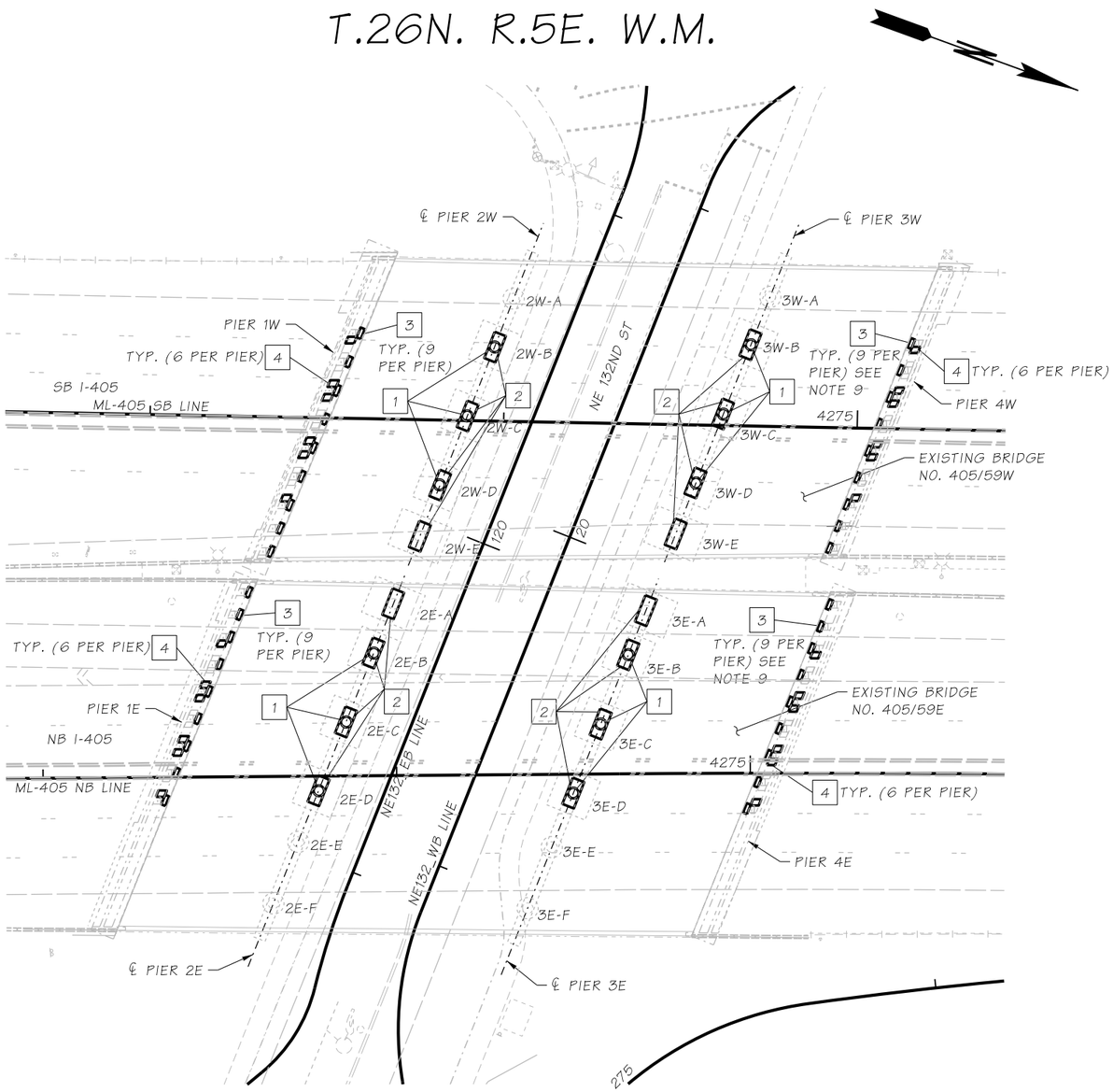

PLAN

GENERAL NOTES:

1. ALL MATERIALS AND WORKMANSHIP SHALL BE IN ACCORDANCE WITH THE REQUIREMENTS OF THE WASHINGTON STATE DEPARTMENT OF TRANSPORTATION STANDARD SPECIFICATIONS FOR ROAD, BRIDGE, AND MUNICIPAL CONSTRUCTION DATED 2021 AND AMENDMENTS.

