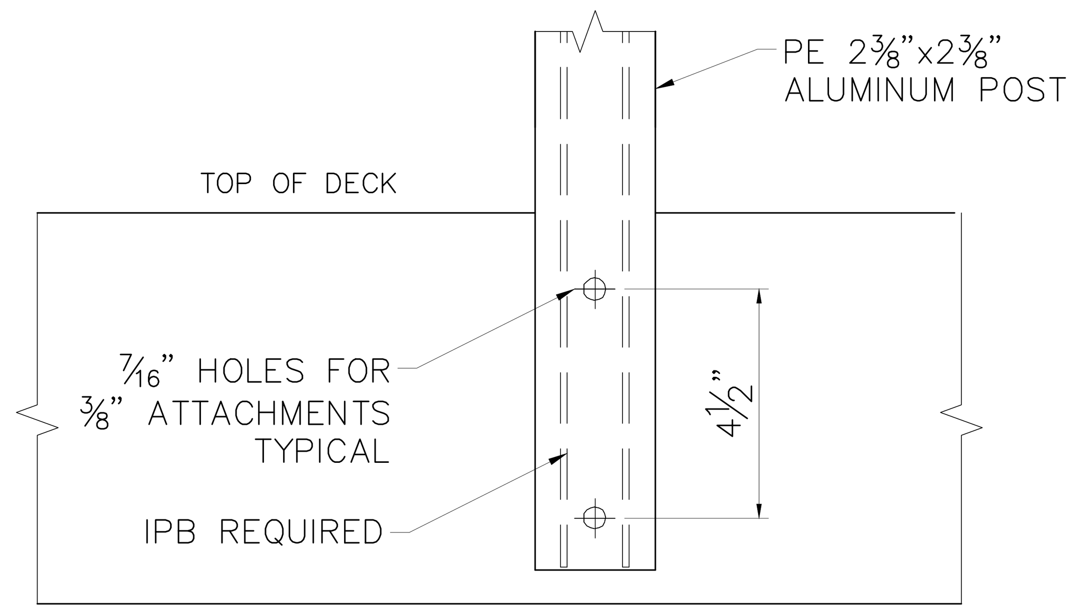
RFX238P WITH RFXPS (STIFFINER) HOLE MUST BE IN LINE WITH STIFFINER



RFX238P DIRECT FASCIA FLUSH MOUNT TO CONCRETE

C DETAIL C

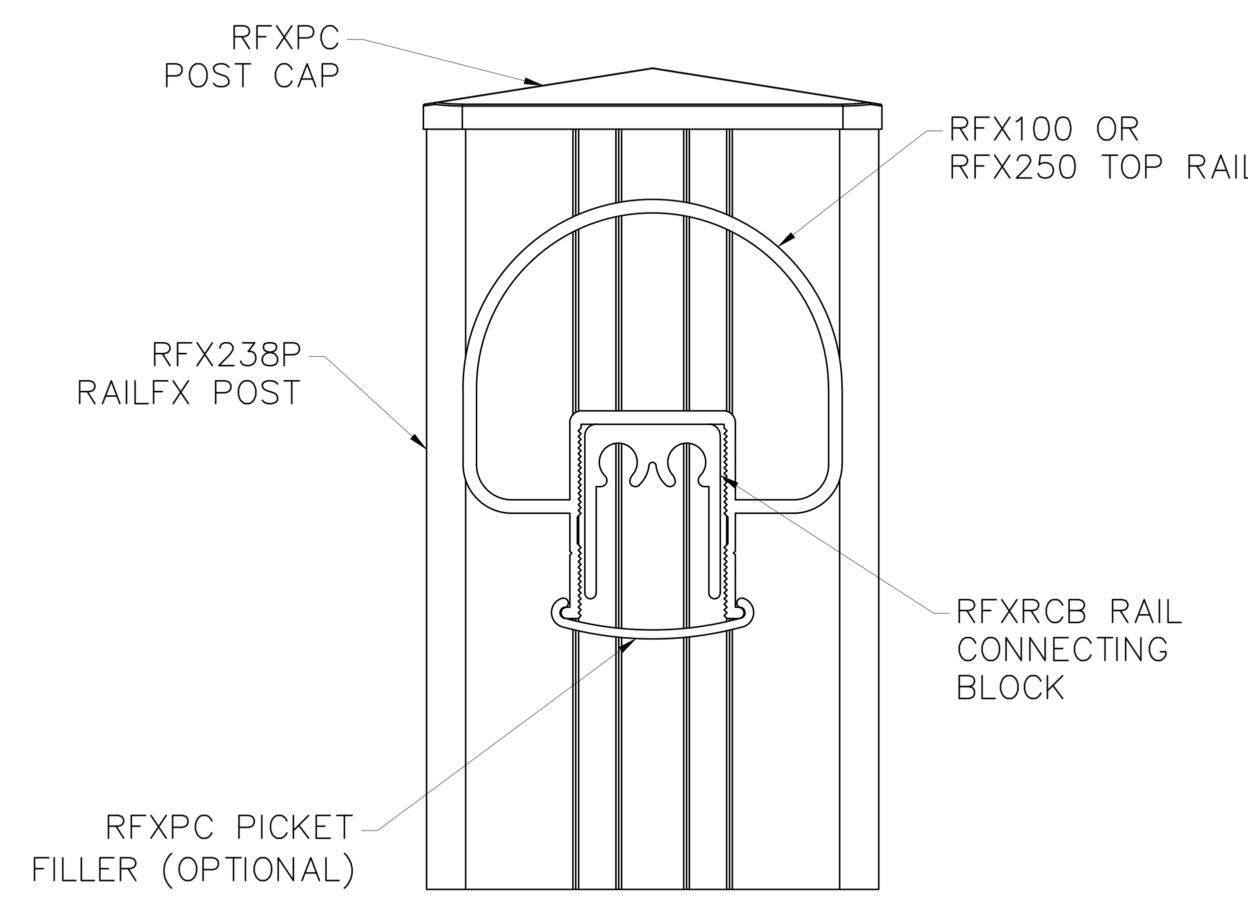
Scale: 4":1'-0"



FLUSH MOUNT FASCIA ATTACHMENT

D DETAIL D

Scale: 4":1'-0"



TOP RAIL PROFILE SS CABLE INFILL

D DETAIL D

Scale: 1'-0":1'-0"

ZENITH ENGINEERS, INC
22320 Foothill Blvd,
Suite 600 Hayward, CA 94541
www.zenithenginers.com

REV: R1 (10.25.21)
REV:

