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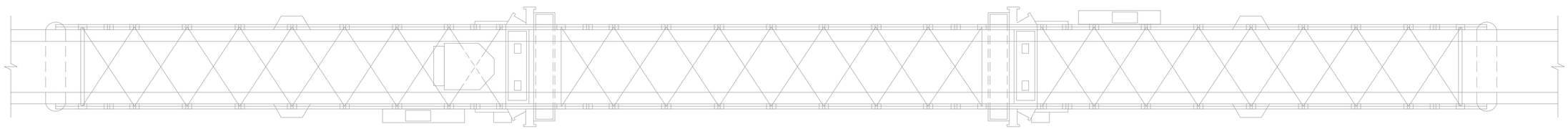
UNIVERSITY OF NEW HAMPSHIRE MONITORING OF THE MEMORIAL BRIDGE IN PORTSMOUTH, NH



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PROJECT NAME

UNIVERSITY OF NEW HAMPSHIRE
MONITORING OF THE MEMORIAL BRIDGE
IN PORTSMOUTH, NH

Drawn By:	DSH
Checked By:	JDS
Date:	12/09/2016
Client No.:	
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SCALE:	NTS

COVER PAGE

LTM-00

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GENERAL NOTES

PROJECT LOGISTICS / TIMELINE

1. MONITORING SYSTEM PARAMETERS CONSIST OF MOBILIZATION/DEMOBILIZATION TO PROJECT SITE AND INSTALLATION OF ALL SENSORS AND DATA ACQUISITION EQUIPMENT.
2. MONITORING SYSTEM INSTALL SHALL BEGIN 2/27/2017.
3. MONITORING OF MEMORIAL BRIDGE SHALL BEGIN AT DISCRETION OF UNIVERSITY OF NEW HAMPSHIRE.

MONITORING INSTRUMENTATION

1. INSTRUMENTATION SHALL INCLUDE WELDABLE ROSETTE STRAIN GAGES, UNI-AXIAL STRAIN GAGES, UNI-AXIAL ACCELEROMETERS, HALF BRIDGE STRAIN GAGES AND BIAXIAL TILTMETERS.
2. ROSETTE STRAIN GAGES:
   - 2.1. ORIENTATION SHOWN IN LTM - 13 SECTION 3B SHALL BE UNIVERSAL ACROSS STRUCTURE.
   - 2.2. ILLUSTRATED DIMENSIONS SHALL BE BASED FROM CENTER OF GAGE SHOWN IN LTM - 13 SECTION 3B.
   - 2.3. EACH ROSETTE STRAIN GAGE REQUIRES 3 CHANNELS OF DATA ACQUISITION.
3. UNI-AXIAL STRAIN GAGES:
   - 3.1. UNI-AXIAL STRAIN GAGES SHALL BE MOUNTED TO A DIAGONAL MEMBER ON EACH SIDE OF THE FIXED TRUSS SPAN AND ORIENTED TO MEASURE STRAIN ALONG LENGTH OF THE MEMBER.
4. UNI-AXIAL ACCELEROMETERS:
   - 4.1. SENSOR ALONG FIXED SPAN SHALL BE MOUNTED SUCH THAT ACCELERATION MEASUREMENTS ARE COLLECTED IN VERTICAL DIRECTION.
   - 4.2. SENSOR ALONG TOWER SHALL BE MOUNTED SUCH THAT ACCELERATION MEASUREMENTS ARE COLLECTED IN LONGITUDINAL DIRECTION.
   - 4.3. EACH UNI-AXIAL ACCELEROMETER REQUIRES 1 CHANNEL OF DATA ACQUISITION.
5. HALF BRIDGE STRAIN GAGES:
   - 5.1. HALF BRIDGE STRAIN GAGES SHALL BE INSTALLED ON MEMBERS 1, 3, 5 & 7 OF VERTICAL GUIDE POSTS AND SHALL MEASURE AXIAL STRAIN.
   - 5.2. EACH HALF BRIDGE STRAIN GAGE REQUIRES 1 CHANNEL OF DATA ACQUISITION.
6. BIAXIAL TILTMETERS:
   - 6.1. BIAXIAL TILTMETERS SHALL BE INSTALLED AT EACH TILMETER LOCATION ALONG THE SOUTH TOWER. SENSOR SHALL BE MOUNTED SUCH THAT IN PLANE ROTATION AND OUT OF PLANE ROTATION MEASUREMENTS ARE COLLECTED.
   - 6.2. EACH BIAXIAL TILTMETER REQUIRES 2 CHANNELS OF DATA ACQUISITION.

MONITORING EQUIPMENT

1. INSTRUMENTATION SHALL CONNECT INTO DATA ACQUISITION SYSTEMS - BDI STS4 TERMINAL NODES (4 AND 16 CHANNEL).
2. DATA ACQUISITION SYSTEMS SHALL CONNECT TO DATA LOGGER VIA POWER OVER ETHERNET CABLING.

EQUIPMENT INSTALLATION

1. SINGLE DATA LOGGER ON SITE SHALL BE LOCATED WITHIN STORAGE HOUSE ON SOUTH SIDE OF STRUCTURE.
2. DATA ACQUISITION SYSTEMS SHALL BE LOCATED AS ILLUSTRATED IN LTM - 04.

1 INSTRUMENTATION INSTALLATION

1. INSTRUMENTATION SHALL BE INSTALLED ON EAST FACE OF SOUTH TOWER DUE TO STAIRCASE ACCESS.
2. ANY SENSORS INSTALLED ABOVE ROADWAY (TOWER SENSORS) SHALL SECURED TO THE STRUCTURE WITH AN ADDITIONAL MECHANICAL SAFETY (CABLE, CORDELETTE, OR SIMILAR)
3. ROSETTE STRAIN GAGES
   - 3.1. GAGE AREA SHALL BE MARKED AND DEGREASED.
   - 3.2. COATING SHALL BE MECHANICALLY REMOVED FROM 3" X 3" AREA OF GAGE INSTALLATION UNTIL SURFACE ABNORMALITIES OR IMPERFECTIONS ARE REMOVED.
   - 3.3. GAGE SHALL BE ATTACHED TO STEEL USING CAPACITIVE DISCHARGE SPOT WELDER.
   - 3.4. ONCE GAGE INSTALLATION IS VERIFIED, AREA SHALL BE COVERED WITH ZINC SPRAY COATING.
4. HALF BRIDGE STRAIN GAGES
   - 4.1. GAGE ARE SHALL BE MARKED AND DEGREASED.
   - 4.2. COATING SHALL BE MECHANICALLY REMOVED FROM 2" X 2" AREA OF GAGE INSTALLATION UNTIL SURFACE ABNORMALITIES OR IMPERFECTIONS ARE REMOVED.
   - 4.3. GAGE SHALL BE ATTACHED TO STEEL USING CAPACITIVE DISCHARGE SPOT WELDER.
   - 4.4. ONCE GAGE INSTALLATION IS VERIFIED, AREA SHALL BE COVERED WITH ZINC SPRAY COATING.
5. UNIAXIAL STRAIN GAGES
   - 5.1. GAGE AREA SHALL BE MARKED AND DEGREASED.
   - 5.2. SENSOR SHALL BE ATTACHED TO CHORD FLANGE USING A MOUNTING TAB AND DEVCON UNDERWATER EPOXY.

BDI WILL NOT GUARANTEE SENSOR PERFORMANCE, PARTICULARLY ZERO SHIFT AND CREEP, FOR STRAIN GAGES INSTALLED ON METALIZED COATING AS THIS TYPE OF INSTALLATION FALLS OUTSIDE STANDARD BDI SENSOR INSTALLATION GUIDELINES.

6. ACCELEROMETERS
   - 6.1. SENSOR AREA SHALL BE MARKED AND DEGREASED.
   - 6.2. SENSOR SHALL BE ATTACHED TO CHORD FLANGE USING A MOUNTING TAB AND DEVCON UNDERWATER EPOXY.

BDI WILL NOT WARRANTY SENSOR ATTACHMENT VIA EPOXY MOUNTING

1 7. TILTMETERS
   - 7.1. SENSOR AREA SHALL BE MARKED AND DEGREASED.
   - 7.2. SENSOR SHALL BE ATTACHED TO TOWER CHORD USING TWO MOUNTING TABS AND DEVCON UNDERWATER EPOXY.

BDI WILL NOT WARRANTY SENSOR ATTACHMENT VIA EPOXY MOUNTING

8. COATING BOND STRENGTH
   - 8.1. ALL OF THE SENSOR INSTALLATION METHODS ARE BASED ON A CANAM SPECIFICATION OF 1000 psi TENSILE BOND STRENGTH BETWEEN MATERIAL AND BASE

FIELD DOCUMENTS

3. ANY MODIFICATIONS TO SHOP DRAWINGS SHALL BE DOCUMENTED IN THE FIELD BY BDI ENGINEERS

1 4. BDI RESERVES THE RIGHT TO MODIFY SENSOR LOCATIONS DUE TO FIELD CONDITIONS
   - 4.1. ANY SIGNIFICANT CHANGES SHALL BE SUBMITTED TO NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION FOR REVIEW AND APPROVAL

5. PHOTOGRAPHS
   - 5.1. EACH SENSOR LOCATION SHALL BE PHOTOGRAPHED NEAR TO SHOW GAGE ID'S AND FAR TO SHOW GAGE PROXIMITY, LOCATION, AND ORIENTATION
   - 5.2. OVERALL BRIDGE PHOTOS SHALL BE TAKEN
   - 5.3. PHOTOGRAPHS OF FINAL INSTALLATION OF DATA LOGGERS, JUNCTION BOXES, AND ANY ADDITIONAL HARDWARE SHALL BE TAKEN
   - 5.4. PHOTOGRAPHS OF THE GENERAL AREA OF INSTRUMENTATION SHALL BE TAKEN

INSTRUMENTATION PLAN NOTES

1. ROSETTE GAGE QUANTITY ([#]) INDICATES NUMBER OF ROSETTE GAGES IN DESIGNATED SECTION.

GENERAL NOTES

1. ACCELEROMETERS INSTALLED ALONG TOP & BOTTOM CHORD OF FIXED TRUSS SPAN SHALL BE MOUNTED TO UNDERSIDE OF TOP FLANGE.
2. ACCELEROMETER LONGITUDINAL LOCATION ALONG TOP & BOTTOM CHORD OF FIXED TRUSS SPAN SHALL BE LINED WITH CENTER OF MIDDLE ARC WITHIN TRUSS JOINT AND SHALL BE LOCATED USING A PLUMB BOB.
3. REFERENCE LINES ARE SHOWN AS AN AID TO MEASURE OUT LOCATION OF SENSORS ALONG SOUTH FIXED TRUSS SPAN AND SOUTH TOWER.

2 4. REFERENCE LINE 1 SHALL BE MARKED OUT FROM INSIDE EDGE OF END ARC WITHIN TRUSS JOINT TO OPPOSITE FLANGE. REFERENCE LINE SHALL BE PERPENDICULAR TO CHORD FLANGE.

5. REFERENCE LINE 2 SHALL BE MARKED OUT HORIZONTALLY ACROSS TRUSS JOINT SUCH THAT LINE INTERSECTS WITH INSIDE EDGE OF ARC.
6. ACCELEROMETERS INSTALLED ALONG EAST FACE OF SOUTH TOWER SHALL BE MOUNTED TO NORTH SIDE OF SOUTHERN FLANGE ALONG NORTH COLUMN.
7. BIAXIAL TILTMETERS SHALL BE INSTALLED AT EACH DESIGNATED TILTMETER LOCATION ALONG NORTH COLUMN OF SOUTH TOWER. FIRST TILTMETER SHALL BE INSTALLED ON NORTH SIDE OF SOUTHERN FLANGE AND ORIENTED TO MEASURE OUT OF PLANE ROTATION. SECOND TILTMETER SHALL BE INSTALLED ALONG CHORD WEB CENTERLINE AND ORIENTED TO MEASURE IN PLANE ROTATION.
8. ADDITIONAL INSTRUMENTATION SHALL BE INSTALLED ON MEMBERS 1, 3, 5, & 7 OF VERTICAL GUIDE POSTS ON PORTSMOUTH-SIDE OF PIER 2.