2. SEISMIC ASSESSMENT AND RETROFIT DESIGN HAVE BEEN PERFORMED IN ACCORDANCE WITH THE FHWA SEISMIC RETROFITTING MANUAL FOR HIGHWAY STRUCTURES: PART 1 BRIDGES DATED 2006, AND AS AMENDED BY WSDOT BRIDGE DESIGN MANUAL DATED 2020 FOR SEISMIC RETROFIT OF RECOVERY BRIDGES AS FOLLOWS:

   THE BRIDGES WERE ASSESSED AND RETROFITTED FOR UPPER LEVEL EARTHQUAKE (975-YEAR RETURN PERIOD, SEE) FOR REQUIREMENTS APPLICABLE TO THE ORDINARY BRIDGES (BDM SECTION 4.4.1). IN ADDITION, THE ADEQUACY OF FOUNDATIONS WAS ASSESSED FOR LOWER LEVEL EARTHQUAKE (210-YEAR RETURN PERIOD, FEE). HOWEVER, THE RETROFIT OF DEFICIENT FOUNDATIONS IS OUT OF SCOPE OF THIS PROJECT.

3. RESPONSE SPECTRUM LOADINGS WERE USED WITH THE FOLLOWING PARAMETERS:

RESPONSE SPECTRA PARAMETERS		
HAZARD EVALUATION LEVEL	SEE (975-YR)	FEE (210-YR)
SITE CLASS	E	E
PEAK GROUND ACCELERATION, PGA	0.388g	0.178g
S_S	0.88g	0.406g
S_1	0.257g	0.107g
F_{PGA}	1.423	2.010
F_A	1.145	1.963
F_V	3.015	4.137
A_S	0.553g	0.358g
S_{DS}	1.007g	0.797g
S_{D1}	0.775g	0.443g
T_O	0.154 sec	0.154 sec
T_S	0.770 sec	0.770 sec

4. THE CONCRETE COVER MEASURED FROM THE FACE OF CONCRETE TO THE FACE OF ANY REINFORCING STEEL SHALL BE 1 1/2 INCHES, UNLESS NOTED OTHERWISE.

5. ANCHORING TO EXISTING CONCRETE:
   REINFORCING BAR DOWELS SHALL BE SET WITH EPOXY RESIN. HOLE DIAMETER AND EMBEDMENT OF THE DOWELS SHALL BE PER TABLE BELOW, UNLESS NOTED OTHERWISE ON THE PLANS. IN ORDER TO AVOID EXISTING REINFORCING THE HOLES CAN BE PLACED WITH 1 1/2" TOLERANCE TO PLAN DIMENSIONS. THE DISTANCE TO EXISTING CONCRETE EDGE SHALL BE AT LEAST 4.5 INCHES. SPACING BETWEEN ADJACENT HOLES SHALL BE AT LEAST 6 INCHES.

BAR SIZE	DRILL HOLE SIZE (IN)	REQUIRED EMBEDMENT (IN)
#4	5/8	7
#5	3/4	8
#6	1	9

6. CAST-IN-PLACE CONCRETE FOR SEAT EXTENDERS AND GIRDERS STOPS SHALL BE CLASS 4000.

7. FOR CARBON FIBER REINFORCED POLYMER (CFRP) STRENGTHENING OF COLUMNS AND CROSSBEAMS SEE CFRP NOTES ON SHEET BG09.

8. THIS SHEET DEPICTS ONLY SEISMIC RETROFIT WORK ELEMENTS. FOR SITE CIVIL FEATURES REFER TO CIVIL AND WALL PLANS.

9. NECESSITY OF SEAT EXTENDERS AT PIERS 4E AND 4W IS CURRENTLY UNDER REVIEW.

LEGEND:

1 CFRP COLUMN JACKET, SEE SHEET BG07

2 CFRP CROSSBEAM STRENGTHENING, SEE SHEET BG07

3 GIRDER SEAT EXTENDER, SEE SHEET BG06

4 GIRDER STOP, SEE SHEET BG06

2E-A (e.g.) - BRIDGE COLUMN IDENTIFICATION
- ALPHA-NUMERIC COUNTER
- BRIDGE DESIGNATOR (E, EAST; W, WEST)
- PIER NUMBER

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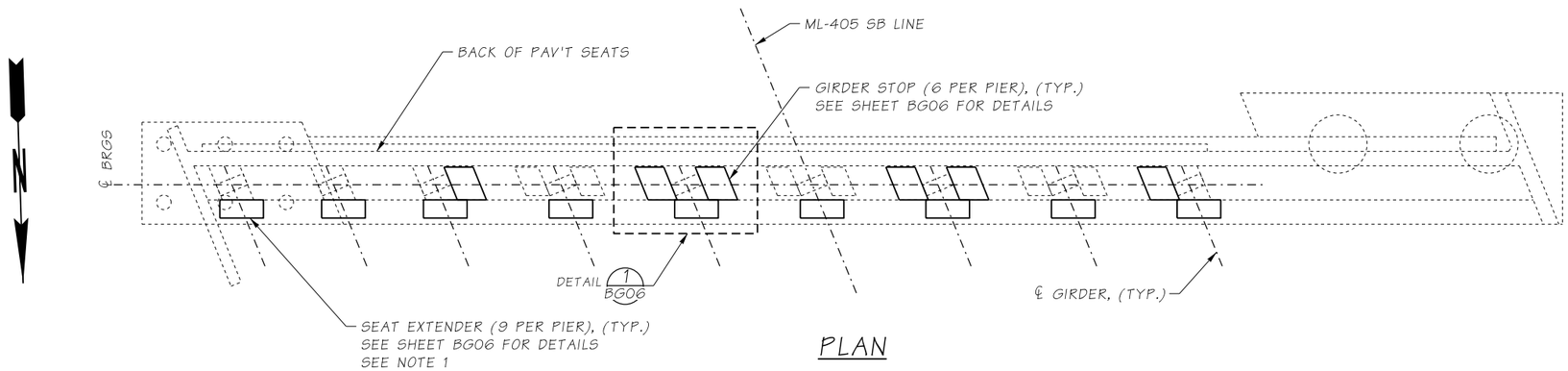
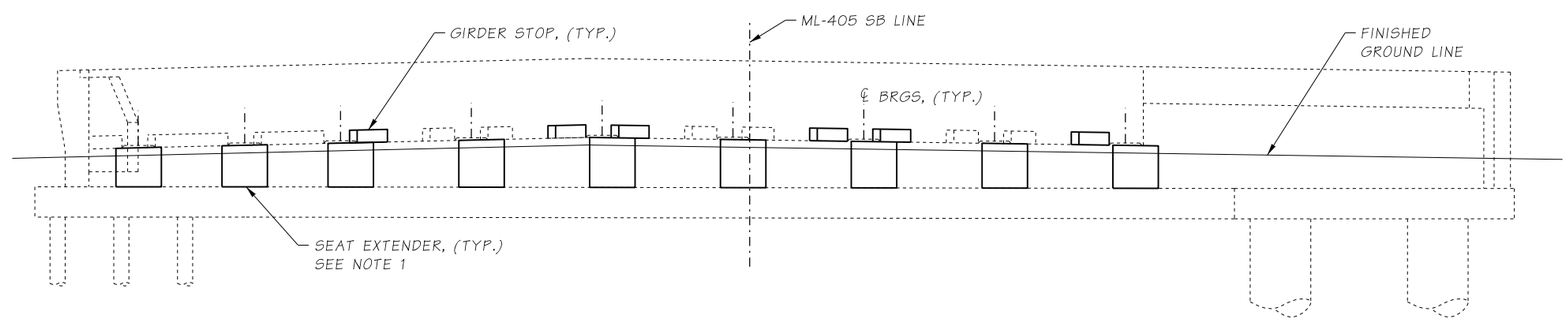
BRIDGE SEISMIC RETROFIT KEY PLAN

PLAN REF NO BG01

SHEET OF SHEETS



PLAN



ELEVATION

(PIER 1W LOOKING SOUTH IS SHOWN. PIER 4W LOOKING NORTH
IS SIMILAR SUPERSTRUCTURE NOT SHOWN FOR CLARITY)

NOTES:

1. NECESSITY OF SEAT EXTENDERS AT PIER 4W IS CURRENTLY UNDER REVIEW.

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PIERS 1W AND 4W RETROFITS

PLAN REF NO
BG02

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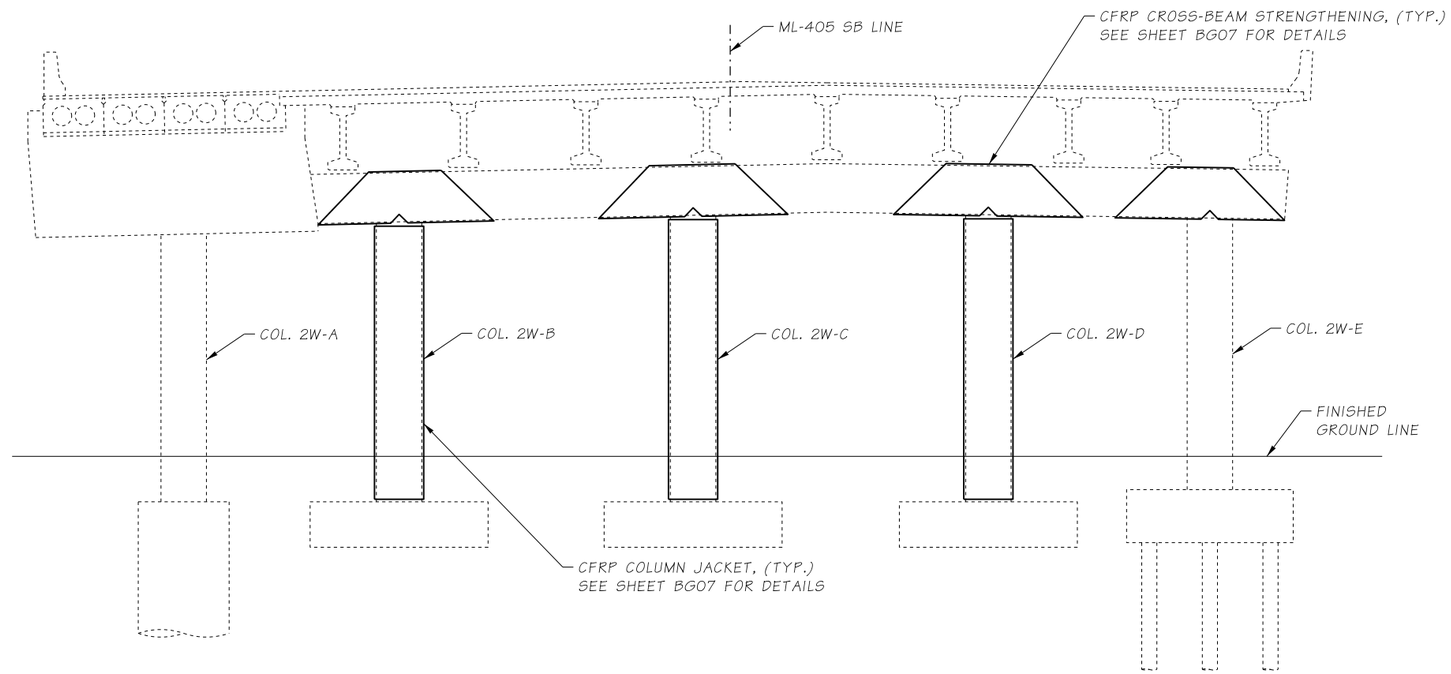
OF
SHEETS



ELEVATION

(PIER 2W LOOKING NORTH IS SHOWN, PIER 3W SIMILAR)