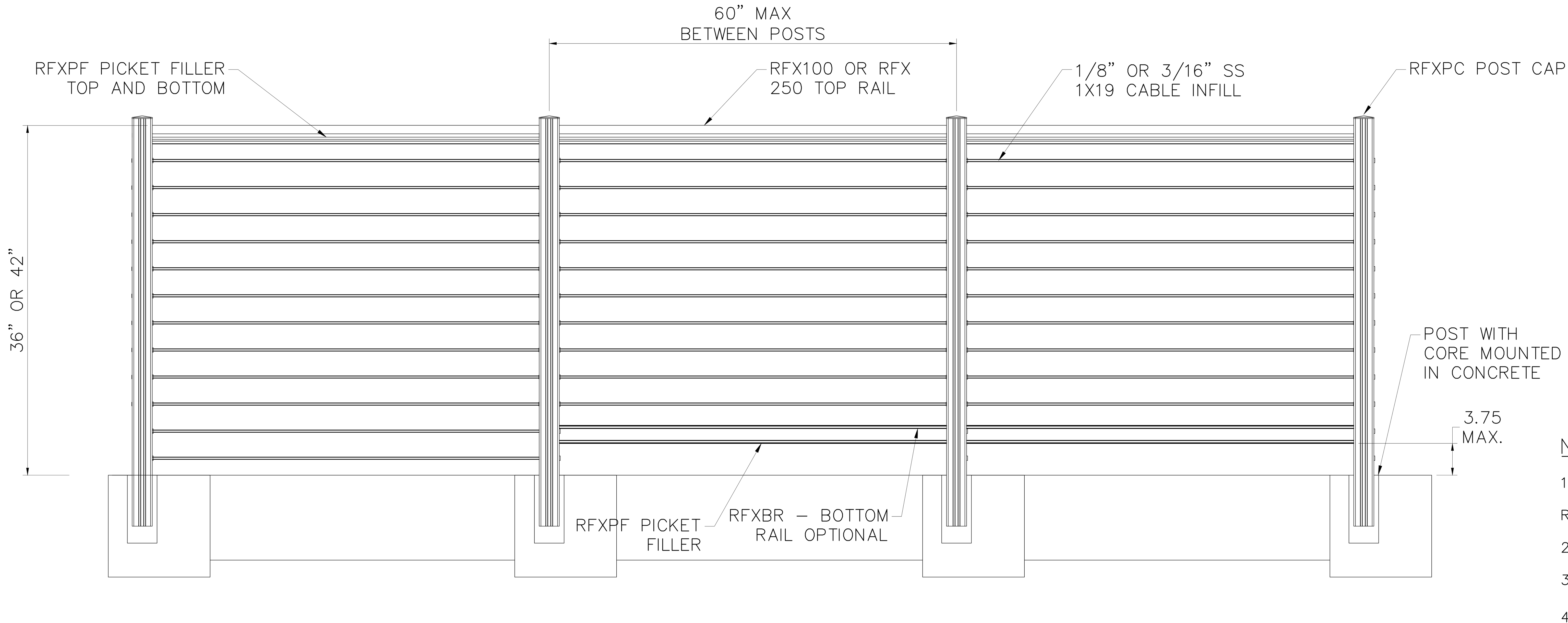
RFX 100 / RFX250 W/STAINLESS STEEL CABLE INFILL FLUSH FASCIA MOUNT

NATIONWIDE INDUSTRIES - 50 STATES

DATE: 07.02.2021
SCALE: AS SHOWN
DESIGN BY: SK
DRAWN BY: SK
REVIEWED BY:SP
190417

S11.0

PAGE 13 of 14

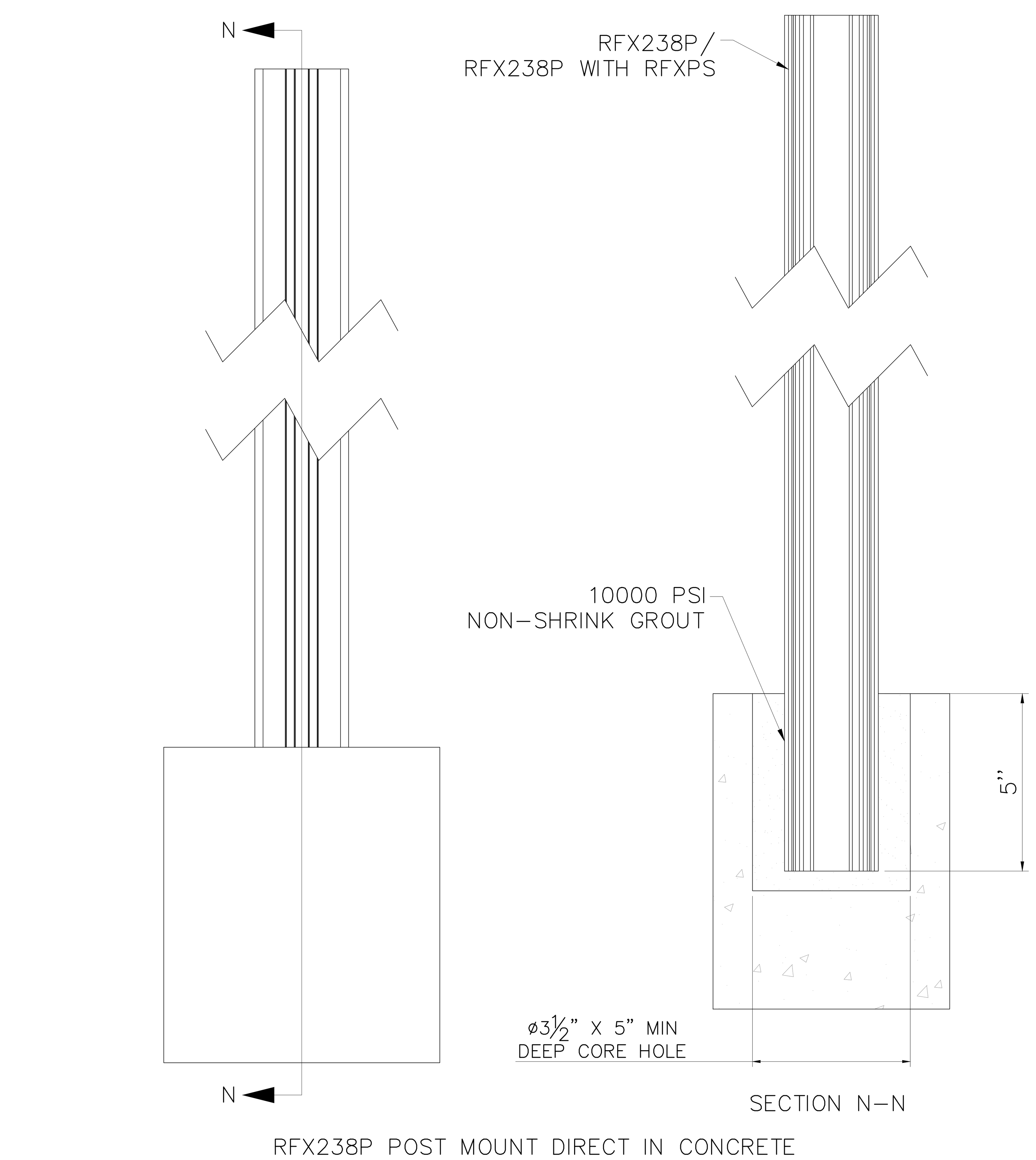


1 RFX 100 / RFX250 ALUMINUM RAIL W/STAINLESS STEEL CABLE INFILL CORE MOUNT

Scale: 1-1/2" : 1'-0"

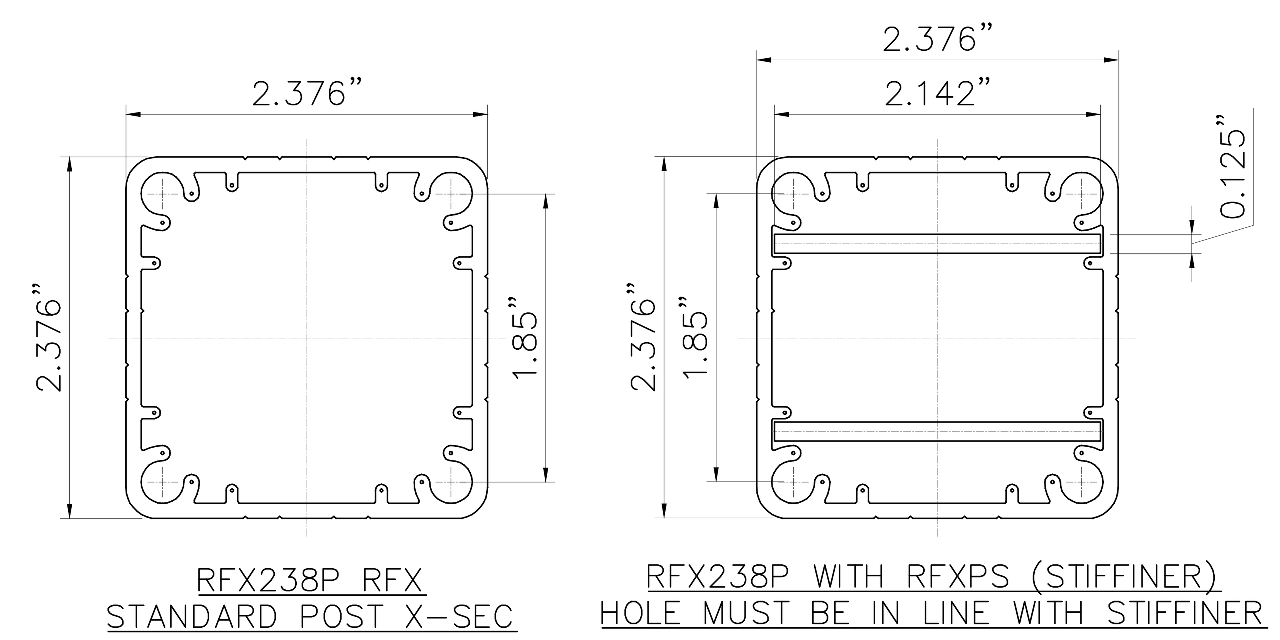
NOTES:

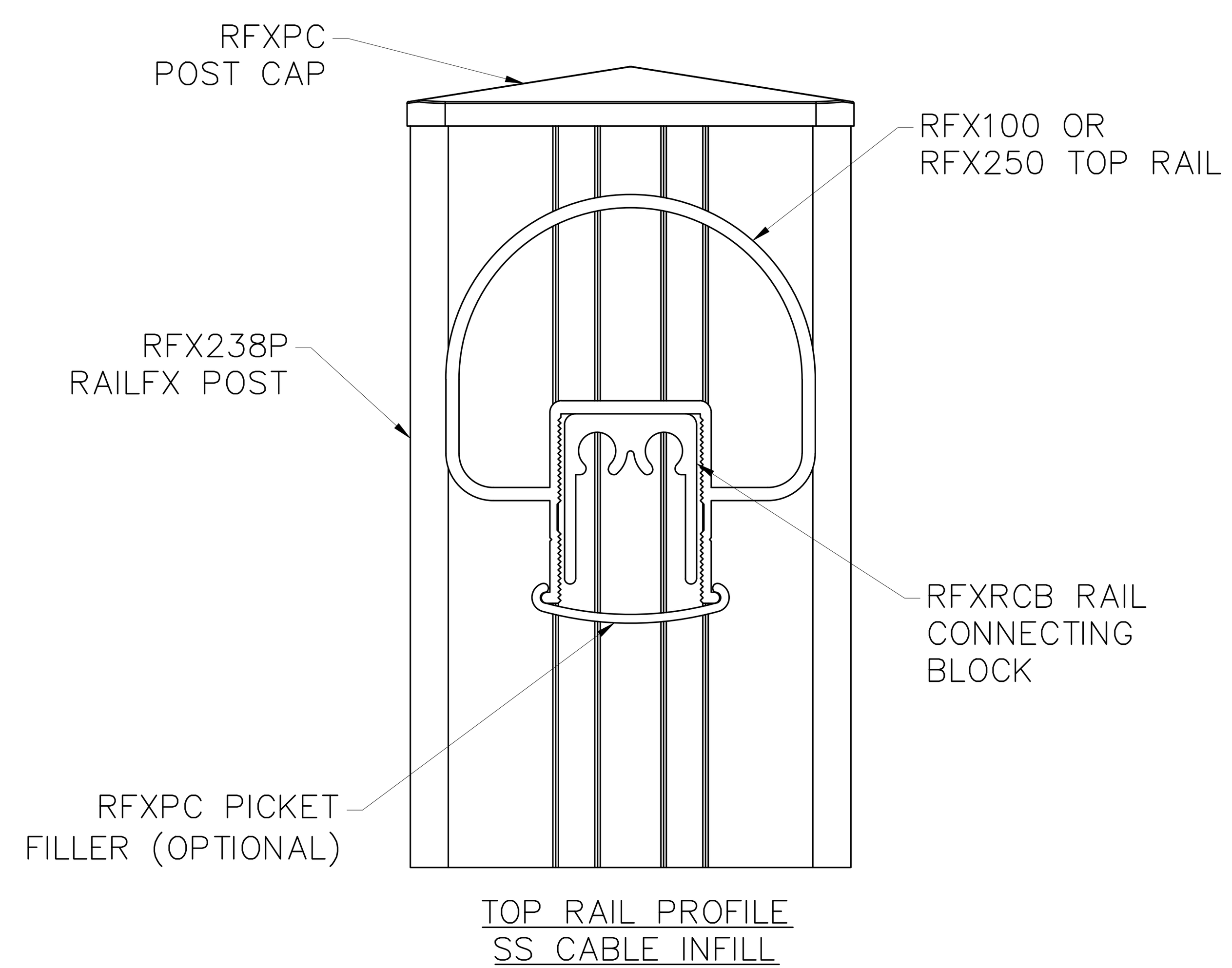
1. DESIGN CAPACITY CHECK OF EXISTING STRUCTURE THAT SUPPORTS THE RAILING IS NOT IN ZENITH SCOPE OF WORK.
2. RAILING IS DESIGNED FOR MAX SPEED OF 110MPH.
3. CABLE IN-FILL & TOP RAIL DESIGN IS NOT IN ZENITH SCOPE OF WORK.
4. POST SPACING IS 5' O.C MAX. OR OTHER SPACING MAY APPLY.



A DETAIL A - POST CORE MOUNTING ATTACHMENT DETAIL

Scale: 5":1'-0"





D DETAIL D

Scale: 1'-0":1'-0"

ZENITH ENGINEERS, INC
22320 Foothill Blvd,
Suite 600 Hayward, CA 94541
www.zenithenginers.com

REV: R1 (10.25.21)
REV: R2 (01.07.22)

REGISTERED PROFESSIONAL ENGINEER SENTHIL PULIYADI C71630 Exp. 12/31/21 CIVIL STATE OF CALIFORNIA

RFX 100 / RFX250 W/STAINLESS STEEL CABLE INFILL
POST CORE MOUNT

NATIONWIDE INDUSTRIES - 50 STATES

DATE: 07.02.2021
SCALE: AS SHOWN
DESIGN BY: SK
DRAWN BY: SK
REVIEWED BY:SP
190417

S12.0

190417 - RailFX Railing System Report

1. POST DESIGN CHECK (WITHOUT STIFFENER)

$L_{outterlength\_post} := 2.376\ in$

$L_{innerlength\_post} := 1.895\ in$

$t_{post} := \frac{L_{outterlength\_post} - L_{innerlength\_post}}{2} = 0.241\ in$

$H_{post\_length} := 42\ in = 3.5\ ft$

$P_{live\_load} := 200\ lbf$

$M_{overturning\_post} := H_{post\_length} \cdot P_{live\_load} = 8.4\ kip \cdot in$

$I_{post} := 0.9341\ in^4$ From AutoCAD

$y_c := 1.1877\ in$ From AutoCAD

$S_{post} := \frac{I_{post}}{y_c} = 0.786\ in^3$

$\sigma_{bendingpost} := \frac{M_{overturning\_post}}{S_{post}} = 10.681\ ksi$

$L_b := H_{post\_length} = 42\ in$

$S_c := S_{post} = 0.786\ in^3$

$J := 0.9335\ in^4$

$C_b := 1.0$ From AutoCAD

$I_y := I_{post} = 0.934\ in^4$

$S := \frac{2 \cdot L_b \cdot S_c}{C_b \cdot \sqrt{I_y \cdot J}} = 70.748$

$S1 := 95$ $S < S_1$ (Aluminum Design Manual Table 2-20 6063 T5)

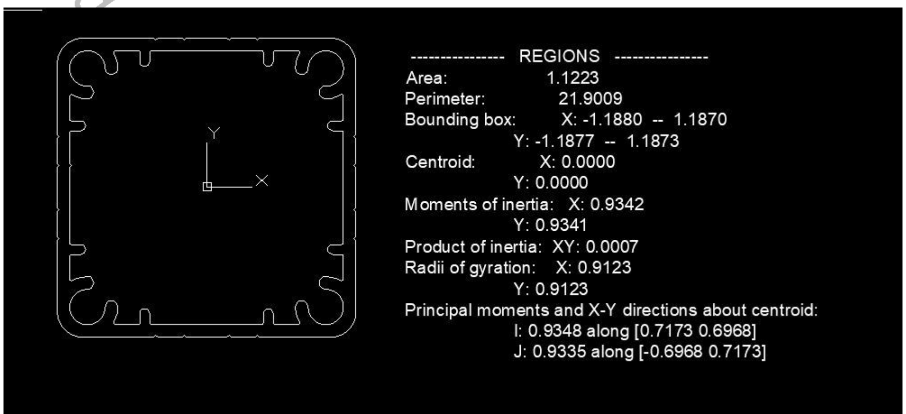
$17.5 - 0.917 \cdot \sqrt{S} = 9.787$ Aluminum Design Manual Table 2-20

