









BONNER BRIDGE FACTS: Opened to Traffic in Nov. 1963 Total Bridge Length = 12,864.74' 28.0' Clear Roadway with 2'7" side walls 204 Spans 201 @ 61'6", 2 @ ~ 161' Channel Span (#145) = 180' Minimum Under Clearance at Channel = 66.8'





SCOUR WAS A HUGE CHALLENGE

- Scour studies and physical model scour tests were performed by OEI
- Conservative RFP values were used for the design.
- 100 year design scour elevation of -84 feet was incorporated over a large portion of the bridge.









SHIP IMPACT IS A LARGE COMPONENT OF THE DESIGN Bridge closed October 26, 1990 when dredge Northerly Island slammed into the bridge overnight during a Nor'easter, destroying 370 feet of the bridge



REPAIR WORK AHEAD!

Due to this catastrophic event, our design ship impact loads were as high as 2151 kips in the navigation unit



REPAIR TOOK APPROXIMATELY 3-1/2 MONTHS Bridge reopened Feb 12, 1991

TWO FOUNDATION ELEMENTS USED

- 36" Prestressed Concrete Square Piles
- 532 Piles Totaling 12 Miles in Length!
- · Used under large footings constructed at the water surface in navigation and transition zones
- Installed in battered configuration for increased bent stability
- 6 to 30 piles under each footing



TWO FOUNDATION ELEMENTS USED • 54" Prestressed Concrete Cylinder Piles in

- the Approaches 137 Cylinder Piles totaling 3.4 Miles in Length!
- Installed in approaches where scour and ship impact are significantly less
- · Piles extend all the way up to the bent
- 3 or 4 piles support each cap

caps





JETTING 36" SQUARE PILE



DRIVING 36" SQUARE PILE













CALCULATE LONG TERM SKIN RESISTANCE
•
$$q_{skin-installation} = \beta \times \sigma'_{v-installation} \Rightarrow$$

• $\beta = \frac{q_{skin-installati}}{\sigma'_{v-installation}} \Rightarrow$
• $q_{skin-long term} = \beta \times \sigma'_{v-scour}$

			CAPI	KAP SUMMARY	RESULTS			
Total CAP	WAP Capaci	ty: 239	9.9: alon	g Shaft	920.0; at T	ce 1479.9	kips	
Soil	Dist.	Depth	Ru	Force	Sum	Unit	Unit	Smith
Symnt	Below	Below		in Pile	lo	Resist.	Resist.	Damping
No.	Gages	Grade			Ru	(Depth)	(Area)	Factor
	ft	ft	kips	kips	kips	kips/ft	ksf	s/ft
				2399.9				
1	40.1	5.1	1.0	2398.9	1.0	0.20	0.02	0.153
2	46.8	11.8	5.0	2393.9	6.0	0.75	0.06	0.153
3	53.5	18.5	17.0	2376.9	23.0	2.54	0.21	0.153
4	60.2	25.2	18.0	2358.9	41.0	2.69	0.22	0.153
5	66.8	31.8	15.0	2343.9	56.0	2.24	0.19	0.153
6	73.5	38.5	15.0	2328.9	71.0	2.24	0.19	0.153
7	80.2	45.2	19.0	2309.9	90.0	2.84	0.24	0.153
DSE 8	86.9	51.9	29.0	2280.9	119.0	4.34	0.36	0.153
9	93.6	58.6	29.0	2251.9	148.0	4.34	0.36	0.153
10	100.3	65.3	29.0	2222.9	177.0	4.34	0.36	0.153
11	106.9	71.9	53.0	2169.9	230.0	7.93	• 0.66	0.153
12	113.6	78.6	115.0	2054.9	345.0	17.20	1 1.43	0.153
13	120.3	85.3	235.0	1819.9	580.0	35.16	2.93	0.153
14	127.0	92.0	340.0	Use Mea	920.0 sured Skin	50.87	4.24	0.153
Avg. Shart 65.7			Resistan	ce Below D	SE -0.00	0.83	0.153	
Toe		1479.9	to Calcula	ate Beta		164.43	0.106	
CAPV	VAP (DUT	PUT					





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CONSTRUCTION LESSONS LEARNED



OFFSHORE HAMMER LEADS WITH BATTERED PILES

