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PIERS 2W AND 3W RETROFITS

PLAN REF NO
BG03

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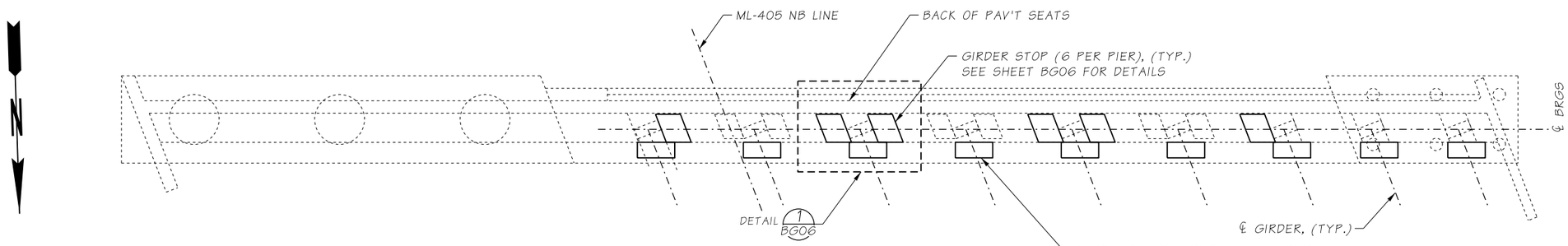
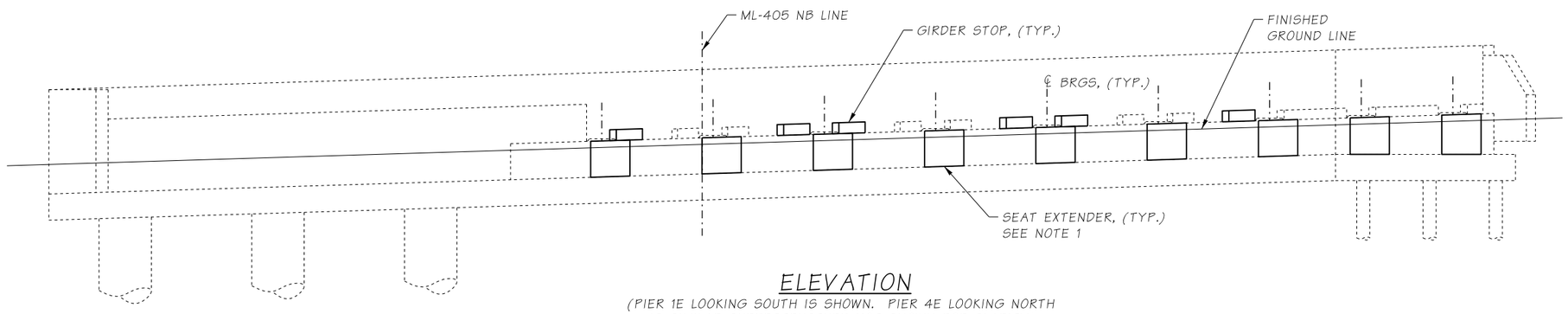


PLAN



ELEVATION

(PIER 1E LOOKING SOUTH IS SHOWN. PIER 4E LOOKING NORTH IS SIMILAR SUPERSTRUCTURE NOT SHOWN FOR CLARITY)

NOTES:

1. NECESSITY OF SEAT EXTENDERS AT PIER 4E IS CURRENTLY UNDER REVIEW.

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PIERS 1E AND 4E RETROFITS

PLAN REF NO BG04
SHEET
OF
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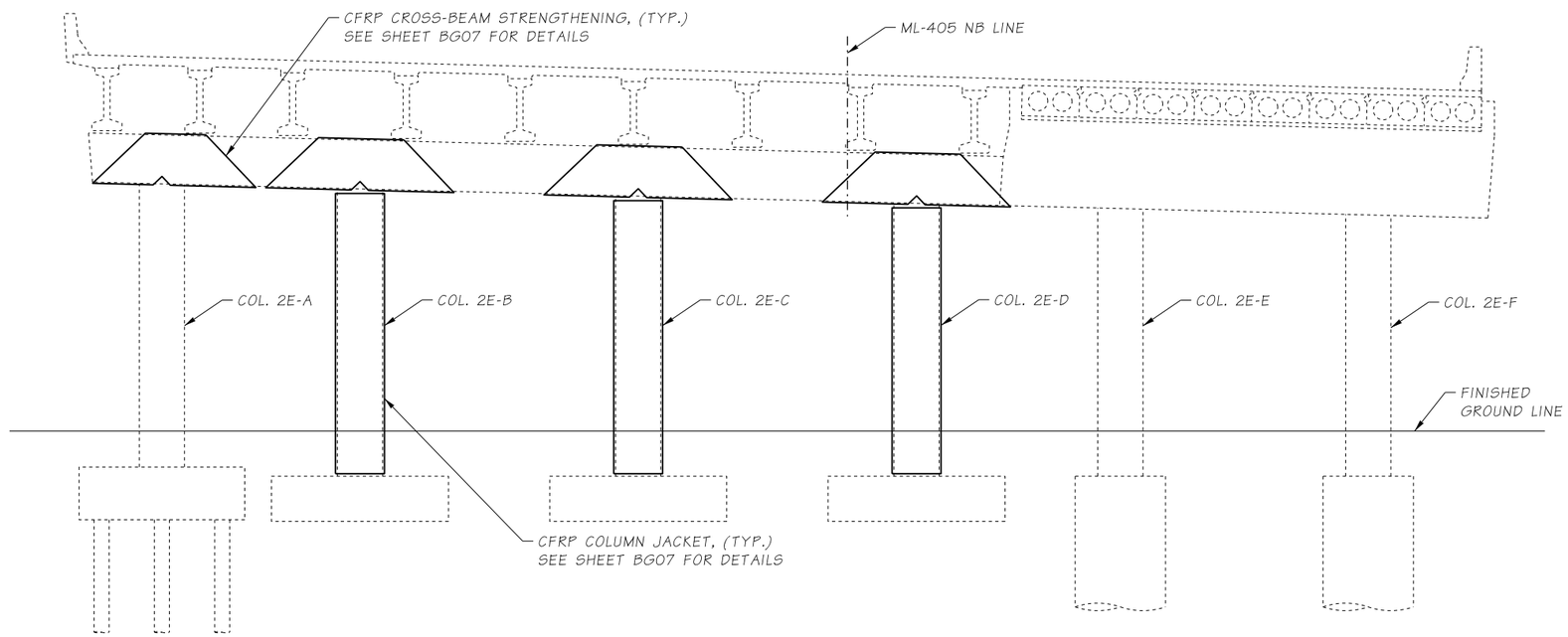