$\sigma_{bending\_aluminumallowable} := \left(17.5 - 0.917 \cdot \sqrt{S}\right) \cdot 1\ ksi = 9.787\ ksi$

Created with PTC Mathcad Express. See www.mathcad.com for more information.

$$\frac{\sigma_{bendingpost}}{\sigma_{bending\_aluminumallowable}} = 1.091$$

Even though it is 9% overstressed it is okay by engineering judgment because this is conservative approach and load will be shared by other post due to frame action



CONNECTION OF POST TO RFXBP5X5 PLATE

Mounted on top of Concrete Slab/ Concrete Stair

$$d_{bolt\_dia} := \frac{5}{16}\ in$$

$$A_{root\_area} := 0.7 \cdot \left(\frac{\pi}{4} \cdot d_{bolt\_dia}{}^{2}\right) = 0.054\ in^{2}$$

$F_u := 60\ ksi$ $\quad F_{tension\_capacity} := 30\ ksi$ $\quad F_{shear\_capacity} := 10\ ksi$

$$V_{reaction} := P_{live\_load} = 200\ lbf$$

$$M_{overturning\_design} := M_{overturning\_post} = 8.4\ kip \cdot in$$

$$Tension_{perbolt\_total} := \frac{M_{overturning\_design}}{2 \cdot 3.7\ in} + \frac{P_{live\_load}}{4} = 1.185\ kip$$

$$\sigma_{tension\_demand} := \frac{Tension_{perbolt\_total}}{A_{root\_area}} = 22.074\ ksi$$

$$\tau_{shear\_demand} := \frac{V_{reaction}}{A_{root\_area}} = 3.725\ ksi$$

$$\frac{\sigma_{tension\_demand}}{0.9 \cdot F_{tension\_capacity}} = 0.818 \qquad \frac{\tau_{shear\_demand}}{0.9 \cdot F_{shear\_capacity}} = 0.414$$

Ok to use
5/16 screws

Created ... Express. See www.mathcad.com for more information.

Created with PTC Mathcad Express. See www.mathcad.com for more information.

CONCRETE ANCHOR CONNECTION

CASE 1: Mounted on top of Concrete Slab/ Concrete Stair

Base Plate Anchorage design for Concrete Connection

$V_{reaction} := P_{live\_load} = 200\ lbf$

$M_{overturning\_design} := M_{overturning\_post} = 8400\ lbf \cdot in$

See attached HILTI calcs for anchorage design assuming minimum concrete thickness of 6 inches. It is okay to use HIT-HY 200 + HIT-Z 3/8 anchors with minimum embedment depth of 2.75 in and minimum edge distance of 5".

CASE 2: Flush Fascia Mounted

$l_{anchrage\_leverarm} := 4.5\ in$

CASE 2a- For 200 lbf load perpendicular to the fascia

$T_{tension\_pure} := P_{live\_load} = 200\ lbf$

$M_{moment} := M_{overturning\_post} = 8400\ lbf \cdot in$ Additional tension due to overturning moment

CASE 2a- For 200 lbf load vertically down

$V_{shear\_pure} := P_{live\_load} = 200\ lbf$ Case 2a governs

Flush fascia mounted will govern the anchorage design as it has single rows of bolts, same design is applicable for offset fascia mounted.

Note: Same design is applicable for offset fascia mounted connection to concrete

CASE 3: Core Mounted in concrete

$S_1 := 4000\ psi = 576000\ psf$ $P := P_{live\_load} = 200\ lbf$ $h := H_{post\_length} = 3.5\ ft$ $b := 8\ in$

$$A := \frac{2.34 \cdot P}{S_1 \cdot b} = 0.001\ ft \qquad d := 0.5 \cdot A \cdot \left(1 + \left(1 + \frac{4.36 \cdot h}{A}\right)^{\frac{1}{2}}\right) = 0.826\ in$$

Required is 0.826in whereas provided is 5" hence okay

Created with PTC Mathcad Express. See www.mathcad.com for more information.

WOOD ANCHOR CONNECTION

CASE 1: Mounted on top of Wood Member

Base Plate Anchorage design for Wood Connection
Reactions

$P_{live} := \max(200\ lbf, 50\ plf \cdot 5\ ft) = 250\ lbf$ $\quad Lever_{arm} := 42\ in$ (Tube height is only 42 inches)

$M_{overturning\_design} := P_{live} \cdot Lever_{arm} = 10.5\ kip \cdot in$

$Min_{anchor\_spacing} := 3.717\ in$ (Minimum spacing between lag screws)

$$T_{reaction} := \frac{M_{overturning\_design}}{2 \cdot Min_{anchor\_spacing}} = 1.412\ kip$$ (Tension on two lag screws bolts)

$Tension_{perbolt} := T_{reaction} = 1412.429\ lbf$ (Conservatively assuming only one lag screw will take tension)

Dry Enviroment - Wood Shall be Douglas-Fir or Better:

$C_D := 1.6 \qquad C_m := 1.0 \qquad C_t := 1.0$

$W_{3\_8\_screw} := 305\ \dfrac{lbf}{in}$ 3/8" Lag Screw Withdrawal Value

$W'_{3\_8\_screw} := C_D \cdot C_m \cdot C_t \cdot W_{3\_8\_screw} = 488\ \dfrac{lbf}{in}$

$Tension_{capacity1} := 4\ in \cdot W'_{3\_8\_screw} = 1.952\ kip$ (Tension Capacity 4 inch embedment into wood member, For One 3/8" Diameter lag screw)

$$DCR := \frac{Tension_{perbolt}}{Tension_{capacity1}} = 0.724$$ (Less than 1, therefore Okay in Tension)

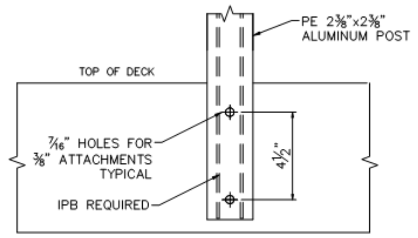
Check for Shear:

$Shear_{capacity} := 130\ lbf$ (Minimum capacity of single shear 3/8" lag bolt per Table 12-K for Wood members of Specific gravity of 0.50)

$$Shear_{demand\_perbolt} := \frac{V_{reaction}}{4} = 50\ lbf$$

$$DCR := \frac{Shear_{demand\_perbolt}}{Shear_{capacity}} = 0.385$$ (Less than 1, therefore Okay in Shear)

CASE 2: Flush Fascia Mounted on Wood Member Reactions



$P_{live} := \max\left(200\ lbf, 50\ plf \cdot 5\ ft\right) = 250\ lbf$

$M_{overturning} := 250\ lbf \cdot 42\ in = 10.5\ kip \cdot in$

Dry Enviroment - Wood Shall be Douglas-Fir or Better:

$C_D := 1.6$ $\qquad C_m := 1.0$ $\qquad C_t := 1.0$

$W_{3\_8\_screw} := 305\ \dfrac{lbf}{in}$ 3/8" Lag Screw Withdrawal Value

$W'_{3\_8\_screw} := C_D \cdot C_m \cdot C_t \cdot W_{3\_8\_screw} = 488\ \dfrac{lbf}{in}$

$L_{lever\_arm\_upper\_lag} := 4.5\ in + 1.5\ in = 6\ in$

$L_{lever\_arm\_lower\_lag} := 1.5\ in$

$T_{3\_8\_screw} := W'_{3\_8\_screw} \cdot 5\ in = 2440\ lbf$ Try 5" Embedment

$$M_{resist} := L_{lever\_arm\_upper\_lag} \cdot T_{3\_8\_screw} + L_{lever\_arm\_lower\_lag} \cdot \frac{L_{lever\_arm\_lower\_lag}}{L_{lever\_arm\_upper\_lag}} \cdot T_{3\_8\_screw} = 15555\ lbf \cdot in$$

$\dfrac{M_{overturning}}{M_{resist}} = 0.675$ (5" Embedment, Okay)

Wet Enviroment - Wood Shall be Douglas-Fir or Better:

$C_D := 1.6$ $\qquad C_m := 0.7$ $\qquad C_t := 1.0$

$W_{3\_8\_screw} := 305\ \dfrac{lbf}{in}$ 3/8" Lag Screw Withdrawal Value

$W'_{3\_8\_screw} := C_D \cdot C_m \cdot C_t \cdot W_{3\_8\_screw} = 341.6\ \dfrac{lbf}{in}$

$L_{lever\_arm\_upper\_lag} := 4.5\ in + 1.5\ in = 6\ in$

$L_{lever\_arm\_lower\_lag} := 1.5\ in$

$T_{3\_8\_screw} := W'_{3\_8\_screw} \cdot 5\ in = 1708\ lbf$ Try 5" Embedment

$$M_{resist} := L_{lever\_arm\_upper\_lag} \cdot T_{3\_8\_screw} + L_{lever\_arm\_lower\_lag} \cdot \frac{L_{lever\_arm\_lower\_lag}}{L_{lever\_arm\_upper\_lag}} \cdot T_{3\_8\_screw} = 10888.5\ lbf \cdot in$$

Created with PTC Mathcad Express. See www.mathcad.com for more information.

Created with PTC Mathcad Express. See www.mathcad.com for more information.

$\frac{M_{overturning}}{M_{resist}} = 0.964$ (5" Embedment, Okay)

Check for Shear:

$Shear_{capacity} := 130\ lbf$ (Minimum capacity of single shear 3/8" lag bolt per Table 12-K for Wood members of Specific gravity of 0.50)

$Shear_{demand\_perbolt} := \frac{V_{reaction}}{2} = 0.1\ kip$

$DCR := \frac{Shear_{demand\_perbolt}}{Shear_{capacity}} = 0.769$ (Less than 1, therefore Okay in Shear)

CASE 3: Offset Fascia Mounted on Wood Member Reactions

$P_{live} := \max(200\ lbf, 50\ plf \cdot 5\ ft) = 250\ lbf$

$M_{overturning\_design} := P_{live} \cdot (Lever_{arm} + 3\ in) = 11250\ lbf \cdot in$

Additional 3in for fascia mounted

$Tension_{perbolt\_total} := \frac{M_{overturning\_design}}{2 \cdot 4\ in} + \frac{P_{live}}{4} = 1468.75\ lbf$

Dry Enviroment - Wood Shall be Douglas-Fir or Better:

$C_D := 1.6$ $C_m := 1.0$ $C_t := 1.0$

$W_{3\_8\_screw} := 305\ \frac{lbf}{in}$ 3/8" Lag Screw Withdrawal Value

$W'_{3\_8\_screw} := C_D \cdot C_m \cdot C_t \cdot W_{3\_8\_screw} = 488\ \frac{lbf}{in}$

$Tension_{capacity} := 4\ in \cdot W'_{3\_8\_screw} = 1.952\ kip$ (Tension Capacity 4 inch embedment into wood member, For One 3/8" Diameter lag screw)

$DCR := \frac{Tension_{perbolt\_total}}{Tension_{capacity}} = 0.752$ (Less than 1, therefore Okay in Tension)

Created with PTC Mathcad Express. See www.mathcad.com for more information.

Check for Shear:

$Shear_{capacity} := 130\ lbf$

(Minimum capacity of single shear 3/8" lag bolt per Table 12-K for Wood members of Specific gravity of 0.50)

$Shear_{demand\_perbolt} := \frac{V_{reaction}}{4} = 50\ lbf$

$DCR := \frac{Shear_{demand\_perbolt}}{Shear_{capacity}} = 0.385$

(Less than 1, therefore Okay in Shear)

Created with PTC Mathcad Express. See www.mathcad.com for more information.