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GENERAL NOTES

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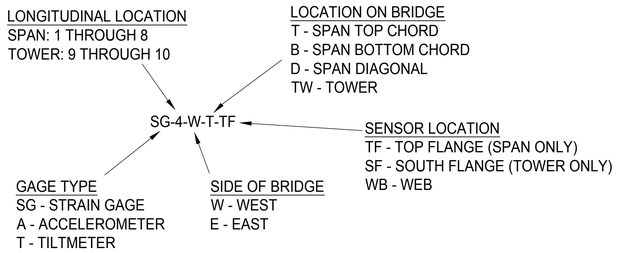
GAGE LEGEND & SPECIFICATION

SYMBOL	TYPE	BRAND	MODEL	NOTES
	ROSETTE STRAIN GAGE	HPI	HBWR-35-125-6-VR	
	UNIAXIAL STRAIN GAGE	BDI	ST350	
	ACCELEROMETER	BDI	UA1512-002	±2g RANGE
	TILTMETER	BDI	T500-030	±3.0° RANGE
	HALF BRIDGE STRAIN GAGE			

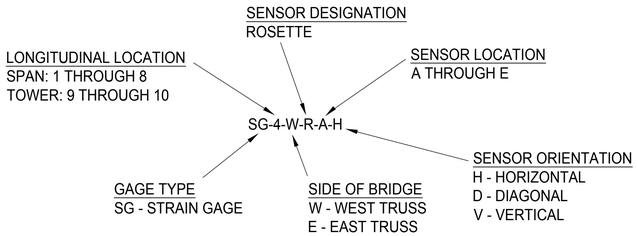
TOTAL SENSOR COUNT

ROSETTE STRAIN GAGE	(16)	[48CH]
UNIAXIAL STRAIN GAGE	(2)	[2CH]
ACCELEROMETER	(12)	[12CH]
TILTMETER	(2)	[4CH]
HALF BRIDGE STRAIN GAGE	(8)	[8CH]
TOTAL	(40)	[74CH]

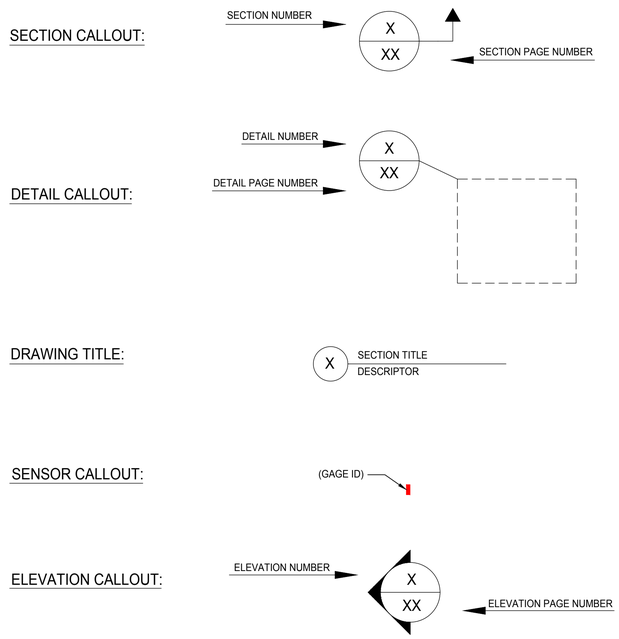
TYPICAL SENSOR LABELING SCHEME



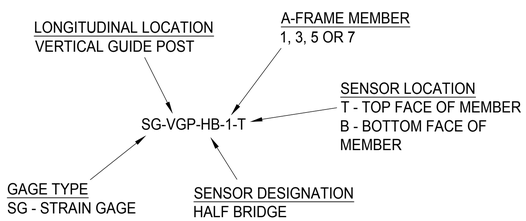
ALTERNATIVE NAMING FOR ROSETTES



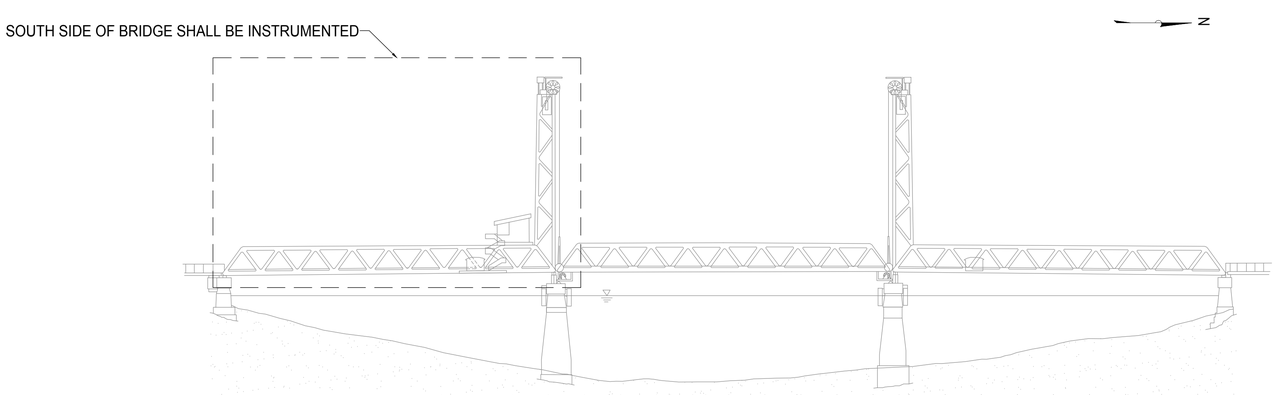
ANNOTATION KEY



ALTERNATIVE NAMING FOR HALF BRIDGE STRAIN GAGES



LOCATION KEY



INDEX OF SHEETS

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LTM - 05	LOCATION 1 INSTALLATION
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LTM - 07	LOCATION 3 INSTALLATION
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LTM - 09	LOCATION 5 INSTALLATION
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LTM - 12	CONDUIT DIAGRAM
LTM - 13	SENSOR INSTALLATION (1)
LTM - 14	SENSOR INSTALLATION (2)

INDEX OF REVISIONS

NO.	DATE	REVISION DESCRIPTION
V0.1	05/02/2016	INITIAL PLANS - PRE-INSTALL
V0.2	06/06/2016	ROSETTE STRAIN GAGE QUANTITY CHANGE
REV 1	7/6/2016	NHDOT REVIEW
V1.1	12/15/2016	ADDITIONAL STRAIN GAGES FOR GUIDE POST CHANGE IN LOCATION OF TOWER INSTRUMENTATION
V3.0	03/27/2017	FINAL INSTRUMENTATION - POST INSTALL
BDI REFERENCE NUMBER: 151104 - NH		
CLIENT PROJECT NUMBER:		

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OVERALL LEGEND

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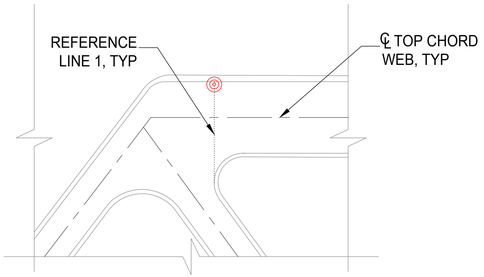
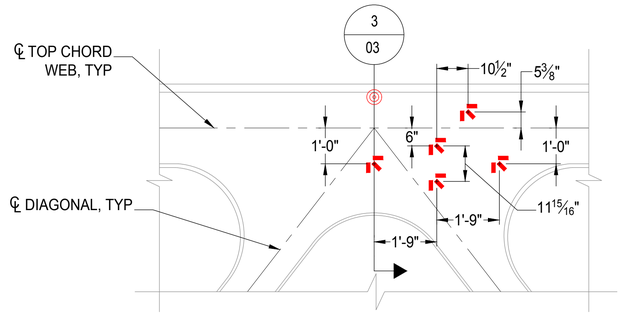
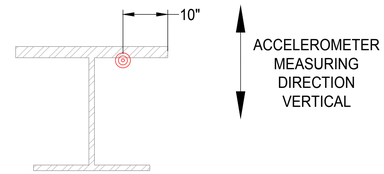


1 ACCELEROMETER INSTRUMENTATION
TOP CHORD ENDSPAN - ELEVATION VIEW

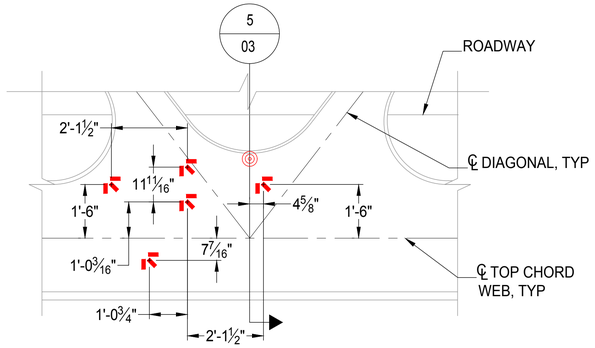


2 ROSETTE & ACCELEROMETER INSTRUMENTATION
TOP CHORD MIDSPAN - ELEVATION VIEW

NOTE: WEST ELEVATION DOES NOT INCLUDE ROSETTE STRAIN GAGES (1)

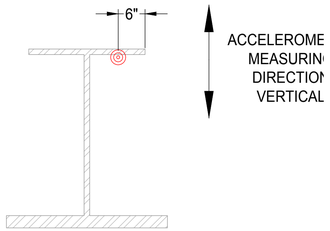


3 ACCELEROMETER INSTRUMENTATION, TYP
TOP CHORD MIDSPAN - SECTION VIEW

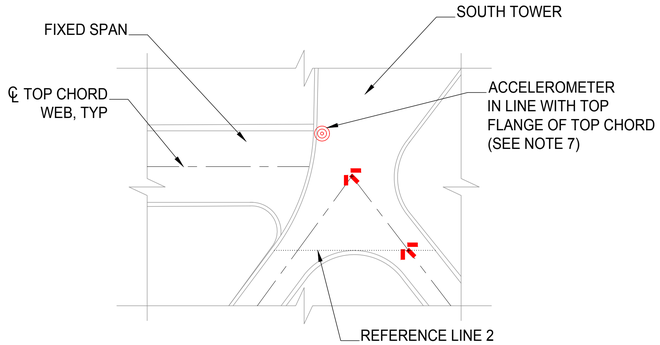


4 ROSETTE & ACCELEROMETER INSTRUMENTATION
BOTTOM CHORD MIDSPAN - ELEVATION VIEW

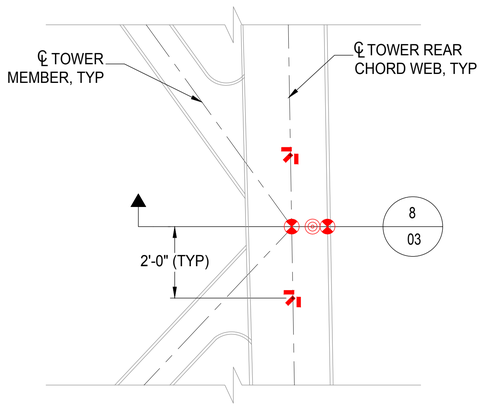
NOTE: WEST ELEVATION DOES NOT INCLUDE ROSETTE STRAIN GAGES (1)



5 ACCELEROMETER INSTRUMENTATION, TYP
BOTTOM CHORD MIDSPAN - SECTION VIEW

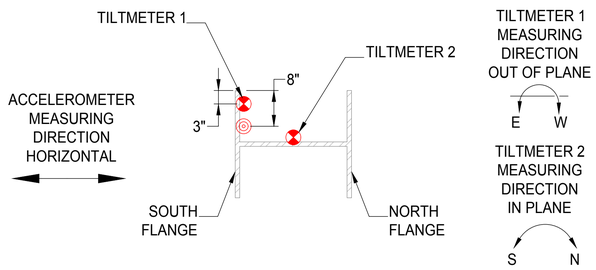


6 ROSETTE & ACCELEROMETER INSTRUMENTATION
TOWER BOTTOM - ELEVATION VIEW



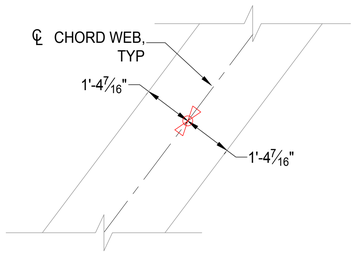
(2) 7 ROSETTE, TILTMETER & ACCELEROMETER INSTRUMENTATION
NORTH COLUMN OF SOUTH TOWER - ELEVATION VIEW

NOTE: DURING INSTALLATION, LOCATIONS OF ACCELEROMETERS AND TILTMETERS ALONG TOWER CHANGED. THESE CHANGES IN LOCATION ARE MARKED ON DETAILED SECTION DRAWINGS ON SUBSEQUENT PAGES.