ELEVATION

(PIER 2E LOOKING NORTH IS SHOWN, PIER 3E SIMILAR)

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PIERS 2E AND 3E RETROFITS

PLAN REF NO BG05

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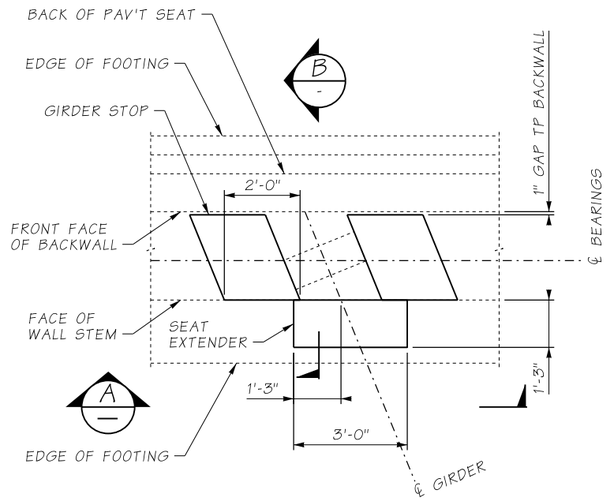

DETAIL 1 BG02

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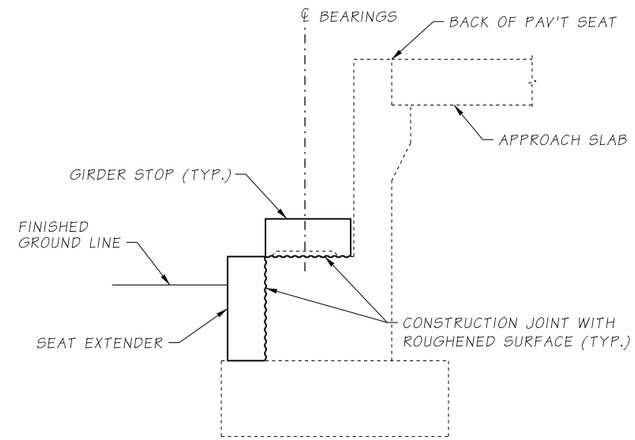

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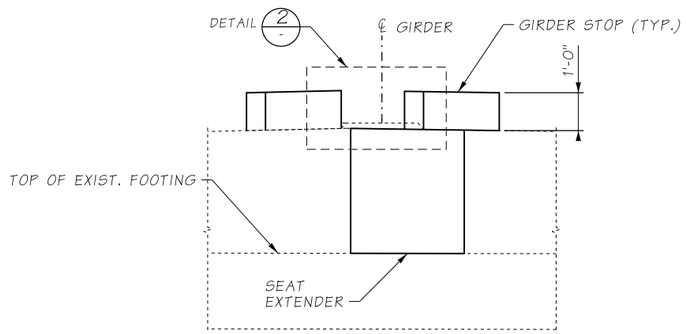