POST (WITH STIFFENER) DESIGN CHECK

$L_{outterlength\_post} := 2.376\ in$

$L_{innerlength\_post} := 1.9\ in$

$t_{post} := \frac{L_{outterlength\_post} - L_{innerlength\_post}}{2} = 0.238\ in$

$H_{post\_length} := 42\ in = 3.5\ ft$

$P_{live\_load} := 200\ lbf$

$M_{overturning\_post} := H_{post\_length} \cdot P_{live\_load} = 8.4\ kip \cdot in$

$I_{post} := 1.1464\ in^4$ From AutoCAD

$y_c := 0.8304\ in$ From AutoCAD

$S_{post} := \frac{I_{post}}{y_c} = 1.381\ in^3$

$\sigma_{bendingpost} := \frac{M_{overturning\_post}}{S_{post}} = 6.085\ ksi$

$L_b := H_{post\_length} = 42\ in$

$S_c := S_{post} = 1.381\ in^3$

$J := 1.1509\ in^4$

$C_b := 1.0$

$I_y := I_{post} = 1.146\ in^4$

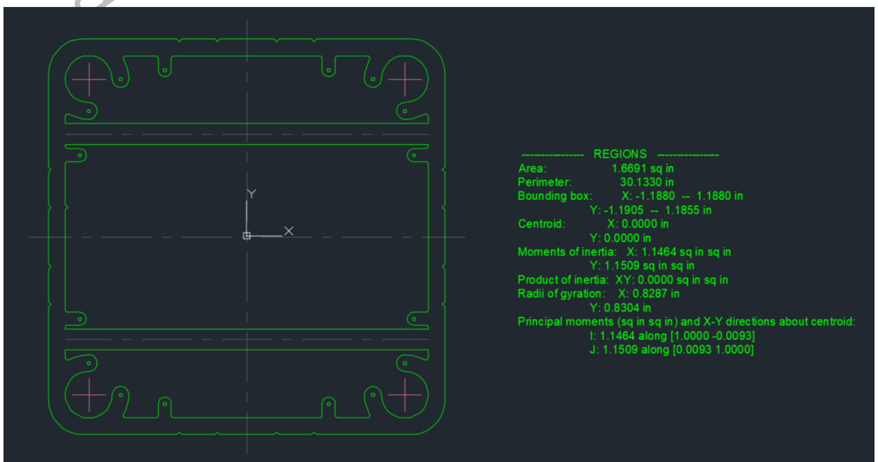
$S := \frac{2 \cdot L_b \cdot S_c}{C_b \cdot \sqrt{I_y \cdot J}} = 100.958$

$S1 := 95$ $S > S_1$ (Aluminum Design Manual Table 2-20 6063 T5)

$10.5 - 0.070 \cdot \sqrt{S} = 9.797$ Aluminum Design Manual Table 2-20

$$\sigma_{bending\_aluminumallowable} := \left(10.5 - 0.070 \cdot \sqrt{S}\right) \cdot 1\ ksi = 9.797\ ksi$$

$$\frac{\sigma_{bendingpost}}{\sigma_{bending\_aluminumallowable}} = 0.621$$



CONNECTION OF POST TO RFXBP5X5 PLATE

Mounted on top of Concrete Slab/ Concrete Stair

$$d_{bolt\_dia} := \frac{5}{16}\ in$$

$$A_{root\_area} := 0.7 \cdot \left(\frac{\pi}{4} \cdot d_{bolt\_dia}^{\ 2}\right) = 0.054\ in^2$$

$F_u := 60\ ksi$ $\quad F_{tension\_capacity} := 30\ ksi$ $\quad F_{shear\_capacity} := 10\ ksi$

$$V_{reaction} := P_{live\_load} = 200\ lbf$$

$$M_{overturning\_design} := M_{overturning\_post} = 8.4\ kip \cdot in$$

$$Tension_{perbolt\_total} := \frac{M_{overturning\_design}}{2 \cdot 3.7\ in} + \frac{P_{live\_load}}{4} = 1.185\ kip$$

$$\sigma_{tension\_demand} := \frac{Tension_{perbolt\_total}}{A_{root\_area}} = 22.074\ ksi$$

$$\tau_{shear\_demand} := \frac{V_{reaction}}{A_{root\_area}} = 3.725\ ksi$$

$$\frac{\sigma_{tension\_demand}}{0.9 \cdot F_{tension\_capacity}} = 0.818 \qquad \frac{\tau_{shear\_demand}}{0.9 \cdot F_{shear\_capacity}} = 0.414$$

Ok

Created ... press. See www.mathcad.com for more information.

CONCRETE ANCHOR CONNECTION

CASE 1: Mounted on top of Concrete Slab/ Concrete Stair

Base Plate Anchorage design for Concrete Connection

$V_{reaction} := P_{live\_load} = 200\ lbf$

$M_{overturning\_design} := M_{overturning\_post} = 8.4\ kip \cdot in$

See attached HILTI calcs for anchorage design assuming minimum concrete thickness of 6 inches. It is okay to use HIT-HY 200 + HIT-Z 3/8 anchors with minimum embedment depth of 2.75 in and minimum edge distance of 5".

CASE 2: Flush Fascia Mounted in concrete

Reactions

$T_{reaction} := P_{live\_load} = 200\ lbf$

$M_{overturning\_design} := M_{overturning\_post} = 8400\ lbf \cdot in$

CASE 2a- For 200 lbf load vertically down

$V_{shear\_pure} := P_{live\_load} = 200\ lbf$

Case 2a governs

Flush fascia mounted will govern the anchorage design as it has single rows of bolts, same design is applicable for offset fascia mounted.

See attached HILTI calcs for anchorage design assuming minimum concrete thickness of 6 inches. It is okay to use HIT-HY 200 + HIT-Z 3/8 anchors with minimum embedment depth of 2.75 in and minimum edge distance of 5".

Note: Same design is applicable for offset fascia mounted connection to concrete

CASE 3: Core Mounted in concrete

$S_1 := 4000\ psi = 576000\ psf$ $P := P_{live\_load} = 200\ lbf$ $h := H_{post\_length} = 3.5\ ft$ $b := 8\ in$

$$A := \frac{2.34 \cdot P}{S_1 \cdot b} = 0.001\ ft \qquad d := 0.5 \cdot A \cdot \left(1 + \left(1 + \frac{4.36 \cdot h}{A}\right)^{\frac{1}{2}}\right) = 0.826\ in$$

Required is 0.826in whereas provided is 5" hence okay

Created with PTC Mathcad Express. See www.mathcad.com for more information.

Created with PTC Mathcad Express. See www.mathcad.com for more information.

WOOD ANCHOR CONNECTION

CASE 1: Mounted on top of Wood Member

Base Plate Anchorage design for Wood Connection
Reactions

$P_{live} := \max(200\ lbf, 50\ plf \cdot 5\ ft) = 250\ lbf$ $\quad Lever_{arm} := 42\ in$ (Tube height is only 42 inches)

$M_{overturning\_design} := P_{live} \cdot Lever_{arm} = 10.5\ kip \cdot in$

$Min_{anchor\_spacing} := 3.717\ in$ (Minimum spacing between lag screws)

$T_{reaction} := \frac{M_{overturning\_design}}{2 \cdot Min_{anchor\_spacing}} = 1.412\ kip$ (Tension on two lag screws bolts)

$Tension_{perbolt} := T_{reaction} = 1412.429\ lbf$ (Conservatively assuming only one lag screw will take tension)

Dry Enviroment - Wood Shall be Douglas-Fir or Better:

$C_D := 1.6$ $\quad C_m := 1.0$ $\quad C_t := 1.0$

$W_{3\_8\_screw} := 305\ \frac{lbf}{in}$ 3/8" Lag Screw Withdrawal Value

$W'_{3\_8\_screw} := C_D \cdot C_m \cdot C_t \cdot W_{3\_8\_screw} = 488\ \frac{lbf}{in}$

$Tension_{capacity1} := 4\ in \cdot W'_{3\_8\_screw} = 1.952\ kip$ (Tension Capacity 4 inch embedment into wood member, For One 3/8" Diameter lag screw)

$DCR := \frac{Tension_{perbolt}}{Tension_{capacity1}} = 0.724$ (Less than 1, therefore Okay in Tension)

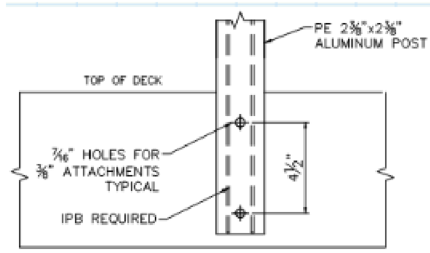
Check for Shear:

$Shear_{capacity} := 130\ lbf$ (Minimum capacity of single shear 3/8" lag bolt per Table 12-K for Wood members of Specific gravity of 0.50)

$Shear_{demand\_perbolt} := \frac{V_{reaction}}{4} = 50\ lbf$

$DCR := \frac{Shear_{demand\_perbolt}}{Shear_{capacity}} = 0.385$ (Less than 1, therefore Okay in Shear)

CASE 2: Flush Fascia Mounted on Wood Member Reactions



$P_{live} := \max(200\ lbf, 50\ plf \cdot 5\ ft) = 250\ lbf$

$M_{overturning} := 250\ lbf \cdot 42\ in = 10.5\ kip \cdot in$

Dry Enviroment - Wood Shall be Douglas-Fir or Better:

$C_D := 1.6 \qquad C_m := 1.0 \qquad C_t := 1.0$

$W_{3\_8\_screw} := 305\ \frac{lbf}{in}$ 3/8" Lag Screw Withdrawal Value

$W'_{3\_8\_screw} := C_D \cdot C_m \cdot C_t \cdot W_{3\_8\_screw} = 488\ \frac{lbf}{in}$

$L_{lever\_arm\_upper\_lag} := 4.5\ in + 1.5\ in = 6\ in$

$L_{lever\_arm\_lower\_lag} := 1.5\ in$

$T_{3\_8\_screw} := W'_{3\_8\_screw} \cdot 5\ in = 2440\ lbf$ Try 5" Embedment

$$M_{resist} := L_{lever\_arm\_upper\_lag} \cdot T_{3\_8\_screw} + L_{lever\_arm\_lower\_lag} \cdot \frac{L_{lever\_arm\_lower\_lag}}{L_{lever\_arm\_upper\_lag}} \cdot T_{3\_8\_screw} = 15555\ lbf \cdot in$$

$\frac{M_{overturning}}{M_{resist}} = 0.675$ (5" Embedment, Okay)

Wet Enviroment - Wood Shall be Douglas-Fir or Better:

$C_D := 1.6 \qquad C_m := 0.7 \qquad C_t := 1.0$

$W_{3\_8\_screw} := 305\ \frac{lbf}{in}$ 3/8" Lag Screw Withdrawal Value

$W'_{3\_8\_screw} := C_D \cdot C_m \cdot C_t \cdot W_{3\_8\_screw} = 341.6\ \frac{lbf}{in}$

$L_{lever\_arm\_upper\_lag} := 4.5\ in + 1.5\ in = 6\ in$

$L_{lever\_arm\_lower\_lag} := 1.5\ in$

$T_{3\_8\_screw} := W'_{3\_8\_screw} \cdot 5\ in = 1708\ lbf$ Try 5" Embedment

$$M_{resist} := L_{lever\_arm\_upper\_lag} \cdot T_{3\_8\_screw} + L_{lever\_arm\_lower\_lag} \cdot \frac{L_{lever\_arm\_lower\_lag}}{L_{lever\_arm\_upper\_lag}} \cdot T_{3\_8\_screw} = 10888.5\ lbf \cdot in$$

Created with PTC Mathcad Express. See www.mathcad.com for more information.

$$\frac{M_{overturning}}{M_{resist}} = 0.964$$ (5" Embedment, Okay)

Created with PTC Mathcad Express. See www.mathcad.com for more information.