8 TILTMETER & ACCELEROMETER INSTRUMENTATION, TYP
NORTH COLUMN OF SOUTH TOWER - SECTION VIEW

NOTE: TILTMETER AND ACCELEROMETER INSTRUMENTATION IS TYPICAL FOR BOTH INSTRUMENTED SECTIONS ALONG TOWER (1)



(1) 9 UNIAXIAL INSTRUMENTATION
TOWER MIDSPAN - ELEVATION VIEW

SENSOR LEGEND

- ROSETTE STRAIN GAGE
- UNIAXIAL STRAIN GAGE
- ACCELEROMETER
- TILTMETER

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TYPICAL DETAILS

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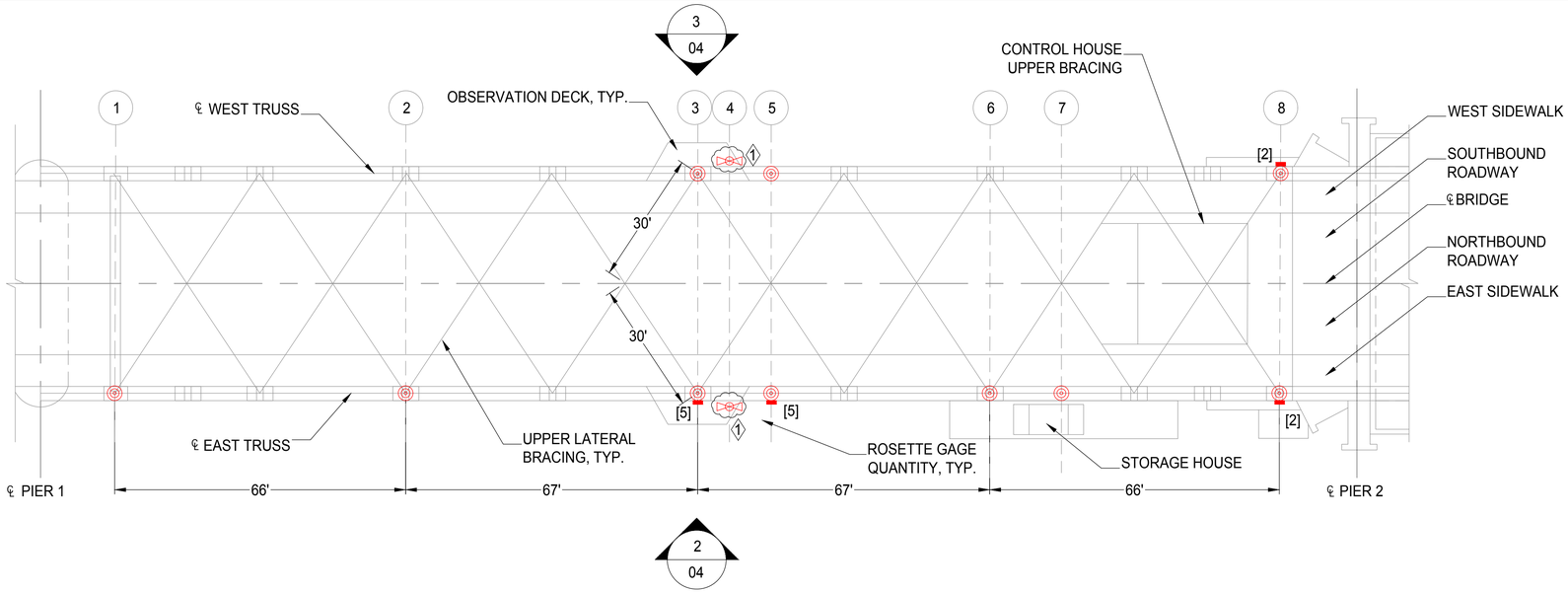
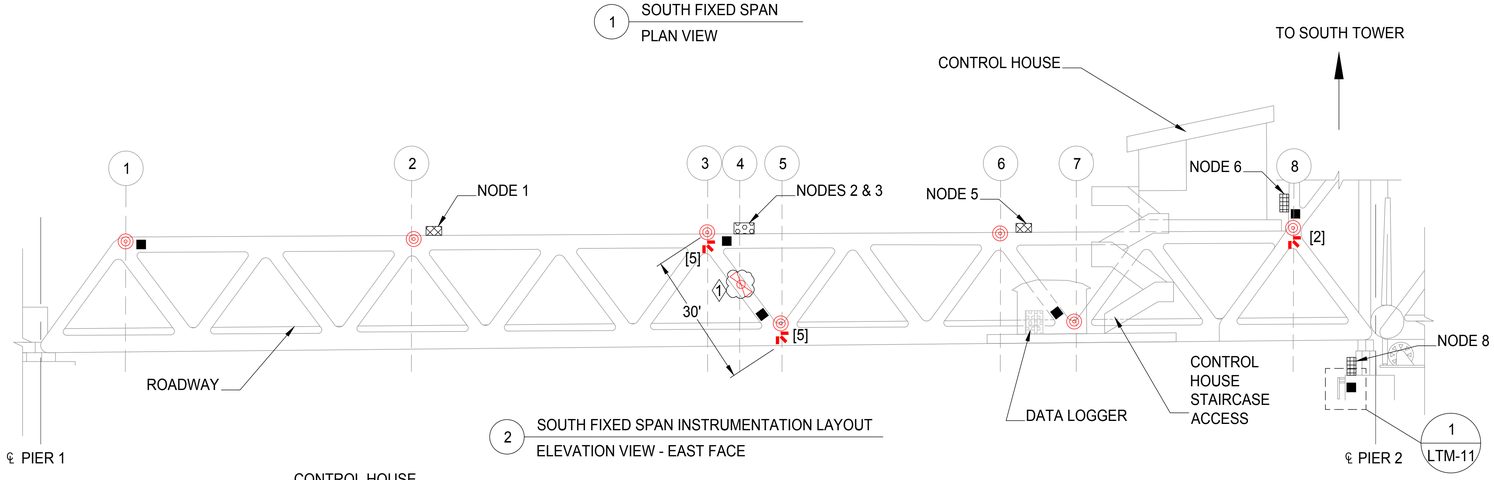
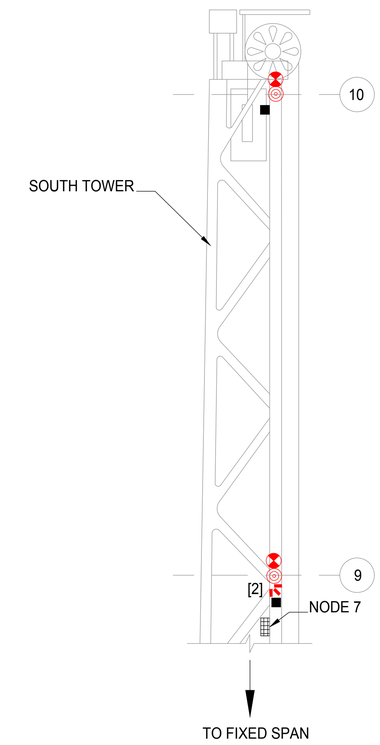


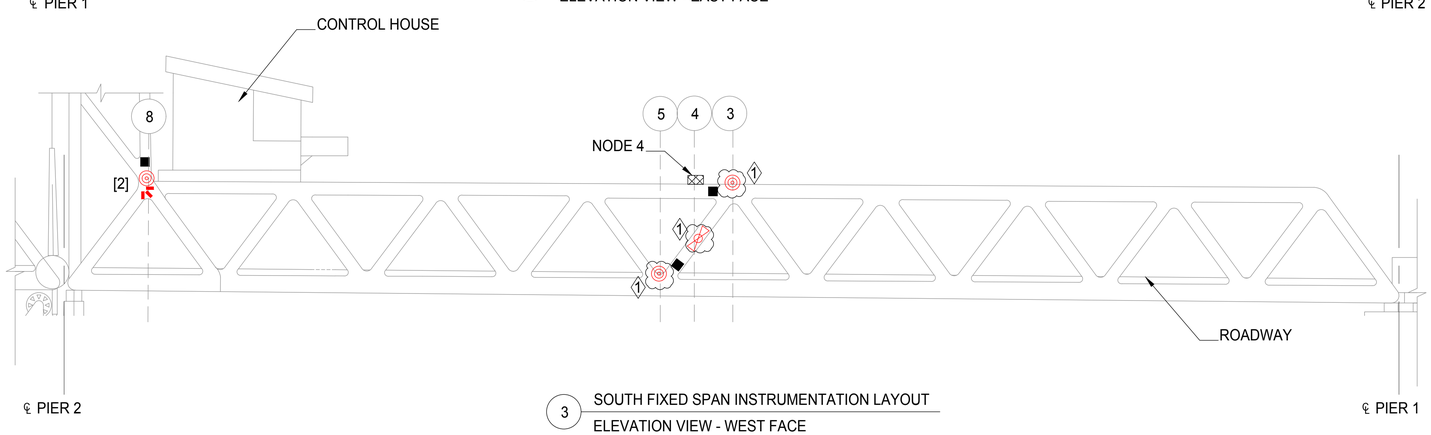
1 SOUTH FIXED SPAN
PLAN VIEW



2 SOUTH FIXED SPAN INSTRUMENTATION LAYOUT
ELEVATION VIEW - EAST FACE



4 SOUTH TOWER INSTRUMENTATION LAYOUT
ELEVATION VIEW - EAST FACE



3 SOUTH FIXED SPAN INSTRUMENTATION LAYOUT
ELEVATION VIEW - WEST FACE

NOTES:

1. CONTROL HOUSE UPPER BRACING IN PLANE WITH UPPER LATERAL BRACING MEMBERS.
2. PLAN VIEW ILLUSTRATED IN SECTION 1 IS FOR DIMENSIONAL PURPOSES ONLY.
3. FURTHER INSTRUMENTATION DETAILS PROVIDED IN LTM-05 THROUGH LTM-10.

SENSOR LEGEND

- ROSETTE STRAIN GAGE (ELEVATION, PLAN)
- UNIAXIAL STRAIN GAGE
- ACCELEROMETER
- TILTMETER

ENCLOSURE LEGEND	QUANTITY
BREAKOUT BOX (8" X 8" X 6")	11
4 CHANNEL DAQ ENCLOSURE (14" X 12" X 8")	3
16 CHANNEL DAQ ENCLOSURE (16" X 14" X 8")	3
TWO 16 CHANNEL DAQ ENCLOSURE (18" X 16" X 10")	1

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MONITORING OF THE MEMORIAL BRIDGE
IN PORTSMOUTH, NH

Drawn By:	DSH
Checked By:	JDS
Date:	12/09/2016
Client No.:	
BDI No.:	151104-NH
SCALE:	NTS

OVERALL
INSTRUMENTATION
LTM-04

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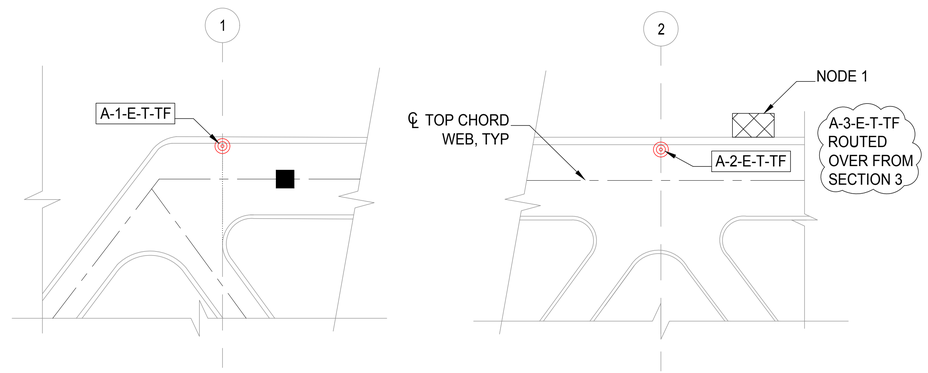
LOCATION 1: NODE 1							
LONGITUDINAL LOCATION	SIDE OF BRIDGE	LOCATION ON BRIDGE	SENSOR LOCATION	ROSETTE STRAIN GAGE QUANTITY	UNAXIAL STRAIN GAGE QUANTITY	ACCELEROMETER QUANTITY	TILTMETER QUANTITY
1	EAST	SPAN TOP CHORD	BOTTOM FACE OF TOP FLANGE	-	-	1	-
2	EAST	SPAN TOP CHORD	BOTTOM FACE OF TOP FLANGE	-	-	1	-
3	EAST	SPAN TOP CHORD	BOTTOM FACE OF TOP FLANGE	-	-	1	-
			TOTAL	-	-	3	-

NODE TE4-107

WIRING							
SENSOR CALLOUT	SENSOR LINE	SENSOR WIRE	FROM COMPLETION	BLACK CABLE WIRE	NODE ID	NODE CHANNEL	SENSOR ID
A-1-E-T-TF	S+	GREEN	-	-	1	1	A1157
	S-	WHITE	-	-			
	E+	RED	-	-			
	E-	BLACK	-	-			
A-2-E-T-TF	S+	GREEN	-	-		2	A1165
	S-	WHITE	-	-			
	E+	RED	-	-			
	E-	BLACK	-	-			
A-3-E-T-TF	S+	GREEN	-	-		3	A1167
	S-	WHITE	-	-			
	E+	RED	-	-			
	E-	BLACK	-	-			



1 LOCATION 1 INSTRUMENTATION
ELEVATION VIEW - EAST FACE

NOTES:
1. ACCELEROMETER CABLING SHALL CONNECT DIRECTLY TO TERMINAL INPUT OF NODE.