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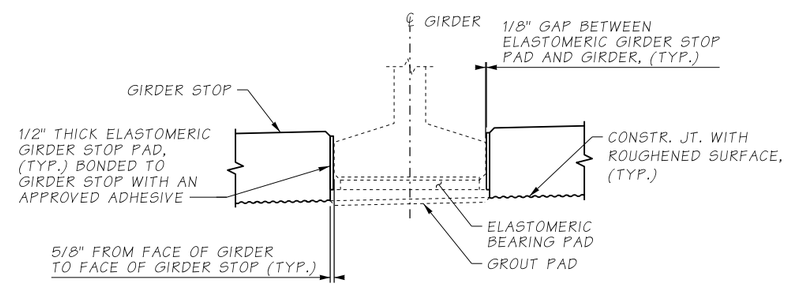

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PIERS 1 AND 4 DETAILS

PLAN REF NO BG06

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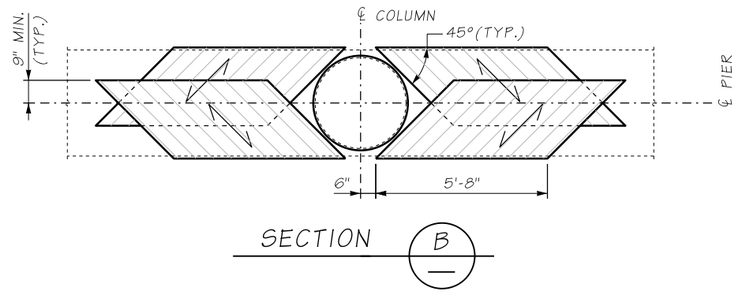

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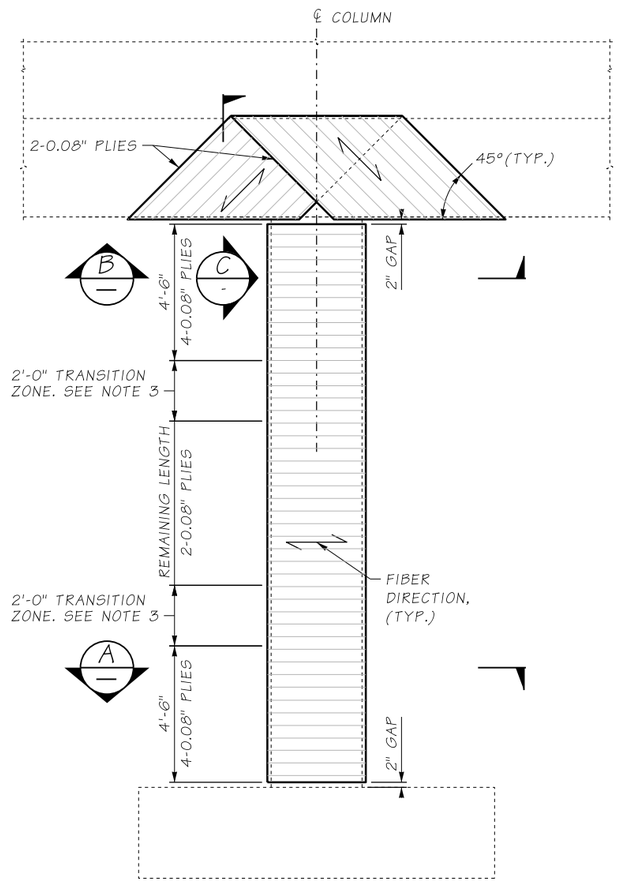

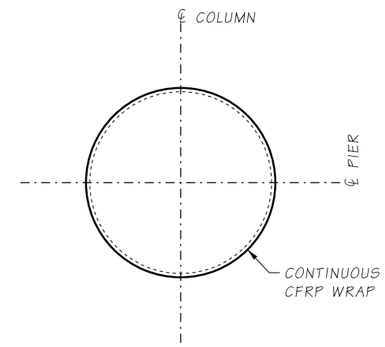

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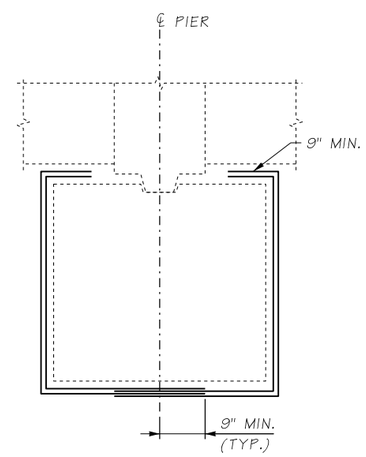