Check for Shear:

$Shear_{capacity} := 130\ lbf$ (Minimum capacity of single shear 3/8" lag bolt per Table 12-K for Wood members of Specific gravity of 0.50)

$$Shear_{demand\_perbolt} := \frac{V_{reaction}}{2} = 0.1\ kip$$

$$DCR := \frac{Shear_{demand\_perbolt}}{Shear_{capacity}} = 0.769$$ (Less than 1, therefore Okay in Shear)

CASE 3: Offset Fascia Mounted on Wood Member Reactions

$P_{live} := \max(200\ lbf, 50\ plf \cdot 5\ ft) = 250\ lbf$

$M_{overturning\_design} := P_{live} \cdot (Lever_{arm} + 3\ in) = 11250\ lbf \cdot in$

Additional 3in for fascia mounted

$$Tension_{perbolt\_total} := \frac{M_{overturning\_design}}{2 \cdot 4\ in} + \frac{P_{live}}{4} = 1468.75\ lbf$$

Dry Enviroment - Wood Shall be Douglas-Fir or Better:

$C_D := 1.6$ $C_m := 1.0$ $C_t := 1.0$

$W_{3\_8\_screw} := 305\ \frac{lbf}{in}$ 3/8" Lag Screw Withdrawal Value

$W'_{3\_8\_screw} := C_D \cdot C_m \cdot C_t \cdot W_{3\_8\_screw} = 488\ \frac{lbf}{in}$

$Tension_{capacity} := 4\ in \cdot W'_{3\_8\_screw} = 1.952\ kip$ (Tension Capacity 4 inch embedment into wood member, For One 3/8" Diameter lag screw)

$$DCR := \frac{Tension_{perbolt\_total}}{Tension_{capacity}} = 0.752$$ (Less than 1, therefore Okay in Tension)

Check for Shear:

$Shear_{capacity} := 130\ lbf$ (Minimum capacity of single shear 3/8" lag bolt per Table 12-K for Wood members of Specific gravity of 0.50)

$$Shear_{demand\_perbolt} := \frac{V_{reaction}}{4} = 50\ lbf$$

$$DCR := \frac{Shear_{demand\_perbolt}}{Shear_{capacity}} = 0.385$$

(Less than 1, therefore Okay in Shear)

Created with PTC Mathcad Express. See www.mathcad.com for more information.

Hilti PROFIS Engineering 3.0.72

www.hilti.com

Company:		Page:	1
Address:		Specifier:	
Phone I Fax:	|	E-Mail:	
Design:	Concrete - Aug 20, 2021	Date:	8/24/2021
Fastening point:			

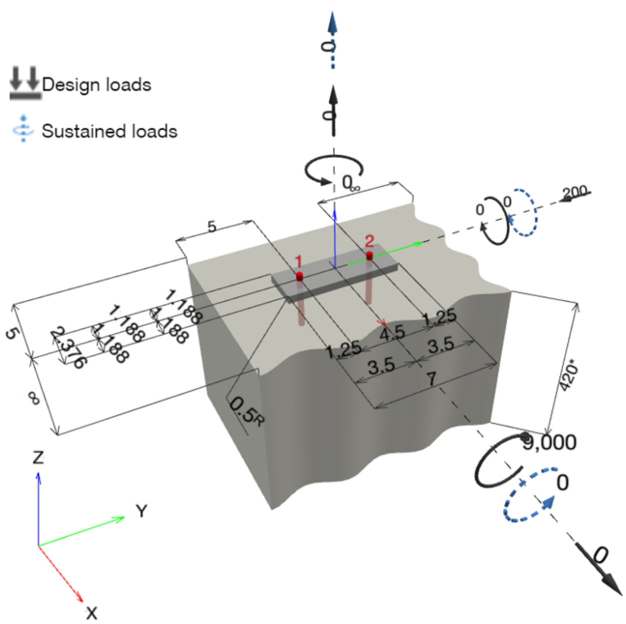
Specifier's comments:

1 Input data

Anchor type and diameter:	**HIT-HY 200 + HIT-Z 3/8**
Item number:	2018440 HIT-Z 3/8" x 4 3/8" (element) / 2022793 HIT-HY 200-R (adhesive)
Effective embedment depth:	$h_{ef,act}$ = 2.750 in. ($h_{ef,limit}$ = - in.)
Material:	DIN EN ISO 4042
Evaluation Service Report:	ESR-3187
Issued I Valid:	5/1/2021 | 3/1/2022
Proof:	Design Method ACI 318-14 / Chem
Stand-off installation:	e_b = 0.000 in. (no stand-off); t = 0.500 in.
Anchor plate^R :	l_x x l_y x t = 2.376 in. x 7.000 in. x 0.500 in.; (Recommended plate thickness: not calculated)
Profile:	no profile
Base material:	cracked concrete, 3000, f_c' = 3,000 psi; h = 420.000 in., Temp. short/long: 32/32 °F
Installation:	**hammer drilled hole, Installation condition: Dry**
Reinforcement:	tension: condition B, shear: condition B; no supplemental splitting reinforcement present
	edge reinforcement: none or < No. 4 bar

R - The anchor calculation is based on a rigid anchor plate assumption.

Geometry [in.] & Loading [lb, in.lb]



PROFIS Engineering (c) 2003-2021 Hilti AG, FL-9494 Schaan Hilti is a registered Trademark of Hilti AG, Schaan

Hilti PROFIS Engineering 3.0.72

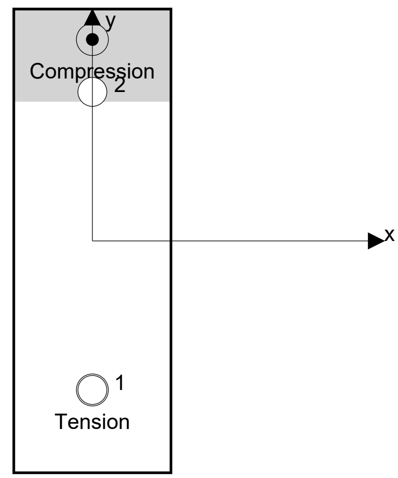
www.hilti.com

Company:		Page:	2
Address:		Specifier:	
Phone I Fax:	|	E-Mail:	
Design:	Concrete - Aug 20, 2021	Date:	8/24/2021
Fastening point:			

1.1 Design results

Case	Description	Forces [lb] / Moments [in.lb]	Seismic	Max. Util. Anchor [%]
1	Combination 1	$N = 0$; $V_x = 0$; $V_y = -200$; $M_x = -9{,}000$; $M_y = 0$; $M_z = 0$; $N_{sus} = 0$; $M_{x,sus} = 0$; $M_{y,sus} = 0$;	no	62

2 Load case/Resulting anchor forces



Anchor reactions [lb]

Tension force: (+Tension, -Compression)

Anchor	Tension force	Shear force	Shear force x	Shear force y
1	1,701	100	0	-100
2	0	100	0	-100

max. concrete compressive strain: 0.24 [‰]
max. concrete compressive stress: 1,039 [psi]
resulting tension force in (x/y)=(0.000/-2.250): 1,701 [lb]
resulting compression force in (x/y)=(0.000/3.040): 1,701 [lb]

Anchor forces are calculated based on the assumption of a rigid anchor plate.

3 Tension load

	Load N_{ua} [lb]	Capacity ϕ N_n [lb]	Utilization $\beta_N = N_{ua}/\phi$ N_n	Status
Steel Strength*	1,701	4,749	36	OK
Pullout Strength*	1,701	5,169	33	OK
Sustained Tension Load Bond Strength*	N/A	N/A	N/A	N/A
Concrete Breakout Failure**	1,701	2,760	62	OK

* highest loaded anchor **anchor group (anchors in tension)

PROFIS Engineering (c) 2003-2021 Hilti AG, FL-9494 Schaan Hilti is a registered Trademark of Hilti AG, Schaan

Hilti PROFIS Engineering 3.0.72

www.hilti.com

Company:		Page:	3
Address:		Specifier:	
Phone I Fax:	|	E-Mail:	
Design:	Concrete - Aug 20, 2021	Date:	8/24/2021
Fastening point:			

3.1 Steel Strength

N_{sa} = ESR value refer to ICC-ES ESR-3187

$\phi\ N_{sa} \geq N_{ua}$ ACI 318-14 Table 17.3.1.1

Variables

$A_{se,N}$ [in.^{2}]	f_{uta} [psi]
0.08	94,200

Calculations

N_{sa} [lb]
7,306

Results

N_{sa} [lb]	ϕ_{steel}	$\phi\ N_{sa}$ [lb]	N_{ua} [lb]
7,306	0.650	4,749	1,701

3.2 Pullout Strength

N_{pn} = $N_p\ \lambda_a$ refer to ICC-ES ESR-3187

$\phi\ N_{pn} \geq N_{ua}$ ACI 318-14 Table 17.3.1.1

Variables

λ_a	N_p [lb]
1.000	7,952

Calculations

N_{pn} [lb]
7,952

Results

N_{pn} [lb]	$\phi_{concrete}$	$\phi\ N_{pn}$ [lb]	N_{ua} [lb]
7,952	0.650	5,169	1,701

Input data and results must be checked for conformity with the existing conditions and for plausibility!
PROFIS Engineering (c) 2003-2021 Hilti AG, FL-9494 Schaan Hilti is a registered Trademark of Hilti AG, Schaan

Hilti PROFIS Engineering 3.0.72

www.hilti.com

Company:		Page:	4
Address:		Specifier:	
Phone I Fax:	|	E-Mail:	
Design:	Concrete - Aug 20, 2021	Date:	8/24/2021
Fastening point:			

3.3 Concrete Breakout Failure

$N_{cbg} = \left(\frac{A_{Nc}}{A_{Nc0}}\right) \psi_{ec,N}\ \psi_{ed,N}\ \psi_{c,N}\ \psi_{cp,N}\ N_b$ — ACI 318-14 Eq. (17.4.2.1b)

$\phi\ N_{cbg} \geq N_{ua}$ — ACI 318-14 Table 17.3.1.1

A_{Nc} see ACI 318-14, Section 17.4.2.1, Fig. R 17.4.2.1(b)

$A_{Nc0} = 9\ h_{ef}^2$ — ACI 318-14 Eq. (17.4.2.1c)

$\psi_{ec,N} = \left(\frac{1}{1 + \frac{2\ e_N'}{3\ h_{ef}}}\right) \leq 1.0$ — ACI 318-14 Eq. (17.4.2.4)

$\psi_{ed,N} = 0.7 + 0.3\left(\frac{c_{a,min}}{1.5h_{ef}}\right) \leq 1.0$ — ACI 318-14 Eq. (17.4.2.5b)

$\psi_{cp,N} = \text{MAX}\left(\frac{c_{a,min}}{c_{ac}}, \frac{1.5h_{ef}}{c_{ac}}\right) \leq 1.0$ — ACI 318-14 Eq. (17.4.2.7b)

$N_b = k_c\ \lambda_a\ \sqrt{f_c'}\ h_{ef}^{1.5}$ — ACI 318-14 Eq. (17.4.2.2a)

Variables

h_{ef} [in.]	$e_{c1,N}$ [in.]	$e_{c2,N}$ [in.]	$c_{a,min}$ [in.]	$\psi_{c,N}$
2.750	0.000	0.000	5.000	1.000

c_{ac} [in.]	k_c	λ_a	f_c' [psi]
4.125	17	1.000	3,000

Calculations

A_{Nc} [in.^{2}]	A_{Nc0} [in.^{2}]	$\psi_{ec1,N}$	$\psi_{ec2,N}$	$\psi_{ed,N}$	$\psi_{cp,N}$	N_b [lb]
68.06	68.06	1.000	1.000	1.000	1.000	4,246

Results

N_{cbg} [lb]	$\phi_{concrete}$	$\phi\ N_{cbg}$ [lb]	N_{ua} [lb]
4,246	0.650	2,760	1,701

Input data and results must be checked for conformity with the existing conditions and for plausibility!
PROFIS Engineering (c) 2003-2021 Hilti AG, FL-9494 Schaan Hilti is a registered Trademark of Hilti AG, Schaan

Hilti PROFIS Engineering 3.0.72

www.hilti.com

Company:		Page:	5
Address:		Specifier:	
Phone I Fax:	|	E-Mail:	
Design:	Concrete - Aug 20, 2021	Date:	8/24/2021
Fastening point:			