SENSOR LEGEND

- ROSETTE STRAIN GAGE (ELEVATION, PLAN)
- UNIAXIAL STRAIN GAGE
- ACCELEROMETER
- TILTMETER

ENCLOSURE LEGEND	QUANTITY
BREAKOUT BOX (8" X 8" X 6")	11
4 CHANNEL DAQ ENCLOSURE (14" X 12" X 8")	3
16 CHANNEL DAQ ENCLOSURE (16" X 14" X 8")	3
TWO 16 CHANNEL DAQ ENCLOSURE (18" X 16" X 10")	1

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REVISIONS
1 NHDOT REVIEW

CLIENT
UNH
33 ACADEMIC WAY
DURHAM, NH 03824

PROJECT NAME
UNIVERSITY OF NEW HAMPSHIRE
MONITORING OF THE MEMORIAL BRIDGE
IN PORTSMOUTH, NH

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LOCATION 1
INSTALLATION
LTM-05

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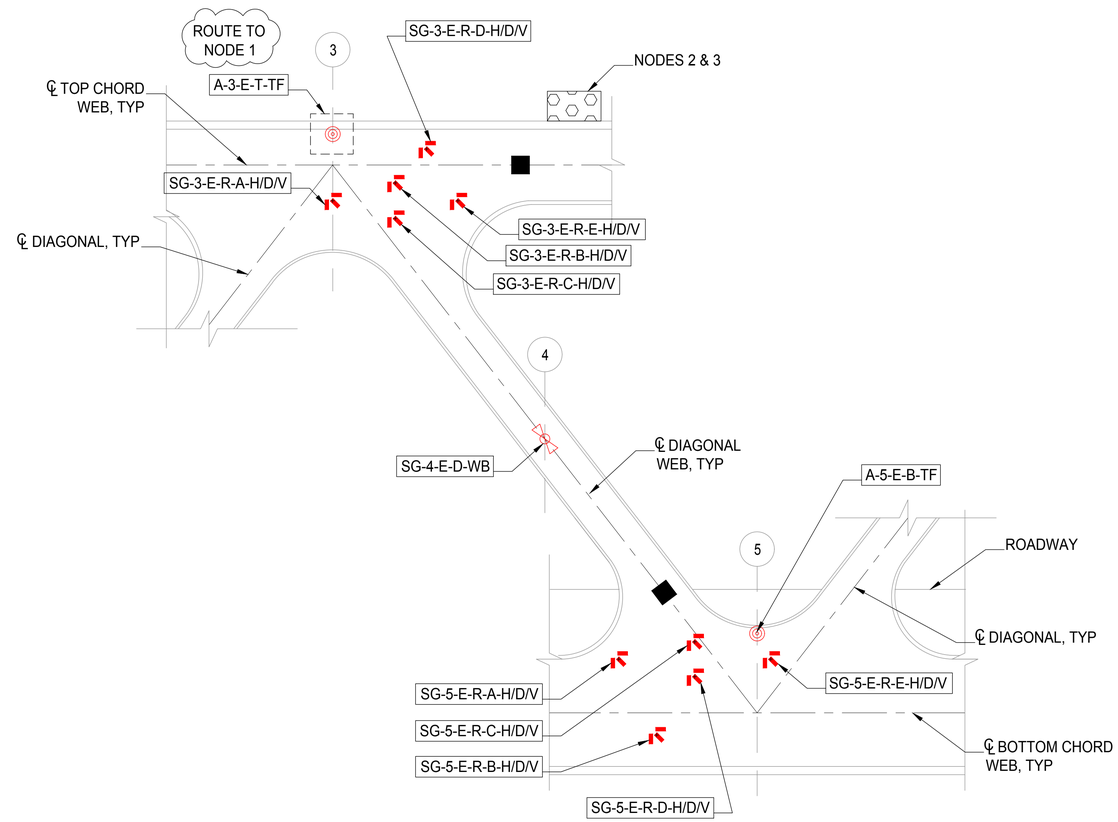
LOCATION 2: NODES 2 & 3							
LONGITUDINAL LOCATION	SIDE OF BRIDGE	LOCATION ON BRIDGE	SENSOR LOCATION	ROSETTE STRAIN GAGE QUANTITY	UNAXIAL STRAIN GAGE QUANTITY	ACCELEROMETER QUANTITY	TILTMETER QUANTITY
3	EAST	SPAN TOP CHORD	WEB	5	-	-	-
4	EAST	SPAN DIAGONAL	WEB	-	1	-	-
5	EAST	SPAN BOTTOM CHORD	BOTTOM FACE OF TOP FLANGE	-	-	1	-
5	EAST	SPAN BOTTOM CHORD	WEB	5	-	-	-
			TOTAL	10 [30 CH.]	1	1	-

NODE TE16-125

WIRING								
SENSOR CALLOUT	SENSOR LINE	SENSOR WIRE	FROM COMPLETION	BLACK CABLE WIRE	BLACK CABLE ID	NODE ID	NODE CHANNEL	SENSOR ID
SG-3-E-R-A-H	S+	-	GREEN	BLACK (WHITE)	3-A	2	1	
	S-	WHITE	WHITE	WHITE (BLACK)				
	E+	RED	RED	BLUE (BLACK)				
	E-	BLACK	BLACK	BLACK (BLUE)				
SG-3-E-R-A-D	S+	-	GREEN	BLACK (GREEN)	3-A		2	
	S-	WHITE	WHITE	GREEN (BLACK)				
	E+	RED	RED	RED (BLACK)				
	E-	BLACK	BLACK	BLACK (RED)				
SG-3-E-R-A-V	S+	-	GREEN	BLACK (YELLOW)	3-A		3	
	S-	WHITE	WHITE	YELLOW (BLACK)				
	E+	RED	RED	BROWN (BLACK)				
	E-	BLACK	BLACK	BLACK (BROWN)				
SG-3-E-R-B-H	S+	-	GREEN	BLACK (WHITE)	3-B		4	
	S-	WHITE	WHITE	WHITE (BLACK)				
	E+	RED	RED	BLUE (BLACK)				
	E-	BLACK	BLACK	BLACK (BLUE)				
SG-3-E-R-B-D	S+	-	GREEN	BLACK (GREEN)	3-B		5	
	S-	WHITE	WHITE	GREEN (BLACK)				
	E+	RED	RED	RED (BLACK)				
	E-	BLACK	BLACK	BLACK (RED)				
SG-3-E-R-B-V	S+	-	GREEN	BLACK (YELLOW)	3-B		6	
	S-	WHITE	WHITE	YELLOW (BLACK)				
	E+	RED	RED	BROWN (BLACK)				
	E-	BLACK	BLACK	BLACK (BROWN)				
SG-3-E-R-C-H	S+	-	GREEN	BLACK (WHITE)	3-C		7	
	S-	WHITE	WHITE	WHITE (BLACK)				
	E+	RED	RED	BLUE (BLACK)				
	E-	BLACK	BLACK	BLACK (BLUE)				
SG-3-E-R-C-D	S+	-	GREEN	BLACK (GREEN)	3-C		8	
	S-	WHITE	WHITE	GREEN (BLACK)				
	E+	RED	RED	RED (BLACK)				
	E-	BLACK	BLACK	BLACK (RED)				
SG-3-E-R-C-V	S+	-	GREEN	BLACK (YELLOW)	3-C		9	
	S-	WHITE	WHITE	YELLOW (BLACK)				
	E+	RED	RED	BROWN (BLACK)				
	E-	BLACK	BLACK	BLACK (BROWN)				
SG-3-E-R-D-H	S+	-	GREEN	BLACK (WHITE)	3-D		10	
	S-	WHITE	WHITE	WHITE (BLACK)				
	E+	RED	RED	BLUE (BLACK)				
	E-	BLACK	BLACK	BLACK (BLUE)				
SG-3-E-R-D-D	S+	-	GREEN	BLACK (GREEN)	3-D		11	
	S-	WHITE	WHITE	GREEN (BLACK)				
	E+	RED	RED	RED (BLACK)				
	E-	BLACK	BLACK	BLACK (RED)				
SG-3-E-R-D-V	S+	-	GREEN	BLACK (YELLOW)	3-D		12	
	S-	WHITE	WHITE	YELLOW (BLACK)				
	E+	RED	RED	BROWN (BLACK)				
	E-	BLACK	BLACK	BLACK (BROWN)				
SG-3-E-R-E-H	S+	-	GREEN	BLACK (WHITE)	3-E		13	
	S-	WHITE	WHITE	WHITE (BLACK)				
	E+	RED	RED	BLUE (BLACK)				
	E-	BLACK	BLACK	BLACK (BLUE)				
SG-3-E-R-E-D	S+	-	GREEN	BLACK (GREEN)	3-E		14	
	S-	WHITE	WHITE	GREEN (BLACK)				
	E+	RED	RED	RED (BLACK)				
	E-	BLACK	BLACK	BLACK (RED)				
SG-3-E-R-E-V	S+	-	GREEN	BLACK (YELLOW)	3-E		15	
	S-	WHITE	WHITE	YELLOW (BLACK)				
	E+	RED	RED	BROWN (BLACK)				
	E-	BLACK	BLACK	BLACK (BROWN)				
SG-4-E-D-WB	S+	GREEN	-	-	-		16	B6148
	S-	WHITE	-	-				
	E+	RED	-	-				
	E-	BLACK	-	-				