SECTION C

CFRP COLUMN JACKETING AND CROSS-BEAM STRENGTHENING DETAIL

CFRP NOTES:

1. THE DESIGN OF CFRP IS BASED ON THE FOLLOWING VALUES OF DESIGN PARAMETERS FOR LAMINATE COMPOSITE MATERIAL:

   ULTIMATE TENSILE STRENGTH: 131 KSI

   ELONGATION AT BREAK: 0.90%

   TENSILE MODULUS 12,600 KSI

   NOMINAL EFFECTIVE COMPOSITE THICKNESS OF ONE PLY: 0.08 INCHES, AS SHOWN

   THE VALUES FOR ULTIMATE TENSILE STRENGTH AND ELONGATION AT BREAK DO NOT INCLUDE ENVIRONMENTAL FACTOR OF 0.85.

2. CFRP UNIDIRECTIONAL FIBERS SHALL BE ORIENTED AS SHOWN ON DETAILS.

3. THE CASING THICKNESS SHALL TAPER EVENLY OVER THE FULL LENGTH OF THE TRANSITION ZONE, ONE PLY AT A TIME.

4. ALL CFRP MATERIALS TO BE INSTALLED IN STRICT ACCORDANCE WITH MANUFACTURER'S REQUIREMENTS PER THE CFRP DATA SHEETS AND INSTALLATION GUIDE.

5. THE COMPOSITE CASING SHALL ADHERE FIRMLY TO THE EXISTING COLUMN SURFACE. NO WRINKLING/KINKING OF CFRP FABRIC IS ALLOWED.

6. NO MORE THAN FOUR PLIES OF CFRP MAY BE APPLIED PER ONE 24-HOUR PERIOD.

7. THE LENGTH OF CFRP LAP SPLICES IN THE DIRECTION OF FIBERS SHALL BE PER MANUFACTURER RECOMMENDATIONS.

8. ALL CONCRETE SURFACES SHALL BE:

   - PREPARED FOR BONDING BY MEANS OF ABRASIVE BLASTING OR GRINDING.
   - CLEANED BY HAND OR BY OIL-FREE COMPRESSED AIR.
   - FREE OF MOISTURE, OILS, LOOSE MATERIAL, DEBRIS, OR DUST.
   - FREE OF VOIDS, PROTRUSIONS AND SHARP EDGES. ANY VOIDS OR UNEVEN SURFACES SHALL BE FILLED WITH A THICKENED EPOXY.

9. A PRIMER COAT OF EPOXY SHALL BE APPLIED TO ALL CONCRETE SURFACES RECEIVING CFRP AND TO ALLOWED TO CURE FOR A MINIMUM OF ONE HOUR PRIOR TO APPLICATION OF CFRP.

10. THE CFRP SURFACE MUST BE FINISHED PER DESIGN SPECIFICATIONS.

11. SEE DESIGN SPECIFICATIONS FOR ADDITIONAL REQUIREMENTS.

12. INSTALLATION OF CONCRETE ANCHORS FOR THE LIGHTING AND ELECTRICAL ATTACHMENTS:

    - THE CONCRETE SURFACE NEAR THE ANCHORS SHALL BE SCANNED AND REBAR MAPPED PRIOR TO DRILLING THE ANCHOR HOLES. HITTING REBAR AND DRILLING UNUTILIZED HOLES MUST BE AVOIDED.
    - THE HOLES CAN BE DRILLED THROUGH THE FINISHED CFRP.
    - ALTERNATIVELY, THE HOLES CAN BE DRILLED AND BLOCKED OUT PRIOR TO CFRP INSTALLATION. THE CARBON FIBERS SHALL BE DIRECTED AROUND THE BLOCKOUT.
    - SPACING BETWEEN ADJACENT HOLES SHALL NOT EXCEED 4".

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PIERS 2 AND 3 CFRP DETAILS

PLAN REF NO BG07

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