4 Shear load

	Load V_{ua} [lb]	Capacity ϕ V_n [lb]	Utilization $\beta_V = V_{ua}/\phi$ V_n	Status
Steel Strength*	100	1,929	6	OK
Steel failure (with lever arm)*	N/A	N/A	N/A	N/A
Pryout Strength (Concrete Breakout Strength controls)**	200	9,187	3	OK
Concrete edge failure in direction y-**	200	2,053	10	OK

* highest loaded anchor **anchor group (relevant anchors)

4.1 Steel Strength

V_{sa} = ESR value refer to ICC-ES ESR-3187

$\phi\ V_{steel} \geq V_{ua}$ ACI 318-14 Table 17.3.1.1

Variables

$A_{se,V}$ [in.^{2}]	f_{uta} [psi]
0.08	94,200

Calculations

V_{sa} [lb]
3,215

Results

V_{sa} [lb]	ϕ_{steel}	$\phi\ V_{sa}$ [lb]	V_{ua} [lb]
3,215	0.600	1,929	100

Input data and results must be checked for conformity with the existing conditions and for plausibility!
PROFIS Engineering (c) 2003-2021 Hilti AG, FL-9494 Schaan Hilti is a registered Trademark of Hilti AG, Schaan

Hilti PROFIS Engineering 3.0.72

www.hilti.com

Company:		Page:	6
Address:		Specifier:	
Phone I Fax:	|	E-Mail:	
Design:	Concrete - Aug 20, 2021	Date:	8/24/2021
Fastening point:			

4.2 Pryout Strength (Concrete Breakout Strength controls)

$V_{cpg} = k_{cp} \left[\left(\frac{A_{Nc}}{A_{Nc0}} \right) \psi_{ec,N} \; \psi_{ed,N} \; \psi_{c,N} \; \psi_{cp,N} \; N_b \right]$	ACI 318-14 Eq. (17.5.3.1b)
$\phi \; V_{cpg} \geq V_{ua}$	ACI 318-14 Table 17.3.1.1
A_{Nc} see ACI 318-14, Section 17.4.2.1, Fig. R 17.4.2.1(b)	
$A_{Nc0} = 9 \; h_{ef}^2$	ACI 318-14 Eq. (17.4.2.1c)
$\psi_{ec,N} = \left(\frac{1}{1 + \frac{2 \; e'_N}{3 \; h_{ef}}} \right) \leq 1.0$	ACI 318-14 Eq. (17.4.2.4)
$\psi_{ed,N} = 0.7 + 0.3 \left(\frac{c_{a,min}}{1.5 h_{ef}} \right) \leq 1.0$	ACI 318-14 Eq. (17.4.2.5b)
$\psi_{cp,N} = \text{MAX} \left(\frac{c_{a,min}}{c_{ac}}, \frac{1.5 h_{ef}}{c_{ac}} \right) \leq 1.0$	ACI 318-14 Eq. (17.4.2.7b)
$N_b = k_c \; \lambda_a \; \sqrt{f'_c} \; h_{ef}^{1.5}$	ACI 318-14 Eq. (17.4.2.2a)

Variables

k_{cp}	h_{ef} [in.]	$e_{c1,N}$ [in.]	$e_{c2,N}$ [in.]	$c_{a,min}$ [in.]
2	2.750	0.000	0.000	5.000

$\psi_{c,N}$	c_{ac} [in.]	k_c	λ_a	f'_c [psi]
1.000	4.125	17	1.000	3,000

Calculations

A_{Nc} [in.^{2}]	A_{Nc0} [in.^{2}]	$\psi_{ec1,N}$	$\psi_{ec2,N}$	$\psi_{ed,N}$	$\psi_{cp,N}$	N_b [lb]
105.19	68.06	1.000	1.000	1.000	1.000	4,246

Results

V_{cpg} [lb]	$\phi_{concrete}$	$\phi \; V_{cpg}$ [lb]	V_{ua} [lb]
13,125	0.700	9,187	200

PROFIS Engineering (c) 2003-2021 Hilti AG, FL-9494 Schaan Hilti is a registered Trademark of Hilti AG, Schaan

Hilti PROFIS Engineering 3.0.72

www.hilti.com

Company:		Page:	7
Address:		Specifier:	
Phone I Fax:	|	E-Mail:	
Design:	Concrete - Aug 20, 2021	Date:	8/24/2021
Fastening point:			

4.3 Concrete edge failure in direction y-

$V_{cb} = \left(\frac{A_{Vc}}{A_{Vc0}}\right) \psi_{ed,V}\ \psi_{c,V}\ \psi_{h,V}\ \psi_{parallel,V}\ V_b$ ACI 318-14 Eq. (17.5.2.1a)

$\phi\ V_{cb} \geq V_{ua}$ ACI 318-14 Table 17.3.1.1

A_{Vc} see ACI 318-14, Section 17.5.2.1, Fig. R 17.5.2.1(b)

$A_{Vc0} = 4.5\ c_{a1}^2$ ACI 318-14 Eq. (17.5.2.1c)

$\psi_{ed,V} = 0.7 + 0.3\left(\frac{c_{a2}}{1.5c_{a1}}\right) \leq 1.0$ ACI 318-14 Eq. (17.5.2.6b)

$\psi_{h,V} = \sqrt{\frac{1.5c_{a1}}{h_a}} \geq 1.0$ ACI 318-14 Eq. (17.5.2.8)

$V_b = \left(7\left(\frac{l_e}{d_a}\right)^{0.2} \sqrt{d_a}\right) \lambda_a \sqrt{f'_c}\ c_{a1}^{1.5}$ ACI 318-14 Eq. (17.5.2.2a)

Variables

c_{a1} [in.]	c_{a2} [in.]	$\psi_{c,V}$	h_a [in.]	l_e [in.]
5.000	5.000	1.000	420.000	2.750

λ_a	d_a [in.]	f'_c [psi]	$\psi_{parallel,V}$
1.000	0.375	3,000	1.000

Calculations

A_{Vc} [in.^{2}]	A_{Vc0} [in.^{2}]	$\psi_{ed,V}$	$\psi_{h,V}$	V_b [lb]
93.75	112.50	0.900	1.000	3,910

Results

V_{cb} [lb]	$\phi_{concrete}$	$\phi\ V_{cb}$ [lb]	V_{ua} [lb]
2,933	0.700	2,053	200

5 Combined tension and shear loads

β_N	β_V	ζ	Utilization $\beta_{N,V}$ [%]	Status
0.616	0.097	5/3	47	OK

$\beta_{NV} = \beta_N^{\zeta} + \beta_V^{\zeta} <= 1$

Input data and results must be checked for conformity with the existing conditions and for plausibility!
PROFIS Engineering (c) 2003-2021 Hilti AG, FL-9494 Schaan Hilti is a registered Trademark of Hilti AG, Schaan

Hilti PROFIS Engineering 3.0.72

www.hilti.com

Company:		Page:	8
Address:		Specifier:	
Phone I Fax:	|	E-Mail:	
Design:	Concrete - Aug 20, 2021	Date:	8/24/2021
Fastening point:			

6 Warnings

- The anchor design methods in PROFIS Engineering require rigid anchor plates per current regulations (AS 5216:2018, ETAG 001/Annex C, EOTA TR029 etc.). This means load re-distribution on the anchors due to elastic deformations of the anchor plate are not considered - the anchor plate is assumed to be sufficiently stiff, in order not to be deformed when subjected to the design loading. PROFIS Engineering calculates the minimum required anchor plate thickness with CBFEM to limit the stress of the anchor plate based on the assumptions explained above. The proof if the rigid anchor plate assumption is valid is not carried out by PROFIS Engineering. Input data and results must be checked for agreement with the existing conditions and for plausibility!
- Condition A applies where the potential concrete failure surfaces are crossed by supplementary reinforcement proportioned to tie the potential concrete failure prism into the structural member. Condition B applies where such supplementary reinforcement is not provided, or where pullout or pryout strength governs.
- Design Strengths of adhesive anchor systems are influenced by the cleaning method. Refer to the INSTRUCTIONS FOR USE given in the Evaluation Service Report for cleaning and installation instructions.
- For additional information about ACI 318 strength design provisions, please go to https://submittals.us.hilti.com/PROFISAnchorDesignGuide/
- Installation of Hilti adhesive anchor systems shall be performed by personnel trained to install Hilti adhesive anchors. Reference ACI 318-14, Section 17.8.1.

Fastening meets the design criteria!

PROFIS Engineering (c) 2003-2021 Hilti AG, FL-9494 Schaan Hilti is a registered Trademark of Hilti AG, Schaan

Hilti PROFIS Engineering 3.0.72

www.hilti.com

Company:		Page:	9
Address:		Specifier:	
Phone I Fax:	|	E-Mail:	
Design:	Concrete - Aug 20, 2021	Date:	8/24/2021
Fastening point:			

7 Installation data

Profile: no profile

Hole diameter in the fixture (pre-setting) : d_f = 0.438 in.

Hole diameter in the fixture (through fastening) : d_f = 0.500 in.

Plate thickness (input): 0.500 in.

Recommended plate thickness: not calculated

Drilling method: Hammer drilled

Cleaning: Compressed air cleaning of the drilled hole according to instructions for use is required

Anchor type and diameter: HIT-HY 200 + HIT-Z 3/8

Item number: 2018440 HIT-Z 3/8" x 4 3/8" (element) / 2022793 HIT-HY 200-R (adhesive)

Maximum installation torque: 177 in.lb

Hole diameter in the base material: 0.438 in.

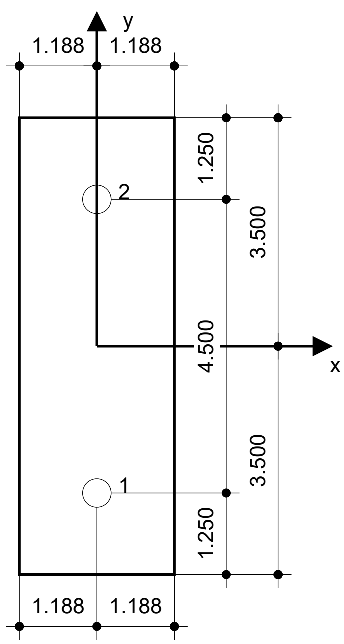
Hole depth in the base material: 2.750 in.

Minimum thickness of the base material: 5.000 in.

3/8 Hilti HIT-Z Carbon steel non-cleaning bonded expansion anchor with Hilti HIT-HY 200 Safe Set System

7.1 Recommended accessories

Drilling	Cleaning	Setting
• Suitable Rotary Hammer • Properly sized drill bit	• -	• Dispenser including cassette and mixer • Torque wrench



Coordinates Anchor [in.]

Anchor	x	y	c_{-x}	c_{+x}	c_{-y}	c_{+y}
1	0.000	-2.250	5.000	-	5.000	-
2	0.000	2.250	5.000	-	9.500	-

Input data and results must be checked for conformity with the existing conditions and for plausibility!
PROFIS Engineering (c) 2003-2021 Hilti AG, FL-9494 Schaan Hilti is a registered Trademark of Hilti AG, Schaan

Hilti PROFIS Engineering 3.0.72

www.hilti.com

Company:		Page:	10
Address:		Specifier:	
Phone I Fax:	|	E-Mail:	
Design:	Concrete - Aug 20, 2021	Date:	8/24/2021
Fastening point:			

8 Remarks; Your Cooperation Duties

- Any and all information and data contained in the Software concern solely the use of Hilti products and are based on the principles, formulas and security regulations in accordance with Hilti's technical directions and operating, mounting and assembly instructions, etc., that must be strictly complied with by the user. All figures contained therein are average figures, and therefore use-specific tests are to be conducted prior to using the relevant Hilti product. The results of the calculations carried out by means of the Software are based essentially on the data you put in. Therefore, you bear the sole responsibility for the absence of errors, the completeness and the relevance of the data to be put in by you. Moreover, you bear sole responsibility for having the results of the calculation checked and cleared by an expert, particularly with regard to compliance with applicable norms and permits, prior to using them for your specific facility. The Software serves only as an aid to interpret norms and permits without any guarantee as to the absence of errors, the correctness and the relevance of the results or suitability for a specific application.
- You must take all necessary and reasonable steps to prevent or limit damage caused by the Software. In particular, you must arrange for the regular backup of programs and data and, if applicable, carry out the updates of the Software offered by Hilti on a regular basis. If you do not use the AutoUpdate function of the Software, you must ensure that you are using the current and thus up-to-date version of the Software in each case by carrying out manual updates via the Hilti Website. Hilti will not be liable for consequences, such as the recovery of lost or damaged data or programs, arising from a culpable breach of duty by you.