NODE TE16-122

WIRING (CONT'D)								
SENSOR CALLOUT	SENSOR LINE	SENSOR WIRE	FROM COMPLETION	BLACK CABLE WIRE	BLACK CABLE ID	NODE ID	NODE CHANNEL	SENSOR ID
SG-5-E-R-A-H	S+	-	GREEN	BLACK (WHITE)	5-A	3	1	
	S-	WHITE	WHITE	WHITE (BLACK)				
	E+	RED	RED	BLUE (BLACK)				
	E-	BLACK	BLACK	BLACK (BLUE)				
SG-5-E-R-A-D	S+	-	GREEN	BLACK (GREEN)	5-A		2	
	S-	WHITE	WHITE	GREEN (BLACK)				
	E+	RED	RED	RED (BLACK)				
	E-	BLACK	BLACK	BLACK (RED)				
SG-5-E-R-A-V	S+	-	GREEN	BLACK (YELLOW)	5-A		3	
	S-	WHITE	WHITE	YELLOW (BLACK)				
	E+	RED	RED	BROWN (BLACK)				
	E-	BLACK	BLACK	BLACK (BROWN)				
SG-5-E-R-B-H	S+	-	GREEN	BLACK (WHITE)	5-B		4	
	S-	WHITE	WHITE	WHITE (BLACK)				
	E+	RED	RED	BLUE (BLACK)				
	E-	BLACK	BLACK	BLACK (BLUE)				
SG-5-E-R-B-D	S+	-	GREEN	BLACK (GREEN)	5-B		5	
	S-	WHITE	WHITE	GREEN (BLACK)				
	E+	RED	RED	RED (BLACK)				
	E-	BLACK	BLACK	BLACK (RED)				
SG-5-E-R-B-V	S+	-	GREEN	BLACK (YELLOW)	5-B		6	
	S-	WHITE	WHITE	YELLOW (BLACK)				
	E+	RED	RED	BROWN (BLACK)				
	E-	BLACK	BLACK	BLACK (BROWN)				
SG-5-E-R-C-H	S+	-	GREEN	BLACK (WHITE)	5-C		7	
	S-	WHITE	WHITE	WHITE (BLACK)				
	E+	RED	RED	BLUE (BLACK)				
	E-	BLACK	BLACK	BLACK (BLUE)				
SG-5-E-R-C-D	S+	-	GREEN	BLACK (GREEN)	5-C		8	
	S-	WHITE	WHITE	GREEN (BLACK)				
	E+	RED	RED	RED (BLACK)				
	E-	BLACK	BLACK	BLACK (RED)				
SG-5-E-R-C-V	S+	-	GREEN	BLACK (YELLOW)	5-C		9	
	S-	WHITE	WHITE	YELLOW (BLACK)				
	E+	RED	RED	BROWN (BLACK)				
	E-	BLACK	BLACK	BLACK (BROWN)				
SG-5-E-R-D-H	S+	-	GREEN	BLACK (WHITE)	5-D		10	
	S-	WHITE	WHITE	WHITE (BLACK)				
	E+	RED	RED	BLUE (BLACK)				
	E-	BLACK	BLACK	BLACK (BLUE)				
SG-5-E-R-D-D	S+	-	GREEN	BLACK (GREEN)	5-D		11	
	S-	WHITE	WHITE	GREEN (BLACK)				
	E+	RED	RED	RED (BLACK)				
	E-	BLACK	BLACK	BLACK (RED)				
SG-5-E-R-D-V	S+	-	GREEN	BLACK (YELLOW)	5-D		12	
	S-	WHITE	WHITE	YELLOW (BLACK)				
	E+	RED	RED	BROWN (BLACK)				
	E-	BLACK	BLACK	BLACK (BROWN)				
SG-5-E-R-E-H	S+	-	GREEN	BLACK (WHITE)	5-E		13	
	S-	WHITE	WHITE	WHITE (BLACK)				
	E+	RED	RED	BLUE (BLACK)				
	E-	BLACK	BLACK	BLACK (BLUE)				
SG-5-E-R-E-D	S+	-	GREEN	BLACK (GREEN)	5-E		14	
	S-	WHITE	WHITE	GREEN (BLACK)				
	E+	RED	RED	RED (BLACK)				
	E-	BLACK	BLACK	BLACK (RED)				
SG-5-E-R-E-V	S+	-	GREEN	BLACK (YELLOW)	5-E		15	
	S-	WHITE	WHITE	YELLOW (BLACK)				
	E+	RED	RED	BROWN (BLACK)				
	E-	BLACK	BLACK	BLACK (BROWN)				
A-5-E-B-TF	S+	GREEN	-	-	-		16	A1160
	S-	WHITE	-	-				
	E+	RED	-	-				
	E-	BLACK	-	-				



1 LOCATION 2 INSTRUMENTATION
ELEVATION VIEW - EAST FACE

NOTES:

1. ACCELEROMETER AND UNIAXIAL STRAIN GAGE CABLING SHALL CONNECT DIRECTLY TO TERMINAL INPUT OF NODE.
2. ROSETTE STRAIN GAGE CABLING SHALL ROUTE TO COMPLETION UNIT WITHIN BREAKOUT BOX. GEOKON BLACK CABLE SHALL RUN FROM BREAKOUT BOX TO TERMINAL INPUT OF NODE.
3. ALL ROSETTE STRAIN GAGES SHALL BE INSTALLED ON CHORD WEB.

SENSOR LEGEND

- ROSETTE STRAIN GAGE (ELEVATION, PLAN)
- UNIAXIAL STRAIN GAGE
- ACCELEROMETER
- TILTMETER

ENCLOSURE LEGEND	QUANTITY
BREAKOUT BOX (8" X 8" X 6")	11
4 CHANNEL DAQ ENCLOSURE (14" X 12" X 8")	3
16 CHANNEL DAQ ENCLOSURE (16" X 14" X 8")	3
TWO 16 CHANNEL DAQ ENCLOSURE (18" X 16" X 10")	1

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REVISIONS
1 NHDOT REVIEW

CLIENT
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DURHAM, NH 03824

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SCALE:	NTS

LOCATION 2
INSTALLATION
LTM-06

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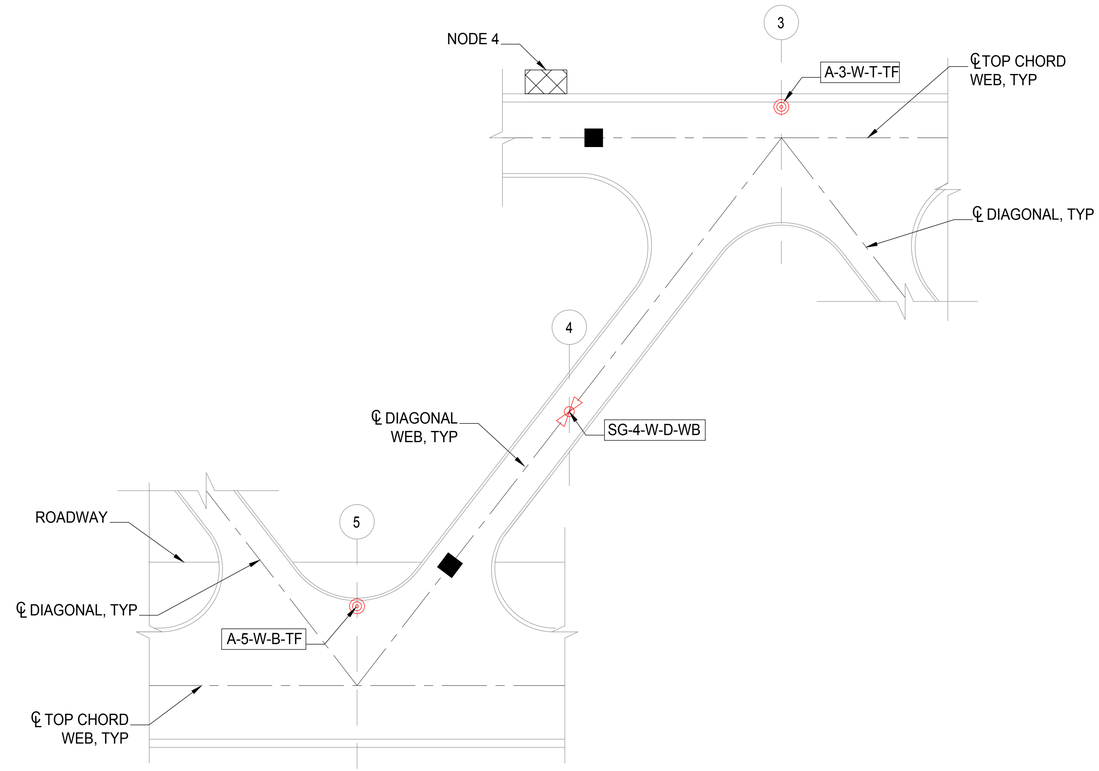
LOCATION 3: NODE 4							
LONGITUDINAL LOCATION	SIDE OF BRIDGE	LOCATION ON BRIDGE	SENSOR LOCATION	ROSETTE STRAIN GAGE QUANTITY	UNAXIAL STRAIN GAGE QUANTITY	ACCELEROMETER QUANTITY	TILTMETER QUANTITY
3	WEST	SPAN TOP CHORD	BOTTOM FACE OF TOP FLANGE	-	-	1	-
4	WEST	SPAN DIAGONAL	WEB	-	1	-	-
5	WEST	SPAN BOTTOM CHORD	BOTTOM FACE OF TOP FLANGE	-	-	1	-
			TOTAL	-	1	2	-

NODE TE4-106

WIRING								
SENSOR CALLOUT	SENSOR LINE	SENSOR WIRE	FROM COMPLETION	BLACK CABLE WIRE	BLACK CABLE ID	NODE ID	NODE CHANNEL	SENSOR ID
A-3-W-T-TF	S+	GREEN	-	-	-	4	1	A1164
	S-	WHITE	-	-				
	E+	RED	-	-				
	E-	BLACK	-	-				
SG-4-W-D-WB	S+	GREEN	-	-	-		2	B6149
	S-	WHITE	-	-				
	E+	RED	-	-				
	E-	BLACK	-	-				
A-5-W-B-TF	S+	GREEN	-	-	-		3	A1158
	S-	WHITE	-	-				
	E+	RED	-	-				
	E-	BLACK	-	-				



1 LOCATION 3 INSTRUMENTATION
ELEVATION VIEW - WEST FACE

NOTES:

1. ACCELEROMETER AND UNIAXIAL STRAIN GAGE CABLING SHALL CONNECT DIRECTLY TO TERMINAL INPUT OF NODE.

SENSOR LEGEND

- ROSETTE STRAIN GAGE (ELEVATION, PLAN)
- UNIAXIAL STRAIN GAGE
- ACCELEROMETER
- TILTMETER

ENCLOSURE LEGEND	QUANTITY
BREAKOUT BOX (8" X 8" X 6")	11
4 CHANNEL DAQ ENCLOSURE (14" X 12" X 8")	3
16 CHANNEL DAQ ENCLOSURE (16" X 14" X 8")	3
TWO 16 CHANNEL DAQ ENCLOSURE (18" X 16" X 10")	1

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1 NHDOT REVIEW

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SCALE:	NTS

LOCATION 3
INSTALLATION
LTM-07

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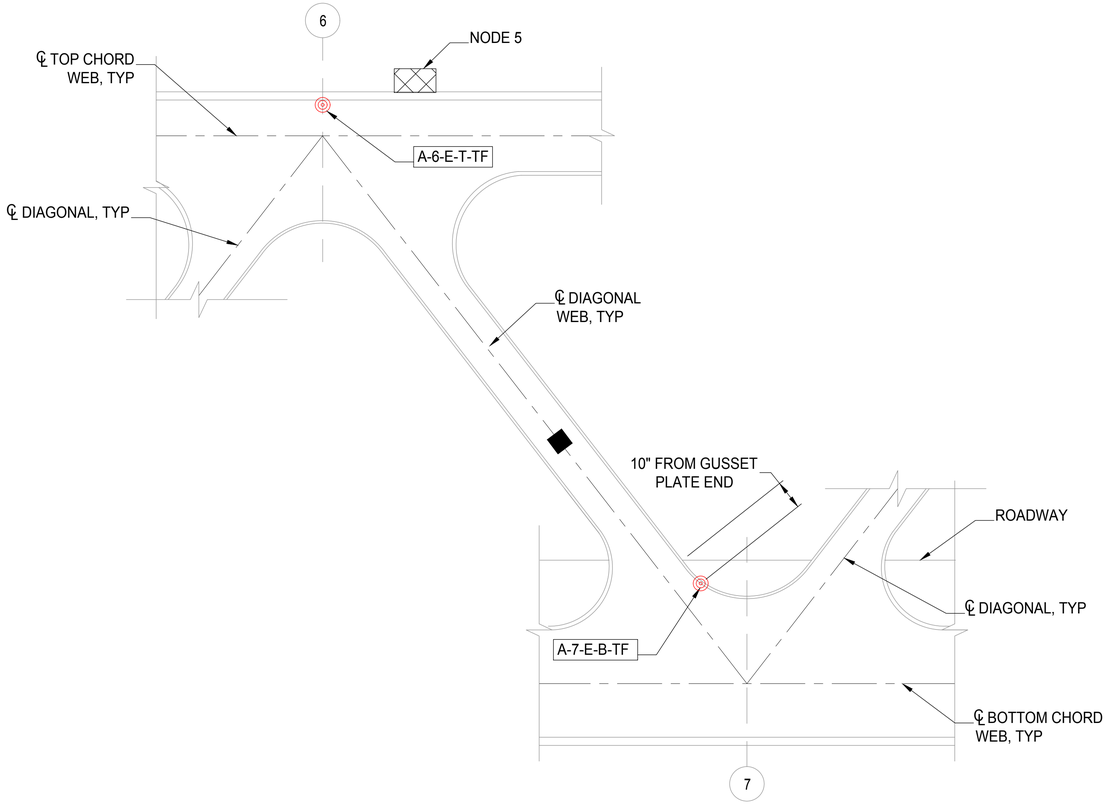
LOCATION 4: NODE 5							
LONGITUDINAL LOCATION	SIDE OF BRIDGE	LOCATION ON BRIDGE	SENSOR LOCATION	ROSETTE STRAIN GAGE QUANTITY	UNAXIAL STRAIN GAGE QUANTITY	ACCELEROMETER QUANTITY	TILTMETER QUANTITY
6	EAST	SPAN TOP CHORD	BOTTOM FACE OF TOP FLANGE	-	-	1	-
7	EAST	SPAN BOTTOM CHORD	BOTTOM FACE OF TOP FLANGE	-	-	1	-
			TOTAL	-	-	2	-

NODE TE4-108

WIRING								
SENSOR CALLOUT	SENSOR LINE	SENSOR WIRE	FROM COMPLETION	BLACK CABLE WIRE	BLACK CABLE ID	NODE ID	NODE CHANNEL	SENSOR ID
A-6-E-T-TF	S+	GREEN	-	-	-	5	1	A1163
	S-	WHITE	-	-				
	E+	RED	-	-				
	E-	BLACK	-	-				
A-7-E-B-TF	S+	GREEN	-	-	-		2	A1162
	S-	WHITE	-	-				
	E+	RED	-	-				
	E-	BLACK	-	-				



1 LOCATION 4 INSTRUMENTATION
ELEVATION VIEW - EAST FACE

NOTES:
1. ACCELEROMETER AND UNIAXIAL STRAIN GAGE CABLING SHALL CONNECT DIRECTLY TO TERMINAL INPUT OF NODE.

SENSOR LEGEND
- ROSETTE STRAIN GAGE (ELEVATION, PLAN)
- UNIAXIAL STRAIN GAGE
- ACCELEROMETER
- TILTMETER

ENCLOSURE LEGEND	QUANTITY
BREAKOUT BOX (8" X 8" X 6")	11
4 CHANNEL DAQ ENCLOSURE (14" X 12" X 8")	3
16 CHANNEL DAQ ENCLOSURE (16" X 14" X 8")	3
TWO 16 CHANNEL DAQ ENCLOSURE (18" X 16" X 10")	1

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SCALE:	NTS

LOCATION 4
INSTALLATION
LTM-08

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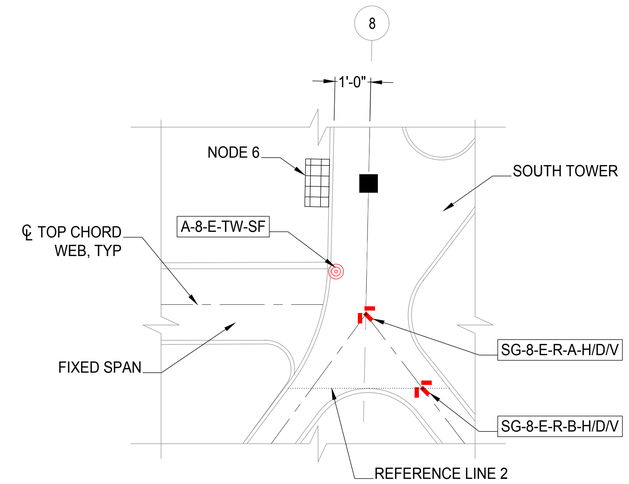
LOCATION 5: NODE 6							
LONGITUDINAL LOCATION	SIDE OF BRIDGE	LOCATION ON BRIDGE	SENSOR LOCATION	ROSETTE STRAIN GAGE QUANTITY	UNAXIAL STRAIN GAGE QUANTITY	ACCELEROMETER QUANTITY	TILTMETER QUANTITY
8	EAST	TOWER	NORTH FACE OF SOUTH FLANGE	-	-	1	-
8	EAST	TOWER	WEB	2	-	-	-
8	WEST	TOWER	NORTH FACE OF SOUTH FLANGE	-	-	1	-
8	WEST	TOWER	WEB	2	-	-	-
			TOTAL	4 [12 CH.]	-	2	-

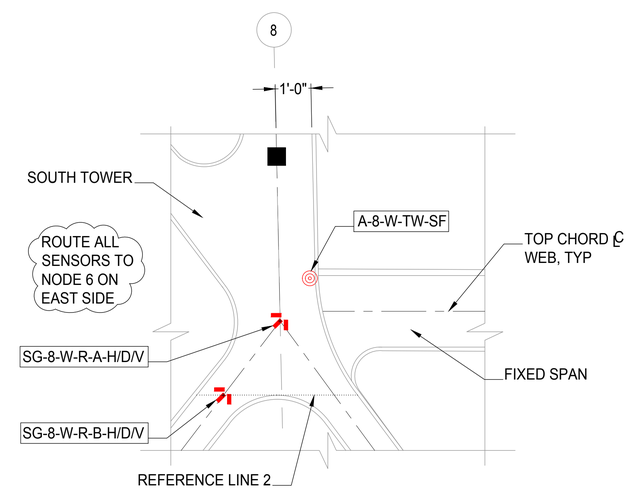
NODE TE16-120

WIRING								
SENSOR CALLOUT	SENSOR LINE	SENSOR WIRE	FROM COMPLETION	BLACK CABLE WIRE	BLACK CABLE ID	NODE ID	NODE CHANNEL	SENSOR ID
A-8-E-TW-SF	S+	GREEN	-	-	-	6	1	A1168
	S-	WHITE	-	-				
	E+	RED	-	-				
	E-	BLACK	-	-				
SG-8-E-R-A-H	S+	-	GREEN	BLACK (WHITE)	8-1A		2	
	S-	WHITE	WHITE	WHITE (BLACK)				
	E+	RED	RED	BLUE (BLACK)				
	E-	BLACK	BLACK	BLACK (BLUE)				
SG-8-E-R-A-D	S+	-	GREEN	BLACK (GREEN)	8-1A		3	
	S-	WHITE	WHITE	GREEN (BLACK)				
	E+	RED	RED	RED (BLACK)				
	E-	BLACK	BLACK	BLACK (RED)				
SG-8-E-R-A-V	S+	-	GREEN	BLACK (YELLOW)	8-1A		4	
	S-	WHITE	WHITE	YELLOW (BLACK)				
	E+	RED	RED	BROWN (BLACK)				
	E-	BLACK	BLACK	BLACK (BROWN)				
SG-8-E-R-B-H	S+	-	GREEN	BLACK (WHITE)	8-1B		5	
	S-	WHITE	WHITE	WHITE (BLACK)				
	E+	RED	RED	BLUE (BLACK)				
	E-	BLACK	BLACK	BLACK (BLUE)				
SG-8-E-R-B-D	S+	-	GREEN	BLACK (GREEN)	8-1B		6	
	S-	WHITE	WHITE	GREEN (BLACK)				
	E+	RED	RED	RED (BLACK)				
	E-	BLACK	BLACK	BLACK (RED)				
SG-8-E-R-B-V	S+	-	GREEN	BLACK (YELLOW)	8-1B		7	
	S-	WHITE	WHITE	YELLOW (BLACK)				
	E+	RED	RED	BROWN (BLACK)				
	E-	BLACK	BLACK	BLACK (BROWN)				

WIRING (CONT'D)								
SENSOR CALLOUT	SENSOR LINE	SENSOR WIRE	FROM COMPLETION	BLACK CABLE WIRE	BLACK CABLE ID	NODE ID	NODE CHANNEL	SENSOR ID
A-8-W-TW-SF	S+	GREEN	-	-	-	6	8	A1161
	S-	WHITE	-	-				
	E+	RED	-	-				
	E-	BLACK	-	-				
SG-8-W-R-A-H	S+	-	GREEN	BLACK (WHITE)	8-2A		9	
	S-	WHITE	WHITE	WHITE (BLACK)				
	E+	RED	RED	BLUE (BLACK)				
	E-	BLACK	BLACK	BLACK (BLUE)				
SG-8-W-R-A-D	S+	-	GREEN	BLACK (GREEN)	8-2A		10	
	S-	WHITE	WHITE	GREEN (BLACK)				
	E+	RED	RED	RED (BLACK)				
	E-	BLACK	BLACK	BLACK (RED)				
SG-8-W-R-A-V	S+	-	GREEN	BLACK (YELLOW)	8-2A		11	
	S-	WHITE	WHITE	YELLOW (BLACK)				
	E+	RED	RED	BROWN (BLACK)				
	E-	BLACK	BLACK	BLACK (BROWN)				
SG-8-W-R-B-H	S+	-	GREEN	BLACK (WHITE)	8-2B		12	
	S-	WHITE	WHITE	WHITE (BLACK)				
	E+	RED	RED	BLUE (BLACK)				
	E-	BLACK	BLACK	BLACK (BLUE)				
SG-8-W-R-B-D	S+	-	GREEN	BLACK (GREEN)	8-2B		13	
	S-	WHITE	WHITE	GREEN (BLACK)				
	E+	RED	RED	RED (BLACK)				
	E-	BLACK	BLACK	BLACK (RED)				
SG-8-W-R-B-V	S+	-	GREEN	BLACK (YELLOW)	8-2B		14	
	S-	WHITE	WHITE	YELLOW (BLACK)				
	E+	RED	RED	BROWN (BLACK)				
	E-	BLACK	BLACK	BLACK (BROWN)				



1 LOCATION 5 INSTRUMENTATION
ELEVATION VIEW - EAST FACE



2 LOCATION 5 INSTRUMENTATION
ELEVATION VIEW - WEST FACE

NOTES:
1. ACCELEROMETER CABLING SHALL CONNECT DIRECTLY TO TERMINAL INPUT OF NODE.
2. ROSETTE STRAIN GAGE CABLING SHALL ROUTE TO COMPLETION UNIT WITHIN BREAKOUT BOX. GEOKON BLACK CABLE SHALL RUN FROM BREAKOUT BOX TO TERMINAL INPUT OF NODE.
3. ALL ROSETTE STRAIN GAGES SHALL BE INSTALLED ON CHORD WEB.

SENSOR LEGEND
- ROSETTE STRAIN GAGE (ELEVATION, PLAN)
- UNIAXIAL STRAIN GAGE
- ACCELEROMETER
- TILTMETER

ENCLOSURE LEGEND	QUANTITY
BREAKOUT BOX (8" X 8" X 6")	11
4 CHANNEL DAQ ENCLOSURE (14" X 12" X 8")	3
16 CHANNEL DAQ ENCLOSURE (16" X 14" X 8")	3
TWO 16 CHANNEL DAQ ENCLOSURE (18" X 16" X 10")	1

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REVISIONS
1 NHDOT REVIEW

CLIENT
UNH
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DURHAM, NH 03824

PROJECT NAME
UNIVERSITY OF NEW HAMPSHIRE
MONITORING OF THE MEMORIAL BRIDGE
IN PORTSMOUTH, NH

Drawn By:	DSH
Checked By:	JDS
Date:	12/09/2016
Client No.:	
BDI No.:	151104-NH
SCALE:	NTS

LOCATION 5
INSTALLATION
LTM-09

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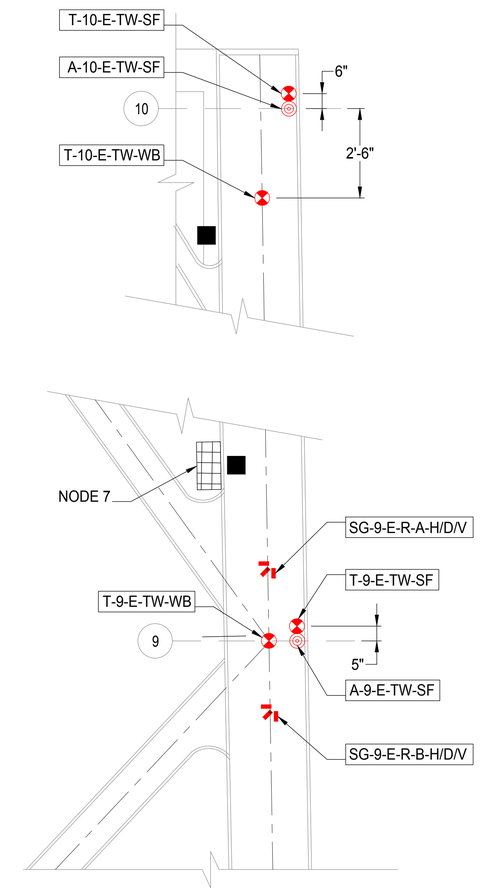
LOCATION 6: NODE 7							
LONGITUDINAL LOCATION	SIDE OF BRIDGE	LOCATION ON BRIDGE	SENSOR LOCATION	ROSETTE STRAIN GAGE QUANTITY	UNAXIAL STRAIN GAGE QUANTITY	ACCELEROMETER QUANTITY	TILTMETER QUANTITY
9	EAST	TOWER	NORTH FACE OF SOUTH FLANGE	-	-	1	1
9	EAST	TOWER	WEB	2	-	-	1
10	EAST	TOWER	NORTH FACE OF SOUTH FLANGE	-	-	1	1
10	EAST	TOWER	WEB	-	-	-	1
			TOTAL	2 [6 CH.]	-	2	4