PROFIS Engineering (c) 2003-2021 Hilti AG, FL-9494 Schaan Hilti is a registered Trademark of Hilti AG, Schaan

Hilti PROFIS Engineering 3.0.72

www.hilti.com

Company:		Page:	1
Address:		Specifier:	Agnimithra Murari
Phone I Fax:	|	E-Mail:	
Design:	Hilti Concrete Mounted with stiffner	Date:	8/24/2021
Fastening point:			

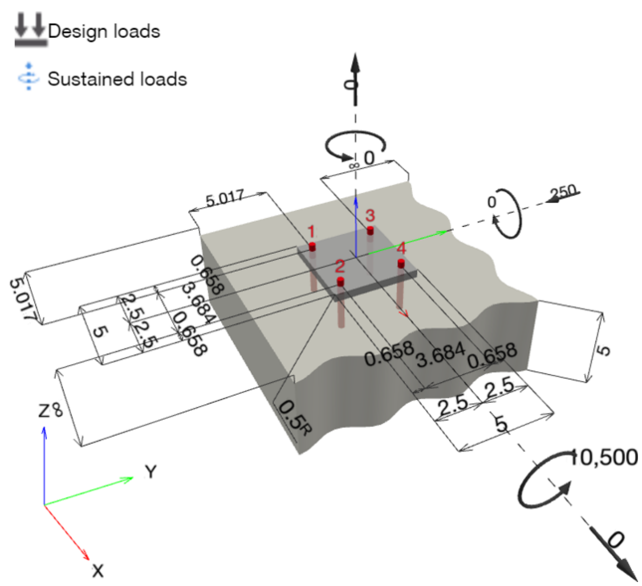
Specifier's comments:

1 Input data

Anchor type and diameter:	**HIT-HY 200 + HIT-Z 3/8**
Item number:	2018440 HIT-Z 3/8" x 4 3/8" (element) / 2022793 HIT-HY 200-R (adhesive)
Effective embedment depth:	$h_{ef,opti}$ = 2.375 in. ($h_{ef,limit}$ = 2.750 in.)
Material:	DIN EN ISO 4042
Evaluation Service Report:	ESR-3187
Issued I Valid:	5/1/2021 | 3/1/2022
Proof:	Design Method ACI 318-08 / Chem
Stand-off installation:	e_b = 0.000 in. (no stand-off); t = 0.500 in.
Anchor plate^R :	l_x x l_y x t = 5.000 in. x 5.000 in. x 0.500 in.; (Recommended plate thickness: not calculated)
Profile:	no profile
Base material:	cracked concrete, 2500, f_c' = 2,500 psi; h = 5.000 in., Temp. short/long: 32/32 °F
Installation:	**hammer drilled hole, Installation condition: Dry**
Reinforcement:	tension: condition B, shear: condition B; no supplemental splitting reinforcement present
	edge reinforcement: none or < No. 4 bar
Seismic loads (cat. C, D, E, or F)	no

^{R} - The anchor calculation is based on a rigid anchor plate assumption.

Geometry [in.] & Loading [lb, in.lb]



PROFIS Engineering (c) 2003-2021 Hilti AG, FL-9494 Schaan Hilti is a registered Trademark of Hilti AG, Schaan

Hilti PROFIS Engineering 3.0.72

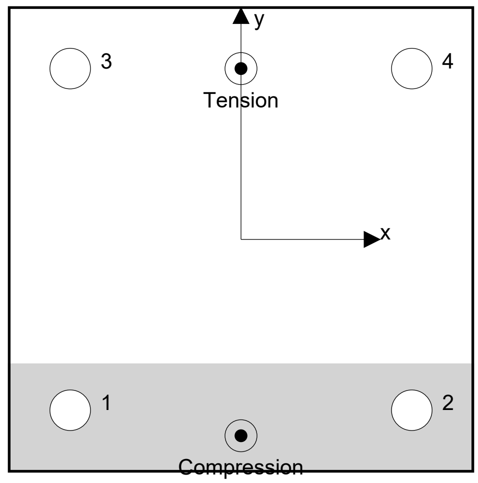
www.hilti.com

Company:		Page:	2
Address:		Specifier:	Agnimithra Murari
Phone I Fax:	|	E-Mail:	
Design:	Hilti Concrete Mounted with stiffner	Date:	8/24/2021
Fastening point:			

1.1 Design results

Case	Description	Forces [lb] / Moments [in.lb]	Seismic	Max. Util. Anchor [%]
1	Load case: Design loads	$N = 0; V_x = 0; V_y = -250;$ $M_x = 10{,}500; M_y = 0; M_z = 0;$ $N_{sus} = 0; M_{x,sus} = 0; M_{y,sus} = 0;$	no	87

2 Load case/Resulting anchor forces



Anchor reactions [lb]

Tension force: (+Tension, -Compression)

Anchor	Tension force	Shear force	Shear force x	Shear force y
1	0	63	0	-63
2	0	63	0	-63
3	1,326	63	0	-63
4	1,326	63	0	-63

max. concrete compressive strain: 0.21 [‰]
max. concrete compressive stress: 923 [psi]
resulting tension force in (x/y)=(0.000/1.842): 2,652 [lb]
resulting compression force in (x/y)=(0.000/-2.117): 2,652 [lb]

Anchor forces are calculated based on the assumption of a rigid anchor plate.

3 Tension load

	Load N_{ua} [lb]	Capacity ϕ N_n [lb]	Utilization $\beta_N = N_{ua}/\phi$ N_n	Status
Steel Strength*	1,326	4,749	28	OK
Pullout Strength*	1,326	5,169	26	OK
Sustained Tension Load Bond Strength*	N/A	N/A	N/A	N/A
Concrete Breakout Failure**	2,652	3,068	87	OK

* highest loaded anchor   **anchor group (anchors in tension)

Hilti PROFIS Engineering 3.0.72

www.hilti.com

Company:		Page:	3
Address:		Specifier:	Agnimithra Murari
Phone I Fax:	|	E-Mail:	
Design:	Hilti Concrete Mounted with stiffner	Date:	8/24/2021
Fastening point:			

3.1 Steel Strength

N_{sa} = ESR value refer to ICC-ES ESR-3187
$\phi\ N_{sa} \geq N_{ua}$ ACI 318-08 Eq. (D-1)

Variables

$A_{se,N}$ [in.^{2}]	f_{uta} [psi]
0.08	94,200

Calculations

N_{sa} [lb]
7,306

Results

N_{sa} [lb]	ϕ_{steel}	$\phi\ N_{sa}$ [lb]	N_{ua} [lb]
7,306	0.650	4,749	1,326

3.2 Pullout Strength

N_{pn} = N_p refer to ICC-ES ESR-3187
$\phi\ N_{pn} \geq N_{ua}$ ACI 318-08 Eq. (D-1)

Variables

N_p [lb]
7,952

Calculations

N_{pn} [lb]
7,952

Results

N_{pn} [lb]	$\phi_{concrete}$	$\phi\ N_{pn}$ [lb]	N_{ua} [lb]
7,952	0.650	5,169	1,326

Input data and results must be checked for conformity with the existing conditions and for plausibility!
PROFIS Engineering (c) 2003-2021 Hilti AG, FL-9494 Schaan Hilti is a registered Trademark of Hilti AG, Schaan

Hilti PROFIS Engineering 3.0.72

www.hilti.com

Company:		Page:	4
Address:		Specifier:	Agnimithra Murari
Phone I Fax:	|	E-Mail:	
Design:	Hilti Concrete Mounted with stiffner	Date:	8/24/2021
Fastening point:			

3.3 Concrete Breakout Failure

$N_{cbg} = \left(\frac{A_{Nc}}{A_{Nc0}}\right) \psi_{ec,N}\ \psi_{ed,N}\ \psi_{c,N}\ \psi_{cp,N}\ N_b$ ACI 318-08 Eq. (D-5)

$\phi\ N_{cbg} \geq N_{ua}$ ACI 318-08 Eq. (D-1)

A_{Nc} see ACI 318-08, Part D.5.2.1, Fig. RD.5.2.1(b)

$A_{Nc0} = 9\ h_{ef}^2$ ACI 318-08 Eq. (D-6)

$\psi_{ec,N} = \left(\frac{1}{1 + \frac{2\ e_N'}{3\ h_{ef}}}\right) \leq 1.0$ ACI 318-08 Eq. (D-9)

$\psi_{ed,N} = 0.7 + 0.3 \left(\frac{c_{a,min}}{1.5h_{ef}}\right) \leq 1.0$ ACI 318-08 Eq. (D-11)

$\psi_{cp,N} = \text{MAX}\left(\frac{c_{a,min}}{c_{ac}}, \frac{1.5h_{ef}}{c_{ac}}\right) \leq 1.0$ ACI 318-08 Eq. (D-13)

$N_b = k_c\ \lambda\ \sqrt{f_c'}\ h_{ef}^{1.5}$ ACI 318-08 Eq. (D-7)

Variables

h_{ef} [in.]	$e_{c1,N}$ [in.]	$e_{c2,N}$ [in.]	$c_{a,min}$ [in.]	$\psi_{c,N}$
2.375	0.000	0.000	5.016	1.000

c_{ac} [in.]	k_c	λ	f_c' [psi]
4.725	17	1	2,500

Calculations

A_{Nc} [in.^{2}]	A_{Nc0} [in.^{2}]	$\psi_{ec1,N}$	$\psi_{ec2,N}$	$\psi_{ed,N}$	$\psi_{cp,N}$	N_b [lb]
77.01	50.77	1.000	1.000	1.000	1.000	3,111

Results

N_{cbg} [lb]	$\phi_{concrete}$	$\phi\ N_{cbg}$ [lb]	N_{ua} [lb]
4,720	0.650	3,068	2,652

Hilti PROFIS Engineering 3.0.72

www.hilti.com

Company:		Page:	5
Address:		Specifier:	Agnimithra Murari
Phone I Fax:	|	E-Mail:	
Design:	Hilti Concrete Mounted with stiffner	Date:	8/24/2021
Fastening point:			

4 Shear load

	Load V_{ua} [lb]	Capacity ϕ V_n [lb]	Utilization $\beta_V = V_{ua}/\phi\ V_n$	Status
Steel Strength*	63	1,929	4	OK
Steel failure (with lever arm)*	N/A	N/A	N/A	N/A
Pryout Strength (Concrete Breakout Strength controls)**	250	5,012	5	OK
Concrete edge failure in direction y-**	250	1,929	13	OK

* highest loaded anchor **anchor group (relevant anchors)

4.1 Steel Strength

V_{sa} = ESR value refer to ICC-ES ESR-3187

$\phi\ V_{steel} \geq V_{ua}$ ACI 318-08 Eq. (D-2)

Variables

$A_{se,V}$ [in.^{2}]	f_{uta} [psi]	$\alpha_{V,seis}$
0.08	94,200	0.650

Calculations

V_{sa} [lb]
3,215

Results

V_{sa} [lb]	ϕ_{steel}	$\phi\ V_{sa}$ [lb]	V_{ua} [lb]
3,215	0.600	1,929	63

Input data and results must be checked for conformity with the existing conditions and for plausibility!
PROFIS Engineering (c) 2003-2021 Hilti AG, FL-9494 Schaan Hilti is a registered Trademark of Hilti AG, Schaan

Hilti PROFIS Engineering 3.0.72

www.hilti.com

Company:		Page:	6
Address:		Specifier:	Agnimithra Murari
Phone I Fax:	|	E-Mail:	
Design:	Hilti Concrete Mounted with stiffner	Date:	8/24/2021
Fastening point:			