NODE TE16-124

WIRING								
SENSOR CALLOUT	SENSOR LINE	SENSOR WIRE	FROM COMPLETION	BLACK CABLE WIRE	BLACK CABLE ID	NODE ID	NODE CHANNEL	SENSOR ID
A-9-E-TW-SF	S+	GREEN	-	-	-	7	1	A1166
	S-	WHITE	-	-				
	E+	RED	-	-				
	E-	BLACK	-	-				
T-9-E-TW-SF	S+	GREEN	-	-	-		2	T2021
	S-	WHITE	-	-				
	v15	RED	-	-				
	E-	BLACK	-	-				
T-9-E-TW-WB	S+	GREEN	-	-	-		3	T2020
	S-	WHITE	-	-				
	v15	RED	-	-				
	E-	BLACK	-	-				
SG-9-E-R-A-H	S+	-	GREEN	BLACK (WHITE)	9-A		4	
	S-	WHITE	WHITE	WHITE (BLACK)				
	E+	RED	RED	BLUE (BLACK)				
	E-	BLACK	BLACK	BLACK (BLUE)				
SG-9-E-R-A-D	S+	-	GREEN	BLACK (GREEN)	9-A		5	
	S-	WHITE	WHITE	GREEN (BLACK)				
	E+	RED	RED	RED (BLACK)				
	E-	BLACK	BLACK	BLACK (RED)				
SG-9-E-R-A-V	S+	-	GREEN	BLACK (YELLOW)	9-A		6	
	S-	WHITE	WHITE	YELLOW (BLACK)				
	E+	RED	RED	BROWN (BLACK)				
	E-	BLACK	BLACK	BLACK (BROWN)				
SG-9-E-R-B-H	S+	-	GREEN	BLACK (WHITE)	9-B		7	
	S-	WHITE	WHITE	WHITE (BLACK)				
	E+	RED	RED	BLUE (BLACK)				
	E-	BLACK	BLACK	BLACK (BLUE)				
SG-9-E-R-B-D	S+	-	GREEN	BLACK (GREEN)	9-B		8	
	S-	WHITE	WHITE	GREEN (BLACK)				
	E+	RED	RED	RED (BLACK)				
	E-	BLACK	BLACK	BLACK (RED)				
SG-9-E-R-B-V	S+	-	GREEN	BLACK (YELLOW)	9-B		9	
	S-	WHITE	WHITE	YELLOW (BLACK)				
	E+	RED	RED	BROWN (BLACK)				
	E-	BLACK	BLACK	BLACK (BROWN)				
A-10-E-TW-SF	S+	GREEN	-	-	-		10	A1159
	S-	WHITE	-	-				
	E+	RED	-	-				
	E-	BLACK	-	-				
T-10-E-TW-SF	S+	GREEN	-	-	-		11	T2019
	S-	WHITE	-	-				
	v15	RED	-	-				
	E-	BLACK	-	-				
T-10-E-TW-WB	S+	GREEN	-	-	-		12	T2018
	S-	WHITE	-	-				
	v15	RED	-	-				
	E-	BLACK	-	-				



2 1 LOCATION 6 INSTRUMENTATION
ELEVATION VIEW - EAST FACE

NOTES:
1. ACCELEROMETER AND TILTMETER CABLING SHALL CONNECT DIRECTLY TO TERMINAL INPUT OF NODE.
2. ROSETTE STRAIN GAGE CABLING SHALL ROUTE TO COMPLETION UNIT WITHIN BREAKOUT BOX. GEOKON BLACK CABLE SHALL RUN FROM BREAKOUT BOX TO TERMINAL INPUT OF NODE.
3. ALL ROSETTE STRAIN GAGES SHALL BE INSTALLED ON CHORD WEB.

SENSOR LEGEND
- ROSETTE STRAIN GAGE (ELEVATION, PLAN)
- UNIAXIAL STRAIN GAGE
- ACCELEROMETER
- TILTMETER

ENCLOSURE LEGEND	QUANTITY
BREAKOUT BOX (8" X 8" X 6")	11
4 CHANNEL DAQ ENCLOSURE (14" X 12" X 8")	3
16 CHANNEL DAQ ENCLOSURE (16" X 14" X 8")	3
TWO 16 CHANNEL DAQ ENCLOSURE (18" X 16" X 10")	1

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1 NHDOT REVIEW

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PROJECT NAME
UNIVERSITY OF NEW HAMPSHIRE
MONITORING OF THE MEMORIAL BRIDGE
IN PORTSMOUTH, NH

Drawn By:	DSH
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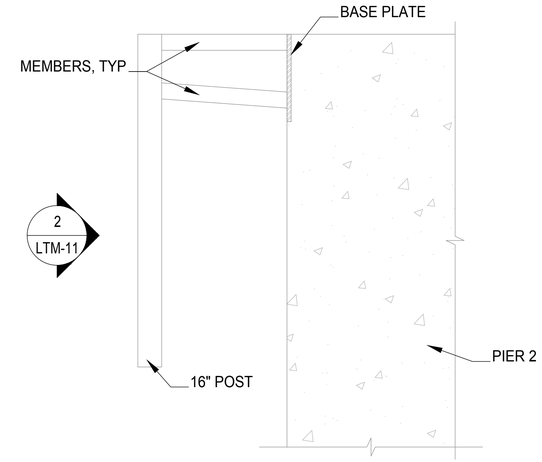
LOCATION 6
INSTALLATION
LTM-10

VERTICAL GUIDE POSTS: NODE 8			
LONGITUDINAL LOCATION	A-FRAME MEMBER	SENSOR LOCATION	HALF BRIDGE STRAIN GAGE QUANTITY
VERTICAL GUIDE POST	1	TOP FACE OF MEMBER	1
VERTICAL GUIDE POST	1	BOTTOM FACE OF MEMBER	1
VERTICAL GUIDE POST	3	TOP FACE OF MEMBER	1
VERTICAL GUIDE POST	5	TOP FACE OF MEMBER	1
VERTICAL GUIDE POST	5	BOTTOM FACE OF MEMBER	1
VERTICAL GUIDE POST	7	TOP FACE OF MEMBER	1
VERTICAL GUIDE POST	7	BOTTOM FACE OF MEMBER	1
		TOTAL	8

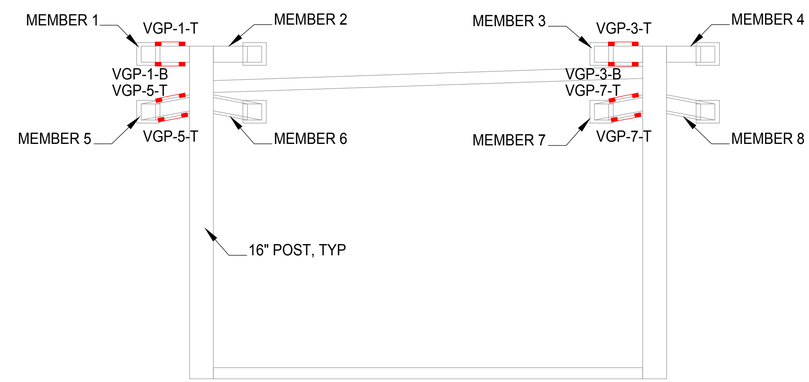
NODE TE16-126

WIRING							
SENSOR CALLOUT	SENSOR LINE	SENSOR WIRE	FROM COMPLETION	BLACK CABLE WIRE	BLACK CABLE ID	NODE ID	NODE CHANNEL
VGP_1_T	S+	RED	RED	WHITE	VGP-1	8	1
	S-	WHITE	GREEN	BLUE			
	E+	-	WHITE	BLACK (BLUE)			
	E-	BLACK	BLACK	BLACK (WHITE)			
VGP_1_B	S+	RED	GREEN	RED	VGP-1		2
	S-	WHITE	WHITE	GREEN			
	E+	-	RED	BLACK (GREEN)			
	E-	BLACK	BLACK	BLACK (RED)			
VGP_5_T	S+	RED	GREEN	WHITE	VGP-5		3
	S-	WHITE	WHITE	BLUE			
	E+	-	RED	BLACK (BLUE)			
	E-	BLACK	BLACK	BLACK (WHITE)			
VGP_5_B	S+	RED	GREEN	RED	VGP-5		4
	S-	WHITE	WHITE	GREEN			
	E+	-	RED	BLACK (GREEN)			
	E-	BLACK	BLACK	BLACK (RED)			
VGP_3_T	S+	RED	GREEN	WHITE	VGP-3		5
	S-	WHITE	WHITE	BLUE			
	E+	-	RED	BLACK (BLUE)			
	E-	BLACK	BLACK	BLACK (WHITE)			
VGP_3_B	S+	RED	GREEN	RED	VGP-3		6
	S-	WHITE	WHITE	GREEN			
	E+	-	RED	BLACK (GREEN)			
	E-	BLACK	BLACK	BLACK (RED)			
VGP_7_T	S+	RED	GREEN	WHITE	VGP-7		7
	S-	WHITE	WHITE	BLUE			
	E+	-	RED	BLACK (BLUE)			
	E-	BLACK	BLACK	BLACK (WHITE)			
VGP_7_B	S+	RED	GREEN	RED	VGP-7		8
	S-	WHITE	WHITE	GREEN			
	E+	-	RED	BLACK (GREEN)			
	E-	BLACK	BLACK	BLACK (RED)			

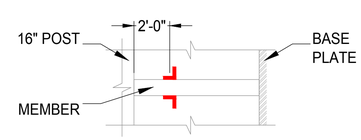
THIS SECTION OF INSTRUMENTATION WAS INSTALLED DURING PHASE II MOBILIZATION.



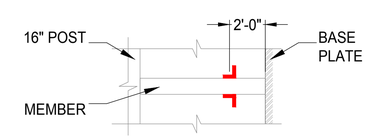
1 VERTICAL GUIDE POST
SIDE VIEW



2 VERTICAL GUIDE POST
FRONT VIEW



3 MEMBERS 1 & 3 INSTRUMENTATION
SIDE VIEW



4 MEMBERS 5 & 7 INSTRUMENTATION
SIDE VIEW

NOTES:
1. VERTICAL GUIDE POSTS (VGP) OF THE TIDAL TURBINE DEPLOYMENT SYSTEM (TTDS) SHALL BE INSTALLED ON THE PORTSMOUTH-SIDE OF PIER 2, SHOWN IN SECTION 2 ON LTM-04.
2. LOCATION OF BREAKOUT BOX AND NODE 8 FOR VGP INSTRUMENTATION SHALL BE DETERMINED IN FIELD AND MARKED OUT ACCORDINGLY.
3. HALF BRIDGE STRAIN GAGE CABLING SHALL ROUTE TO COMPLETION UNIT WITHIN BREAKOUT BOX. GEOKON BLACK CABLE SHALL RUN FROM BREAKOUT BOX TO TERMINAL INPUT OF NODE.