4.2 Pryout Strength (Concrete Breakout Strength controls)

$V_{cpg} = k_{cp} \left[\left(\frac{A_{Nc}}{A_{Nc0}} \right) \psi_{ec,N} \; \psi_{ed,N} \; \psi_{c,N} \; \psi_{cp,N} \; N_b \right]$ ACI 318-08 Eq. (D-31)

$\phi \; V_{cpg} \geq V_{ua}$ ACI 318-08 Eq. (D-2)

A_{Nc} see ACI 318-08, Part D.5.2.1, Fig. RD.5.2.1(b)

$A_{Nc0} = 9 \; h_{ef}^2$ ACI 318-08 Eq. (D-6)

$\psi_{ec,N} = \left(\frac{1}{1 + \frac{2 \; e_N'}{3 \; h_{ef}}} \right) \leq 1.0$ ACI 318-08 Eq. (D-9)

$\psi_{ed,N} = 0.7 + 0.3 \left(\frac{c_{a,min}}{1.5 h_{ef}} \right) \leq 1.0$ ACI 318-08 Eq. (D-11)

$\psi_{cp,N} = \mathrm{MAX}\left(\frac{c_{a,min}}{c_{ac}}, \frac{1.5 h_{ef}}{c_{ac}} \right) \leq 1.0$ ACI 318-08 Eq. (D-13)

$N_b = k_c \; \lambda \; \sqrt{f_c'} \; h_{ef}^{1.5}$ ACI 318-08 Eq. (D-7)

Variables

k_{cp}	h_{ef} [in.]	$e_{c1,N}$ [in.]	$e_{c2,N}$ [in.]	$c_{a,min}$ [in.]
1	2.375	0.000	0.000	5.016

$\psi_{c,N}$	c_{ac} [in.]	k_c	λ	f_c' [psi]
1.000	4.725	17	1	2,500

Calculations

A_{Nc} [in.^{2}]	A_{Nc0} [in.^{2}]	$\psi_{ec1,N}$	$\psi_{ec2,N}$	$\psi_{ed,N}$	$\psi_{cp,N}$	N_b [lb]
116.83	50.77	1.000	1.000	1.000	1.000	3,111

Results

V_{cpg} [lb]	$\phi_{concrete}$	$\phi \; V_{cpg}$ [lb]	V_{ua} [lb]
7,160	0.700	5,012	250

Input data and results must be checked for conformity with the existing conditions and for plausibility!
PROFIS Engineering (c) 2003-2021 Hilti AG, FL-9494 Schaan Hilti is a registered Trademark of Hilti AG, Schaan

Hilti PROFIS Engineering 3.0.72

www.hilti.com

Company:		Page:	7
Address:		Specifier:	Agnimithra Murari
Phone I Fax:	|	E-Mail:	
Design:	Hilti Concrete Mounted with stiffner	Date:	8/24/2021
Fastening point:			

4.3 Concrete edge failure in direction y-

$V_{cbg} = \left(\frac{A_{Vc}}{A_{Vc0}}\right) \psi_{ec,V}\ \psi_{ed,V}\ \psi_{c,V}\ \psi_{h,V}\ \psi_{parallel,V}\ V_b$ ACI 318-08 Eq. (D-22)

$\phi\ V_{cbg} \geq V_{ua}$ ACI 318-08 Eq. (D-2)

A_{Vc} see ACI 318-08, Part D.6.2.1, Fig. RD.6.2.1(b)

$A_{Vc0} = 4.5\ c_{a1}^2$ ACI 318-08 Eq. (D-23)

$\psi_{ec,V} = \left(\frac{1}{1 + \frac{2e_V'}{3c_{a1}}}\right) \leq 1.0$ ACI 318-08 Eq. (D-26)

$\psi_{ed,V} = 0.7 + 0.3\left(\frac{c_{a2}}{1.5c_{a1}}\right) \leq 1.0$ ACI 318-08 Eq. (D-28)

$\psi_{h,V} = \sqrt{\frac{1.5c_{a1}}{h_a}} \geq 1.0$ ACI 318-08 Eq. (D-29)

$V_b = \left(7\left(\frac{l_e}{d_a}\right)^{0.2}\sqrt{d_a}\right) \lambda\ \sqrt{f_c'}\ c_{a1}^{1.5}$ ACI 318-08 Eq. (D-24)

Variables

c_{a1} [in.]	c_{a2} [in.]	e_{cV} [in.]	$\psi_{c,V}$	h_a [in.]
5.016	5.016	0.000	1.000	5.000

l_e [in.]	λ	d_a [in.]	f_c' [psi]	$\psi_{parallel,V}$
2.375	1.000	0.375	2,500	1.000

Calculations

A_{Vc} [in.^{2}]	A_{Vc0} [in.^{2}]	$\psi_{ec,V}$	$\psi_{ed,V}$	$\psi_{h,V}$	V_b [lb]
81.13	113.24	1.000	0.900	1.227	3,483

Results

V_{cbg} [lb]	$\phi_{concrete}$	$\phi\ V_{cbg}$ [lb]	V_{ua} [lb]
2,755	0.700	1,929	250

5 Combined tension and shear loads

β_N	β_V	ζ	Utilization $\beta_{N,V}$ [%]	Status
0.865	0.130	5/3	82	OK

$\beta_{NV} = \beta_N^{\zeta} + \beta_V^{\zeta} <= 1$

Input data and results must be checked for conformity with the existing conditions and for plausibility!
PROFIS Engineering (c) 2003-2021 Hilti AG, FL-9494 Schaan Hilti is a registered Trademark of Hilti AG, Schaan

Hilti PROFIS Engineering 3.0.72

www.hilti.com

Company:		Page:	8
Address:		Specifier:	Agnimithra Murari
Phone I Fax:	|	E-Mail:	
Design:	Hilti Concrete Mounted with stiffner	Date:	8/24/2021
Fastening point:			

6 Warnings

- The anchor design methods in PROFIS Engineering require rigid anchor plates per current regulations (AS 5216:2018, ETAG 001/Annex C, EOTA TR029 etc.). This means load re-distribution on the anchors due to elastic deformations of the anchor plate are not considered - the anchor plate is assumed to be sufficiently stiff, in order not to be deformed when subjected to the design loading. PROFIS Engineering calculates the minimum required anchor plate thickness with CBFEM to limit the stress of the anchor plate based on the assumptions explained above. The proof if the rigid anchor plate assumption is valid is not carried out by PROFIS Engineering. Input data and results must be checked for agreement with the existing conditions and for plausibility!
- Condition A applies where the potential concrete failure surfaces are crossed by supplementary reinforcement proportioned to tie the potential concrete failure prism into the structural member. Condition B applies where such supplementary reinforcement is not provided, or where pullout or pryout strength governs.
- Design Strengths of adhesive anchor systems are influenced by the cleaning method. Refer to the INSTRUCTIONS FOR USE given in the Evaluation Service Report for cleaning and installation instructions.
- The present version of the software does not account for special design provisions for overhead applications. Refer to related approval (e.g. section 4.1.1 of the ICC-ESR 2322) for details.
- For additional information about ACI 318 strength design provisions, please go to https://submittals.us.hilti.com/PROFISAnchorDesignGuide/

Fastening meets the design criteria!

PROFIS Engineering (c) 2003-2021 Hilti AG, FL-9494 Schaan Hilti is a registered Trademark of Hilti AG, Schaan

Hilti PROFIS Engineering 3.0.72

www.hilti.com

Company:		Page:	9
Address:		Specifier:	Agnimithra Murari
Phone I Fax:	|	E-Mail:	
Design:	Hilti Concrete Mounted with stiffner	Date:	8/24/2021
Fastening point:			

7 Installation data

Profile: no profile

Hole diameter in the fixture (pre-setting) : d_f = 0.438 in.

Hole diameter in the fixture (through fastening) : d_f = 0.500 in.

Plate thickness (input): 0.500 in.

Recommended plate thickness: not calculated

Drilling method: Hammer drilled

Cleaning: Compressed air cleaning of the drilled hole according to instructions for use is required

Anchor type and diameter: HIT-HY 200 + HIT-Z 3/8

Item number: 2018440 HIT-Z 3/8" x 4 3/8" (element) / 2022793 HIT-HY 200-R (adhesive)

Maximum installation torque: 177 in.lb

Hole diameter in the base material: 0.438 in.

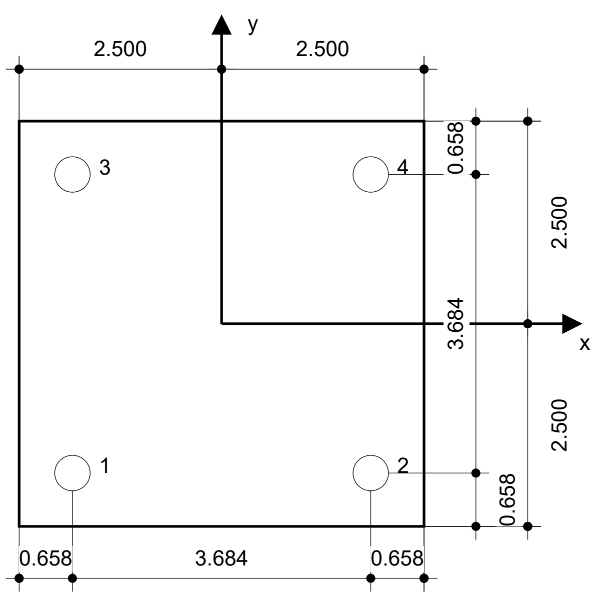
Hole depth in the base material: 2.375 in.

Minimum thickness of the base material: 4.625 in.

3/8 Hilti HIT-Z Carbon steel non-cleaning bonded expansion anchor with Hilti HIT-HY 200 Safe Set System

7.1 Recommended accessories

Drilling	Cleaning	Setting
• Suitable Rotary Hammer • Properly sized drill bit	• -	• Dispenser including cassette and mixer • Torque wrench



Coordinates Anchor [in.]

Anchor	x	y	c_{-x}	c_{+x}	c_{-y}	c_{+y}
1	-1.842	-1.842	5.016	-	5.016	-
2	1.842	-1.842	8.700	-	5.016	-
3	-1.842	1.842	5.016	-	8.700	-
4	1.842	1.842	8.700	-	8.700	-

Input data and results must be checked for conformity with the existing conditions and for plausibility!
PROFIS Engineering (c) 2003-2021 Hilti AG, FL-9494 Schaan Hilti is a registered Trademark of Hilti AG, Schaan

8 Remarks; Your Cooperation Duties

- Any and all information and data contained in the Software concern solely the use of Hilti products and are based on the principles, formulas and security regulations in accordance with Hilti's technical directions and operating, mounting and assembly instructions, etc., that must be strictly complied with by the user. All figures contained therein are average figures, and therefore use-specific tests are to be conducted prior to using the relevant Hilti product. The results of the calculations carried out by means of the Software are based essentially on the data you put in. Therefore, you bear the sole responsibility for the absence of errors, the completeness and the relevance of the data to be put in by you. Moreover, you bear sole responsibility for having the results of the calculation checked and cleared by an expert, particularly with regard to compliance with applicable norms and permits, prior to using them for your specific facility. The Software serves only as an aid to interpret norms and permits without any guarantee as to the absence of errors, the correctness and the relevance of the results or suitability for a specific application.
- You must take all necessary and reasonable steps to prevent or limit damage caused by the Software. In particular, you must arrange for the regular backup of programs and data and, if applicable, carry out the updates of the Software offered by Hilti on a regular basis. If you do not use the AutoUpdate function of the Software, you must ensure that you are using the current and thus up-to-date version of the Software in each case by carrying out manual updates via the Hilti Website. Hilti will not be liable for consequences, such as the recovery of lost or damaged data or programs, arising from a culpable breach of duty by you.

PROFIS Engineering (c) 2003-2021 Hilti AG, FL-9494 Schaan Hilti is a registered Trademark of Hilti AG, Schaan