SENSOR LEGEND
HALF BRIDGE STRAIN GAGE

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SCALE:	NTS

VERTICAL GUIDE POST INSTRUMENTATION
LTM-11

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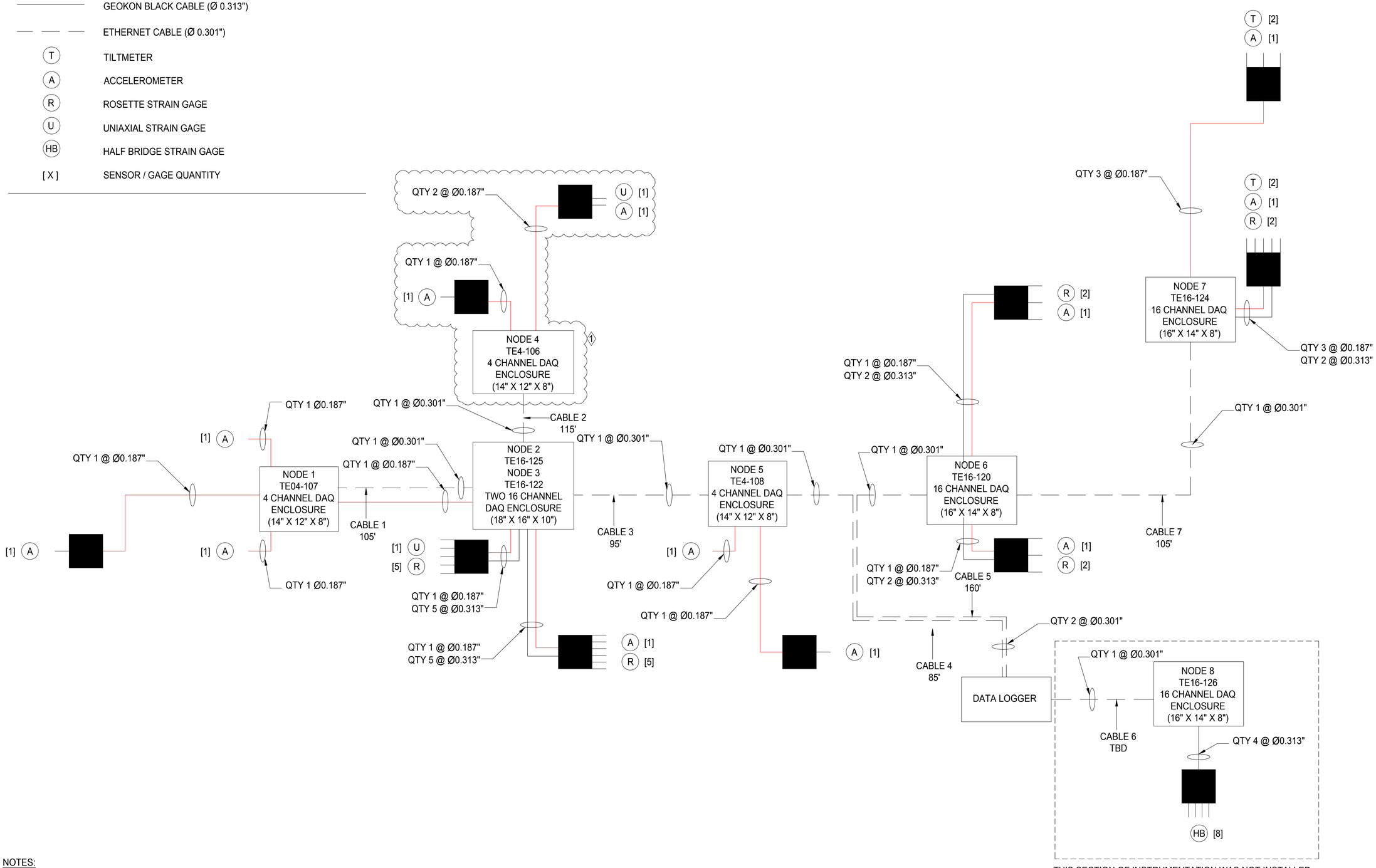
LEGEND

- BREAKOUT BOX (8" X 8" X 6")
- GEOKON RED CABLE (Ø 0.187")
- GEOKON BLACK CABLE (Ø 0.313")
- ETHERNET CABLE (Ø 0.301")
- (T) TILTMETER
- (A) ACCELEROMETER
- (R) ROSETTE STRAIN GAGE
- (U) UNIAXIAL STRAIN GAGE
- (HB) HALF BRIDGE STRAIN GAGE
- [X] SENSOR / GAGE QUANTITY



THIS SECTION OF INSTRUMENTATION WAS NOT INSTALLED DURING FIRST MOBILIZATION. TO BE INSTALLED AT A LATER DATE.

NOTES:

1. CONDUIT AND BREAKOUT BOXES PROVIDED BY OTHERS. BDI TO PROVIDE SPECIFICATION DRAWINGS FOR BREAKOUT BOXES.

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CONDUIT DIAGRAM

LTM-12

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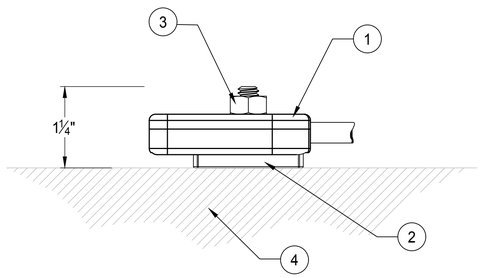
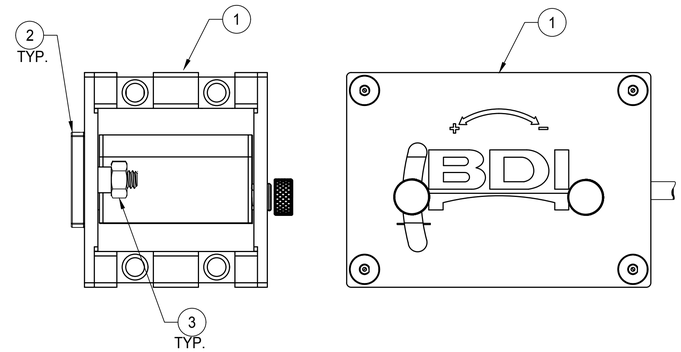


1. BDI UNI-AXIAL ACCELEROMETER
2. 1/4"-20 THREADED MOUNTING TAB
3. 1/4"-20 STAINLESS STEEL NUT
4. TYPICAL MOUNTING SURFACE

FOOTNOTES - EPOXY APPLICATION
1. ACCELEROMETERS TO BE MOUNTED DIRECTLY TO METALIZED PAINT WITH DEVCON UNDERWATER EPOXY. 2. BDI WILL NOT WARRANTY SENSOR ATTACHMENT VIA THE EPOXY METHOD DESCRIBED ABOVE

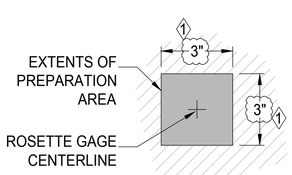
1 BDI ACCELEROMETER INSTALLATION 1



1. BDI TILTMETER
2. 1/4"-20 THREADED MOUNTING TAB
3. 1/4"-20 STAINLESS STEEL NUT
4. TYPICAL MOUNTING SURFACE

FOOTNOTES - EPOXY APPLICATION
1. ACCELEROMETERS TO BE MOUNTED DIRECTLY TO METALIZED PAINT WITH DEVCON UNDERWATER EPOXY. 2. BDI WILL NOT WARRANTY SENSOR ATTACHMENT VIA THE EPOXY METHOD DESCRIBED ABOVE

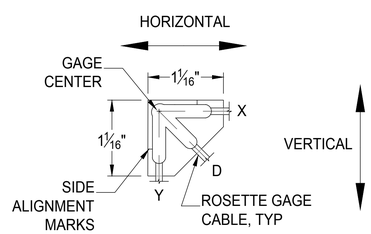
2 BDI TILTMETER INSTALLATION 1



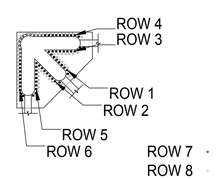
PREPARATION INSTRUCTIONS:

1. AREA SHALL BE THOROUGHLY DEGREASED.
2. PAINT SHALL BE REMOVED FROM PREPARATION AREA
3. SURFACE SHALL BE MECHANICALLY ABRADED TO ACHIEVE A SMOOTH FINISH, REMOVING ANY PITTING OR IMPERFECTIONS TO SSPC STANDARD SP-11.

3A PREPARATION AREA - ROSETTE STRAIN GAGE 1



3B ROSETTE GAGE ORIENTATION & DIMENSIONS



3C ROSETTE GAGE WELD PATTERN

ROSETTE WIRING

SENSOR ID	SENSOR WIRE	BLACK CABLE WIRE	COMPLETION
X AXIS (GOLD DOT)	WHITE	YELLOW (BLACK)	WHITE
	RED	BLACK (BLUE)	RED
	BLACK	BLUE (BLACK)	BLACK
Y AXIS	WHITE	WHITE (BLACK)	WHITE
	RED	BLACK (RED)	RED
	BLACK	RED (BLACK)	BLACK
DIAGONAL	WHITE	BROWN (BLACK)	WHITE
	RED	BLACK (GREEN)	RED
	BLACK	GREEN (BLACK)	BLACK

WELDABLE ROSETTE GAGE INSTALLATION:

1. CLEARLY MARK OUT ROSETTE GAGE LOCATION WITHIN PREPARATION AREA.
2. WIPE PREPARATION AREA WITH CLEAN CLOTH OR GAUZE PAD TO ENSURE IT IS FREE OF CONTAMINANTS.
3. REMOVE ROSETTE GAGE FROM PACKAGING, INSPECT FOR ANY IMPERFECTIONS, AND POSITION INTO PROPER LOCATION.
4. TO KEEP ROSETTE GAGE IN PLACE, TAPE DOWN TO STRUCTURE AT BASE OF GAGE WHERE WIRES ENTER SHIM.
5. USING CAPACITIVE DISCHARGE SPOT WELDER, TACK ROSETTE GAGE IN PLACE WITH ONE WELD AT EACH OF THE SIDE ALIGNMENT MARKS.
6. CAREFULLY REMOVE TAPE AND ENSURE ROSETTE GAGE IS POSITIONED IN PROPER LOCATION.
7. CONTINUE TO WELD ROSETTE GAGE IN PLACE FOLLOWING PATTERN OUTLINED BELOW AND SHOWN IN SECTION 5.
   - 7.1. ROW 1 STARTING AT CROTCH OF HERMETIC SEALANT TO TIP.
   - 7.2. ROW 2 STARTING AT CROTCH OF HERMETIC SEALANT TO TIP.
   - 7.3. ROW 3 STARTING AT BEGINNING OF ROW 1 TO TIP.
   - 7.4. ROW 4 BEGINNING AT CORNER OF HERMETIC SEALANT TO TIP.
   - 7.5. ROWS 5 AND 6 SIMILAR TO ROWS 3 AND 4.
   - 7.6. ROW 7 ACROSS TIPS OF ALL 3 SENSOR LOCATIONS.
   - 7.7. ROW 8 STAGGERED OUTBOARD OF FIRST ROW OF WELDS AS SHOWN
8. CONDUCT VISUAL INSPECTION TO ENSURE ROSETTE GAGE IS SECURELY WELDED INTO THE PROPER LOCATION.
9. ANCHOR CABLES AND PROVIDE STRAIN RELIEF GOING INTO ROSETTE GAGE. 1

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REVISIONS

1 NHDOT REVIEW

CLIENT

UNH
33 ACADEMIC WAY
DURHAM, NH 03824

PROJECT NAME

UNIVERSITY OF NEW HAMPSHIRE
MONITORING OF THE MEMORIAL BRIDGE
IN PORTSMOUTH, NH

Drawn By:	DSH
Checked By:	JDS
Date:	12/09/2016
Client No.:	
BDI No.:	151104-NH
SCALE:	NTS

SENSOR INSTALLATION - 1

LTM-13

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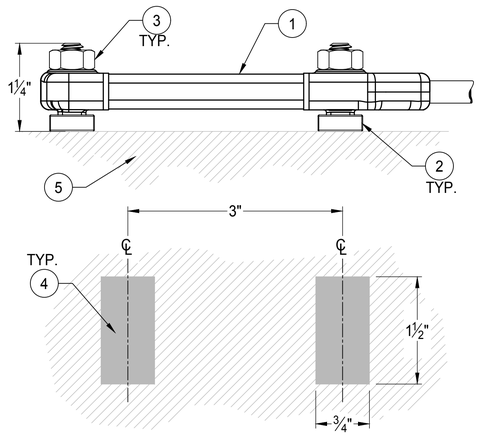

MOUNTING - INSTANT ADHESIVE

MATERIAL DESCRIPTION

1. 3" STRAIN GAGE
2. 1/4"-20 THREADED MOUNTING TAB
3. 1/4"-20 STAINLESS STEEL NUT
4. TYPICAL SURFACE PREP REQUIRED TO MOUNT STRAIN GAGES
5. TYPICAL MOUNTING SURFACE

FOOTNOTES - INSTANT AHDESIVE
1. STRAIN GAGES SHALL BE MOUNTED WITH LOCTITE 410 INSTANT ADHESIVE AND LOCTITE 7452 ACCELERANT. 2. DURING SURFACE PREP ALL PAINT AND SURFACE DEFORMATIONS MUST BE REMOVED WITH A GRINDER. 3. SURFACE PREP IS REQUIRED JUST PRIOR TO GAGE INSTALLATION AS TO NOT ALLOW SURFACE CONTAMINANTS TO ACCUMULATE.

1 BDI STRAIN GAGE INSTALLATION 1

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SENSOR
INSTALLATION - 2
LTM-14 1

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